Comparative Mineral Composition of Longstalk and Alsike Clovers[1]

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Highlight

Longstalk and alsike clovers are widely distributed in many areas of the United States. These clovers have similar growth requirements and often grow side by side. Longstalk, a valuable native range plant, on the basis of mineral and proximate composition appears to be equal to alsike clover in all respects, but not markedly superior. Both clovers are good pasture, range, and hay plants. They are highly palatable, and furnish nutritious forage for livestock and game animals.

Longstalk clover (*Trifolium longipes* Nutt.) is a species of native clover that is widely distributed in many western states. It is reported by numerous botanists to grow in Washington, Oregon, Colorado, Arizona, Utah, Idaho, Montana, Wyoming, Nevada, New Mexico, and California. Doubtless it grows in other states. If seeded it would grow in several of the remaining states and in other areas of the world. This leafy clover withstands grazing well and is of considerable forage value, having a palatability rating of from very good to excellent for all classes of livestock. It is reputed to be a favorite of mule deer on the Kaibab Forest in Arizona, and is undoubtedly highly palatable to other game animals. On some of the high mountain ranges in the fir and spruce belts its presence markedly contributes to the rather high grazing capacity of these areas (Forest Service, 1937). The plant usually forms a rather dense sod but sometimes occurs as single or somewhat tufted plants. Alsike clover (*T. hybridium* L.) is found growing throughout Wyoming and is widely distributed in many sections of the United States and other countries either as a cultivated legume or escaped from cultivation. In Wyoming as well as other states both clovers are important sources of forage for livestock and game animals.

Alsike and longstalk clovers are similar in appearance and growth habits. As a general rule longstalk clover is slightly shorter and does not produce as many stalks per root system as does alsike; however, the plants of the former are usually closely spaced on a growing site. Longstalk leaflets differ from alsike leaflets in that they are oval to oblong lanceolate and sharply serrate. Leaflets of the upper stem are more lanceolate than are those on the lower stem. The flower heads reflex with age and are generally white-yellow and only occasionally tinged with pink. Longstalk heads are considerably larger than the predominantly pink-tinged or pink alsike heads. Longstalk clover is extremely variable in size, appearance, and growth habits. This variability has led to the appearance of several special and varietal names in the literature such as *T. Rydbergii* Greene, *T. longipes* var. *rushbyi* Greene, *T. rushbyi* Greene, *T. pedunculatum* Ryd., *T. longipes* var. *pygmaeum* Gray, and *T. longipes* var. *reflexum* A. Nels., all of which certain botanists feel represent *T. longipes* Nutt. Both clovers appear to possess similar requirements of moisture, soil, and climate since they are frequently found growing side by side, or on adjacent sites. Longstalk clover seems capable of growing anywhere alsike will grow.

Extensive published data related to the chemical composition of alsike clover at different stages of maturity is available. The carotene, ash, crude protein, ether extract, crude fiber, nitrogen-free extract, calcium, phosphorus, and magnesium values for 26 samples of longstalk clover from 9 locations were reported by Hamilton (1961). The levels of most of these components, in bloom stage alsike, were reported by Tobiska et al. (1937), Beath and Hamilton (1952), and Plummer (1953). Average values for the composition and percentage digestibility of certain components of alsike clover were reported by Morrison (1959). Little information concerning the mineral composition of longstalk clover has been published. More information relative to the chemical composition of longstalk clover will assist in determining its nutritional qualities and potential promise as a valuable forage plant.

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Methods

Samples were collected at mid-bloom stage, late June and early July, during the 1956 and 1957 growing seasons from identical or similar adjacent areas: (1) Snowy Range, Albany County; (2) Lonetree-Burnt Fork area, Uinta County; (3) South Pass City area, Fremont County; (4) Jackson Lake shore, Teton County; (5) Two Ocean Lake area, Teton County; (6) Turpin Meadows, Teton County. The soils of collection sites 1, 4, 5, and 6 are deep black loams. The clovers were collected in moist areas near willows and other shrubs. The Uinta County samples were collected from an irrigated hay meadow harvested each year. The soil of the site 3 is somewhat rocky and aspen and sagebush plants are plentiful.

The 30-year average annual precipitation for the 6 areas varied from 10.50 inches for area 2 to 16.70 inches for area 1. The 30-year average precipitation for the April, May, and June months varied from 3.28 inches for area 2 to 6.46 inches for area 3 (Becker and Alyea, 1964). Precipitation and temperatures during the 1956 and 1957 seasons did not markedly vary from the average pattern and were similar.

The green samples were hand picked to contain only one species and the current year's growth, dried in the laboratory, and ground in a Wiley mill. Carotene, moisture, ash, crude protein, crude fat, crude fiber, calcium, phosphorus, magnesium, iron, manganese, zinc, copper, cobalt, and sulfur were determined by use of A.O.A.C. (1955) methods. Nitrogen-free extract values were obtained by difference. Sodium, molybdenum, and potassium were determined using the methods of Parks et al. (1943) with minor modifications. The results were calculated using oven-dry sample weights and are expressed in terms of generally accepted units. All of the analyses were made in duplicate with the exception of sodium and sulfur. With these exceptions, the figures given in the table are averages of two analyses for each of two growing seasons from six locations. From these data the range of individual sample values, means, and standard error of the means were determined.

Results and Discussion

The levels of carotene, ash, crude protein, crude fat, crude fiber, and nitrogen-free extract are similar for the two clovers from each collection site and are not included. These values for longstalk closely resembled those published by Hamilton (1961) and the alsike values are quite similar to published values for alsike clover.

The mineral components of the two species of clovers are shown in Table 1. The calcium, phosphorus, and magnesium mean values, as determined by this study, are essentially the same for both clovers although the calcium and phosphorus mean values for both clovers are higher than the average values of 1.32 and 0.25% for samples of alsike clover reported by Morrison (1959).

The range and mean values of sodium in the two species are identical. These values are much lower than the average sodium content of 0.41% for samples of alsike clover reported by Jordan (1955); however, he reported wide variations of 0.04 to 0.93%. The values for the potassium content of alsike are 2.80% compared to 2.46% for longstalk. The ranges of values are wide: 1.82 to 4.12% for alsike and 1.85 to 3.20% for longstalk. Morrison (1959) reported a mean potassium content of 2.44% for alsike. The sulfur contents are quite similar with an overall range of 0.22 to 0.46% and species means of 0.33% for alsike and 0.31% for longstalk. Morrison (1959) reported an average sulfur value of 0.19% for alsike.

The levels of iron present are variable. The yearly average for area samples of alsike vary from 167 to 463 ppm and 177 to 652 ppm for longstalk. The species mean for longstalk is 429 in contrast to 347 ppm for alsike. In spite of the differences in species mean values and the wider range of area mean values, the mean iron contents of alsike from three areas are higher

Table 1. Mineral components[a] of alsike and longstalk clovers.

Location	Clover	Ca %	P %	Mg %	Na %	K %	S %	Fe ppm	Mn ppm	Mo ppm	Cu ppm	Co ppm	Zn ppm
1	Alsike	1.46	0.26	0.39	0.15	3.23	0.29	228	54	2.85	11.4	0.39	22.2
	Longstalk	1.80	0.28	0.31	0.15	2.50	0.29	477	84	5.51	18.1	0.44	38.6
2	Alsike	1.65	0.31	0.47	0.14	2.90	0.41	187	51	4.29	15.7	0.25	20.0
	Longstalk	1.89	0.30	0.54	0.16	2.44	0.43	640	89	5.02	17.5	0.48	23.9
3	Alsike	1.51	0.35	0.55	0.17	2.56	0.35	444	90	3.22	18.5	0.27	19.0
	Longstalk	2.05	0.33	0.46	0.13	2.22	0.24	426	52	4.11	8.3	0.38	36.6
4	Alsike	1.62	0.36	0.44	0.15	4.00	0.26	357	80	3.35	28.9	0.53	47.3
	Longstalk	1.42	0.33	0.48	0.16	3.15	0.23	186	70	2.86	9.1	0.31	54.7
5	Alsike	1.51	0.46	0.37	0.15	1.88	0.38	442	53	3.35	10.3	0.39	30.3
	Longstalk	1.50	0.43	0.38	0.15	1.88	0.38	408	48	3.58	8.1	0.35	28.5
6	Alsike	1.38	0.32	0.41	0.15	2.25	0.30	426	76	2.87	13.0	0.33	47.4
	Longstalk	1.32	0.32	0.43	0.16	2.59	0.31	439	90	3.35	15.2	0.40	47.7
Range of values	Alsike	1.32–1.71	0.22–0.46	0.27–0.57	0.13–0.17	1.82–4.12	0.25–0.43	167–463	39–94	2.20–4.37	10.2–29.4	0.24–0.55	16.7–49.0
Mean	Alsike	1.52	0.34	0.43	0.15	2.80	0.33	347	67	3.32	16.3	0.36	31.0
Error of mean	Alsike	0.03	0.06	0.02	0.004	0.21	0.05	32	5	0.17	1.0	0.03	3.7
Range of values	Longstalk	1.29–2.09	0.26–0.45	0.36–0.58	0.13–0.17	1.85–3.20	0.22–0.46	177–652	48–91	2.62–5.88	7.7–18.6	0.27–0.49	21.5–55.6
Mean	Longstalk	1.65	0.33	0.43	0.15	2.46	0.31	429	72	4.07	12.7	0.39	38.3
Error of mean	Longstalk	0.08	0.02	0.02	0.004	0.12	0.02	43	5	0.29	1.3	0.02	3.2

[a] Oven-dry basis.

than similar values for longstalk indicating no overall species difference. If we consider the iron content of these clovers only 50% "available," Underwood (1962), these clovers supply adequate amounts of iron for optimal animal nutrition. The sample contents of manganese are variable with ranges 39 to 94 ppm for alsike and 48 to 91 ppm for longstalk. The mean manganese content of longstalk is somewhat higher; 72 as compared to 67 ppm. The species variability of alsike is greater. The iron : manganese ratio of these clover samples: 2.6 : 1 to 8.5 : 1 is much wider than the range of 1.5 : 1 to 2.5 : 1 found in certain plants by Shive (1941).

The molybdenum sample means varied widely 2.20 to 5.88 ppm with species means of 3.32 for alsike and 4.07 ppm for longstalk. The mean sample copper values are extremely variable 10.2 to 29.4 ppm for alsike and 7.7 to 18.6 ppm for longstalk. The mean species copper values are 16.3 for alsike and 12.7 ppm for longstalk. The molybdenum and copper variability pictures were complicated in this study since in areas 2, 5, and 6 only slight species variation exists for either element; however, in area 1 the molybdenum and copper levels are much higher in longstalk. In samples from area 3 the copper levels in alsike are much higher while the molybdenum levels are less variable. In area 4 the mean copper level of alsike is 28.9 as contrasted to 9.1 ppm for longstalk.

The mean cobalt levels of 0.36 and 0.39 ppm for the two species varied by less than 10%. The range of individual sample values for alsike is wider than that of the longstalk samples. The mean cobalt values are in general higher than those reported by Jordan (1955) for Idaho grown legumes.

The zinc levels in the samples varied within limits of 16.7 to 49.0 ppm for alsike and 21.5 to 55.6 ppm for longstalk. Zinc is one of the few components studied in which the mean species values varied by more than 10%. Longstalk has a mean species value of 38.3 ppm compared with 31.0 ppm for alsike.

Overall appraisal indicates that these two *Trifolium* species are quite similar as to soil, nutrient, water, and elevation requirements. They also closely resemble each other in appearance, growth habits, palatability, and chemical composition.

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