Reed Canarygrass

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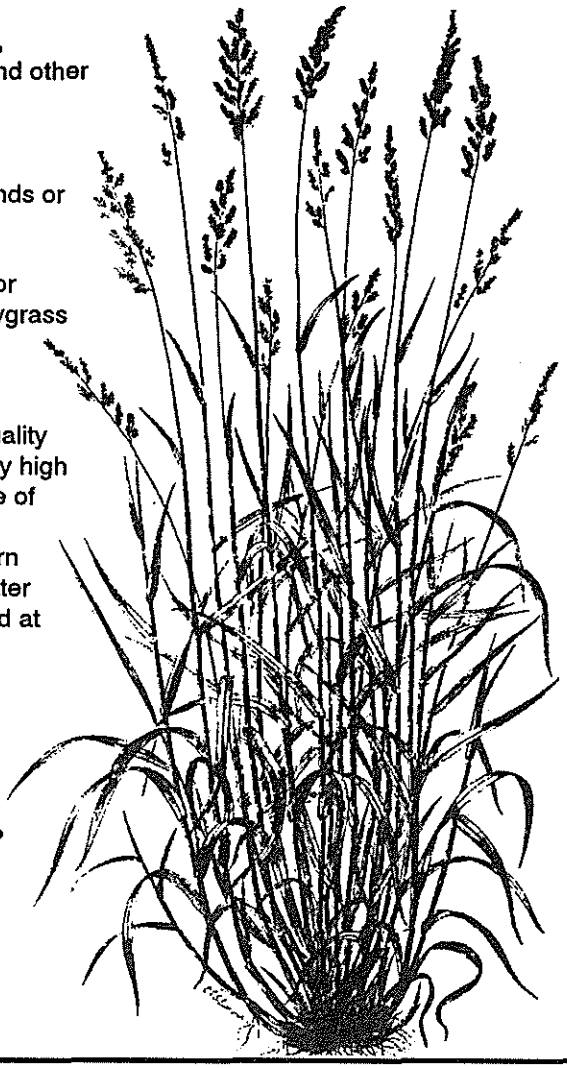
Reed canararygrass (*Phalaris arundinacea* L.) is a tall-growing, perennial grass which is widely distributed across Minnesota and other northern states. Particularly well adapted to wet soils, it is also productive on upland sites. Reed canarygrass spreads by underground stems (rhizomes) and forms a solid sod. It can be harvested as pasture, silage, or hay, whether sown in pure stands or in mixture with legumes.

New low-alkaloid varieties of reed canarygrass offer potential for improved animal performance and expanded use. Reed canarygrass is better adapted to diverse uses and environmental conditions than most other commonly used perennial grasses (Table 1).

Reed canarygrass has unjustly gained a reputation as a low quality forage grass. This misconception is in part due to the potentially high alkaloid content of native ecotypes, and to the frequent practice of delayed mid-summer harvest of very mature reed canarygrass from wetlands which were flooded during the spring. But modern reed canarygrass forage yields and quality are equal to or greater than those of other cool season forage grasses when harvested at a similar stage of maturity (Tables 2, 3 and 4).



Low Alkaloid Reed Canarygrass

WHAT ARE ALKALOIDS AND WHAT DO THEY DO?

Lack of palatability to livestock (selection when a choice is given) is frequently cited as why this agronomically superior species is not more widely grown. Older varieties such as Rise

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and Vantage, and most native types growing in wetlands, contain significant amounts of one or two basic types of alkaloids.

Alkaloids are bitter, complex, nitrogen containing compounds which can reduce the performance of grazing animals. Animal performance may be highly negatively correlated with total alkaloid concentration, however, the two types of alkaloids in reed canarygrass have been documented to affect grazing animals somewhat differently. High concentrations of simple gramine alkaloids reduce palatability. The more complex tryptamine-carboline alkaloids cause diarrhea as well as reduce palatability.

NEW VARIETIES

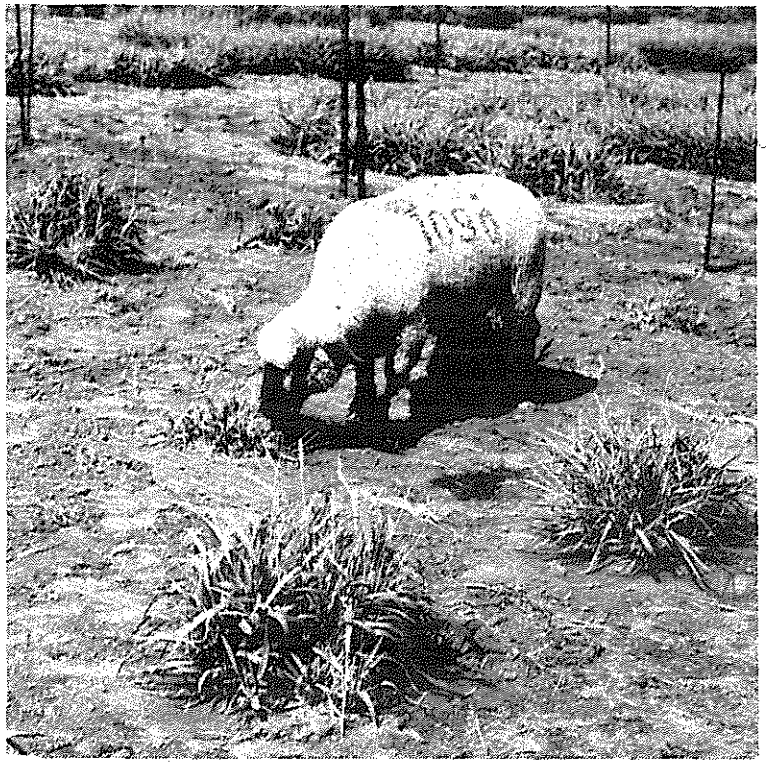
Experiments conducted by agronomists, animal scientists, and plant breeders with the USDA-Agricultural Research Service, University of Minnesota and a private seed company, led to the development and release of MN-76, a low alkaloid germplasm, and the commercial varieties, Venture and Palaton.

Each of these new varieties has a low concentration of alkaloids relative to older varieties, but MN-76, Venture, and Palaton also have no tryptamine-carboline alkaloids. The older variety, Vantage, also has no tryptamines-carbolines.

The breeding efforts substantially increased both the palatability of reed canarygrass (Table 5 and Figure 1) and the performance of grazing animals. Lambs grazing low alkaloid MN-76 reed canarygrass gained 51% to 95% more per day than did those grazing Rise, and 14% to 87% more than those grazing Vantage (Table 6).

The low alkaloid varieties, Venture and Palaton, have forage yield potential, forage quality, and persistence equal or superior to older varieties such as Rise (Tables 2, 3 and 4). Both Venture and Palaton have high levels of leaf disease resistance.

Figure 1. ***Low alkaloid varieties of reed canarygrass are clearly more palatable. In trials, livestock consistently choose the new varieties and graze them shorter than older varieties (such as is the ungrazed clump at the bottom center of photo).***



Why Reed Canarygrass is Unique

ADAPTABLE TO A DIVERSITY OF SOILS AND CLIMATES.

Reed canarygrass tolerates a soil pH range of 4.9 to 8.2. Mature plants have been known to tolerate five to eight weeks of spring flooding. However, like most cool season grasses, it has only moderate tolerance to saline soils.

Reed canarygrass has superior persistence on poorly drained soils, yet its yield and persistence under moisture deficits is equal or superior to other commonly grown cool season grasses (Table 7). Reed canarygrass is very winterhardy.

THRIVES UNDER DIVERSE CUTTING MANAGEMENTS.

Of the perennial grasses adapted to Minnesota, reed canarygrass is among the most persistent. It maintains yield under cutting strategies designed to produce both low and high quality forage.

While tall fescue and orchardgrass do not persist under infrequent cutting and smooth bromegrass and timothy do not persist well under frequent cutting (initial cutting before anthesis), reed canarygrass persists when cut at a diversity of growth stages. It is, therefore, very adaptable to use as harvested forage or as pasture (Tables 4 and 6).

SUITABLE FOR LEGUME MIXTURES.

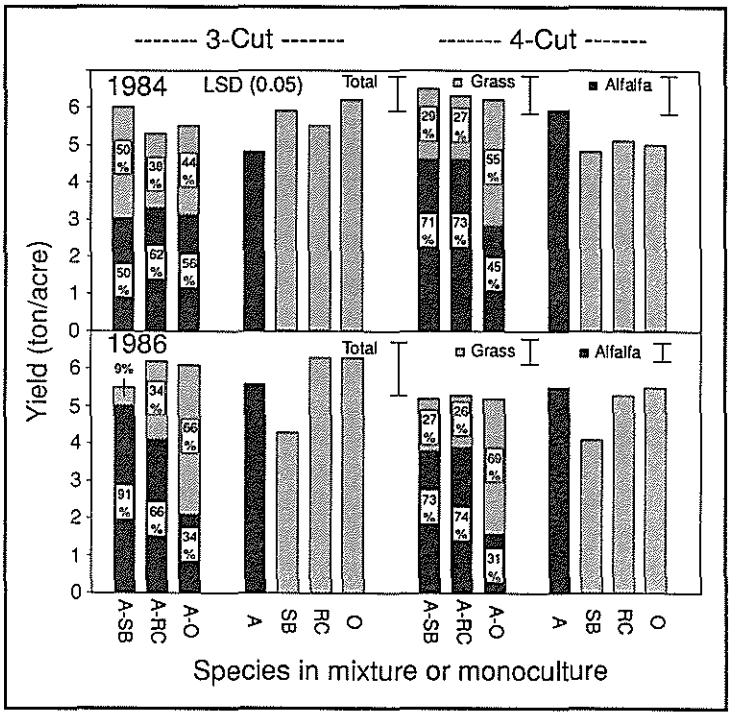
Grasses are mixed with legumes to minimize bloat potential, soil erosion, legume heaving and weed invasion inherent in legume monocultures, and to increase hay drying rates. Recommended grass composition varies from 20% to 50% depending on use of the forage. For animals with high nutrient intake requirements, reduced grass composition is desired. If grass composition exceeds 50%, forage intake potential can be greatly reduced.

Reed canarygrass is uniquely adapted for mixtures with many of the legumes grown in Minnesota. In addition to being productive under a diversity of cutting managements, it is not excessively competitive in mixtures.

Figure 2 shows that the grass composition of reed canarygrass-alfalfa mixtures subject to two cutting managements was more consistent (about 30%) than were smooth bromegrass- or orchardgrass-alfalfa mixtures. Smooth bromegrass did not persist under the 3-cut harvest management used by many producers. Excessive orchardgrass competitiveness resulted in alfalfa stand loss and low yield.

Because it has a sod-forming habit, reed canarygrass can fill in gaps in the stand, and it will never forms clumps in the field like those found with orchardgrass.

Figure 2. ***Effect of 3-cut and 4-cut schedules on weed free dry matter yield and species composition of binary mixtures of alfalfa (A) with Baylor smooth bromegrass (SB), Venture reed canarygrass (RC), and Onion orchardgrass (O) and of monocultures of each species at St. Paul, MN in the initial (1984) and final year (1986) of harvest. Percentage values within bars represent proportion of yield in alfalfa or grass.***



Reed canarygrass is adapted to mixtures with legumes such as birdsfoot trefoil and alsike clover which also tolerate wet soils. On upland sites in southern Minnesota under cutting and grazing, it is more capable than other grasses of preventing weed invasion of mixtures with birdsfoot trefoil, without excessively competing with the legume.

WASTEWATER AND SEWAGE EFFLUENT RENOVATION.

Reed canarygrass has a superior capacity to persist and remove nitrogen when irrigated with municipal and industrial waste effluents (Table 8).

How to Manage Reed Canarygrass

ESTABLISHMENT

Reed canarygrass may require two weeks to germinate and emerge and its seedlings are not highly competitive. Therefore, careful attention needs to be given to establishment practices.

TIME OF SEEDING: Early spring (mid-April to early June) or late summer (mid-July to mid-August) are the best times to seed. Spring seedings provide best chances for adequate moisture for germination. Summer seedings have less weed competition, but may not be successful in areas with inadequate summer moisture.

Figure 3. The density of a good reed canarygrass stand is evident for this Venture variety grown in 1990 at the Minnesota Agricultural Experiment Station's branch at Grand Rapids, Minnesota.

SEEDBED PREPARATION: A firm and level seedbed which insures good soil-seed contact and shallow seed placement is essential. Loose and uneven seedbeds are a major cause of poor stands. Your shoes should sink only about one inch into a properly prepared seedbed.

SEEDING RATE: For pure stands, seed 8 to 10 lbs/acre of pure live seed; for mixtures with legumes seed 6 lbs/acre of reed canarygrass.

PLANTING DEPTH: Seed at 1/4 to 1/2 inch soil depth. The deeper seeding is advantageous on sandy soils and for summer seeding when surface soil moisture may be limiting. Test your planter and determine the depth of seeding. Seeds sown on the soil surface or greater than 1/2 inch deep have little chance of developing into seedlings.

WEED CONTROL: Summer seeding usually results in relatively less weed competition with new grass seedlings than does spring seedings. For mixtures with alfalfa, annual weeds are often eliminated by a timely first harvest when alfalfa is at bud stage and before weeds flower. For pure reed canarygrass stands, weeds should be clipped or harvested when they shade the reed canarygrass seedlings. A number of herbicides may be used (consult *Cultural & Chemical Weed Control in Field Crops*, Minnesota Extension Bulletin AG-BU-3157) Reed canarygrass can be seeded with oat or

barley companion crops, if the companion crop variety is early and lodging resistant.

COMPANION CROPS: If small grain companion crops are used for establishment, seeding rate should be reduced to between 1/3 and 1/2 of normal, and early removal for forage at boot stage becomes mandatory to reduce competition, especially for light and moisture.

SOIL FERTILITY: Fertilizers should be applied according to soil test recommendations. Reed canarygrass will respond to nitrogen fertilization, and to a lesser extent to potassium and phosphate fertilization. For economically optimum forage yield and to enhance crude protein concentration on non-organic soils, a total of 100 to 150 pounds of nitrogen per acre should be applied each year. For best utilization and uniform growth, total nitrogen should be divided between at least two applications per year.

SPECIAL ROW ARRANGEMENTS: Reed canarygrass establishment and yield contribution to legume mixtures can be altered by changing the seeding technique. Whereas reed canarygrass yield in mixture with alfalfa is similar when seeded in alternate rows (1:1) as when mixed in the same row (Table 9), increasing the rows of reed canarygrass relative to those of alfalfa (to 2:1 or 3:1) increases reed canarygrass yield in mixtures. Row arrangements are achieved by separating the forage seed box with dividers.

HAY AND SILAGE HARVEST MANAGEMENT

Reed canarygrass tolerates a diversity of cutting strategies better than most other grasses. It can consequently offer forage with a wide range of yield and quality.

The cutting strategy employed by producers will depend on their relative needs for forage quality or yield. Forage quality and yield at individual regrowth cycles are related to maturity at harvest.

Producers desiring highest quality should harvest at boot stage, while those desiring highest yield should harvest at heading in the first growth in the spring, or at the end of stem elongation for the summer regrowth. Reed canarygrass will normally flower only once when subject to repeated harvests during the year. The spring growth will ultimately terminate in the production of an inflorescence and seed. Subsequent regrowths will result in stem elongation but no inflorence.

Forage quality is greatest when reed canarygrass is immature and vegetative (Figure 4). Nutrient concentration declines rapidly with increased maturity. This change is primarily associated with increases in lignin and other fibrous portions of the stem and a decrease in leaf proportion. In contrast to forage quality, forage yield is lowest at vegetative stages and increases rapidly until heading.

GRAZING MANAGEMENT.

For best quality pasture and most effective utilization, grazing should begin when reed canarygrass is 6 to 12 inches tall. Short duration rotational grazing with a heavy grazing pressure will allow the best utilization and greatest animal gains per acre.

Reed canarygrass must be grazed to minimize steminess. This is especially critical in the spring. Reed canarygrass does not make high quality late fall pasture.

Figure 4. Effect of reed canarygrass maturity on forage yield and quality at the spring regrowth. Source: Decker et al., 1969.

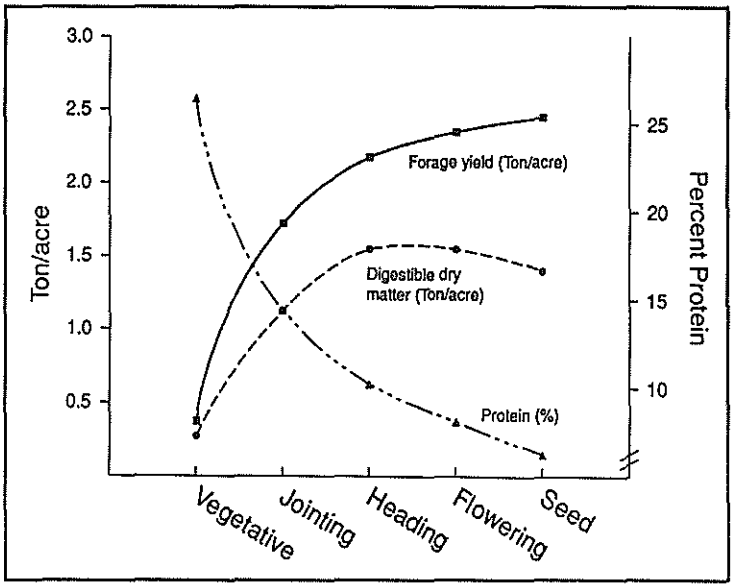


Table 1. Characteristics of perennial cool season grasses.

Grass	Heat/drought Tolerance	Flooding Tolerance	Winterhardiness	Frequent cutting Tolerance	Seedling Vigor	Sod-forming Capacity
Reed canarygrass	E	E	E	E	F	E
Smooth bromegrass	E	F	E	P	E	E
Orchardgrass	G	P	F	E	E	P
Tall Fescue	E	P	F	E	E	F
Timothy	P	P	E	P	F	P
Perennial Ryegrass	P	P	P	E	E	P
Kentucky bluegrass	P	F	E	E	F	E

E = excellent, G = good, F = fair, P = poor

Table 2. Forage yield and stand persistence (percent ground cover) of perennial grasses with first cut at seed (two cuts per year, 60 days between cuttings), heading (three cuts per year, 45 days between cuttings) and vegetative (four cuts per year, 30 days between cuttings)stages in southern Minnesota (St. Paul). [1]

	Forage Yield (tons/acre) [2]			Grass Stand (%)		
Grass	2-cut	3-cut	4-cut	2-cut	3-cut	4-cut
Baylor smooth bromegrass	6.6	5.0	4.5	83	50	45
Orion orchardgrass	5.9	5.7	4.8	55	95	77
Rise reed canarygrass	6.4	6.0	5.0	95	88	68
Venture reed canarygrass	6.6	5.6	4.9	95	90	79
Palaton reed canarygrass	6.3	6.0	5.6	93	88	82
LSD (0.05) [3]	0.8			11		

[1] Sheaffer et al., 1990. Journal of Production Agriculture.
[2] Yield values averaged for three years. Stand persistence measured in the spring following three years of harvesting. Grasses fertilized with 150 lb N/acre in the spring of each year.
[3] LSD: for statistical separation of all means within yield and stand categories.

Table 3. Forage quality of perennial grasses cut at seed (two cuts per year; 60 days between cuttings), heading (three cuts per year; 45 days between cuttings) and vegetative (four cuts per year; 30 days between cuttings) stages in southern Minnesota (St. Paul). [1, 2, 3]

	2-cut management (%)			3-cut management (%)			4-cut management (%)		
Grass	CP	NDF	DDM	CP	NDF	DDM	CP	NDF	DDM
Baylor smooth bromegrass	10.8	62.9	54.8	13.5	59.9	60.8	17.9	52.6	69.8
Orion orchardgrass	11.7	61.7	58.7	13.4	57.7	66.4	16.8	52.6	70.6
Rise reed canarygrass	12.6	61.7	54.2	14.6	59.9	58.0	18.1	54.6	65.9
Venture reed canarygrass	11.9	62.8	52.5	13.2	61.8	57.8	18.4	54.0	66.8
Palaton reed canarygrass	12.9	61.4	54.8	13.6	60.1	59.1	18.4	54.3	66.4
LSD (0.05) [4]	1.2	1.9	2.3						

[1] Sheaffer et al., 1990. Journal of Production Agriculture.
[2] Grasses fertilized with 150 lb N/acre in the spring.
[3] CP = crude protein; NDF = neutral detergent fiber; DDM = digestible dry matter.
[4] LSD: for statistical separation of CP, NDF, and DDM means within and over cutting managements.

Table 4. Forage yield and stand persistence (percent ground cover) of perennial grasses with first cut at heading (two cuts per year) and boot (three cuts per year) in Northern Minnesota (Grand Rapids).

Grass	Forage yield (tons/acre) [1]		Grass stand (%)	
	2-cut	3-cut	2-cut	3-cut
Baylor smooth bromegrass	2.3	1.1	0[2]	0
Orion orchardgrass	4.6	3.5	80	81
Venture reed canarygrass	5.2	3.0	84	56
Palaton reed canarygrass	5.4	3.0	80	64
LSD (0.05) [3]	0.3		20	

[1] Yield values averaged for two years. Stand persistence measured in the spring following two years of harvesting. Grasses fertilized with 150 lb N/arce.
[2] Smooth bromegrass only persisted for one harvest year.
[3] LSD: for statistical comparison of yield and stand means within or over cutting managements.

Table 5. Alkaloids and palatability (consumption by livestock when given a choice) of perennial grasses. [1]

Grass	Alkaloids (%)	Palatability [2]
Smooth bromegrass	none	2.0
Orchardgrass	none	4.4
Venture reed canarygrass	0.11	3.2
Palaton reed canarygrass	0.11	2.8
MN-76 reed canarygrass	0.09	3.2
Rise reed canarygrass	0.21	5.6
Vantage reed canarygrass	0.15	5.5

[1] Marten (1989), unpublished data.
[2] Palatability scores: 1 = complete consumption, 10 = complete rejection

Table 6. Average daily gain and incidence of diarrhea of lambs grazing high and low alkaloid reed canarygrass varieties. [1]

Source	Indole Alkaloid [2]		Average daily gain	Diarrhea
	Concentration (%)	Type	(pounds)	(%)
Rise	0.32	(high) mixed	0.15	20
Vantage	0.26	(high) gramine only	0.18	2
MN-76	0.10	(low) gramine only	0.26	2

[1] Marten et al., 1981. Crop Science, 21:295-298.
[2] The indole alkaloid threshold at or above which lambs will have reduced gain is about 0.2% dry weight.

Table 7. Forage dry matter yields of perennial grasses when grown under irrigation or when subject to drought on a sandy soil. [1,2]

Grass	Forage Yield (tons/acre)	
	Irrigated	Drought
Reed canarygrass	2.0	0.8
Smooth bromegrass	1.4	0.5
Orchardgrass	1.3	0.6
Timothy	0.7	0.4
LSD (0.05) [3]	0.5	

[1] Sheaffer, 1990. Unpublished.
[2] Yield from a mid-July harvest for two years. Grasses fertilized in the spring with 150 lb N/acre.
[3] LSD: for comparison of two means within and over irrigated and drought environments.

Table 8. Feed component yield, N uptake and stand persistence (percent ground cover) of perennial grasses cut three times and treated with municipal wastewater. [1]

Grass	Yield (tons/acre) [2]		N Uptake	Stands
	Forage	Digestible nutrients	(lbs/acre)	(%) [3]
Reed canarygrass	5.0	3.7	363	46
Orchardgrass	3.6	2.7	234	55
Tall fescue	5.1	3.5	308	12
Kentucky bluegrass	3.2	2.3	222	77
Smooth bromegrass	3.1	2.3	225	8
Timothy	3.1	2.3	213	6

[1] Marten et al., 1979. Agronomy Journal 71:650-658.
[2] Yield of dry matter and digestible nutrients are those of a one-year-old stand.
[3] Stands after five years of treatment. Smooth bromegrass and timothy stands declined beginning in the second year.

Table 9. Effect of row arrangement on forage yield of alfalfa and reed canarygrass mixtures. [1]

Row Arrangement [2]	Seeding year (tons/acre)			3 year average (tons/acre) [3]		
	Alfalfa	Grass	Total	Alfalfa	Grass	Total
1:1	2.2	1.0	3.2	4.1	1.1	5.2
2:1	1.5	1.7	3.2	3.5	1.6	5.1
3:1	1.1	2.3	3.4	2.5	2.3	4.8
Mix in row	2.5	1.1	3.6	4.7	1.1	5.8
Broadcast	3.2	0.7	3.9	4.8	0.6	5.4
LSD (0.05) [4]	0.4	0.3	0.5	0.6	0.3	0.6

[1] Sheaffer 1990. Unpublished.
[2] Row arrangements: 1:1 = 1 row grass:1 row alfalfa, 2:1 = 2 rows grass:1 row alfalfa, 3:1 = 3 rows grass:1 row alfalfa. Mixed in row = grass and legume seeded in row, broadcast = random broadcasting of grass and legume seeds. Seeding rate = alfalfa 10 lbs/acre, reed canarygrass 6 lbs/acre.
[3] Seeding year and two production years.
[4] LSD: for comparison of two means within columns.

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