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FORAGE PERFORMANCE TRIALS IN NEW HAMPSHIRE

by

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INTRODUCTION

This publication reports the results of alfalfa, timothy and smooth bromegrass variety trials at the University of New Hampshire Agricultural Experiment Station located at Madbury, N.H., during the period 1970-75. Desirable forage traits include higher yield potential, increased insect and disease resistance, greater tolerance to frequent cutting, and increased persistence. Recently released varieties with one or more of these characteristics need to be evaluated alongside of locally adapted and currently recommended varieties. The reader is cautioned that varietal yield comparisons may be different at other locations and in other years. The testing of varieties does not constitute recommendation by the University of New Hampshire.

Alfalfa

Acreage of alfalfa in New Hampshire and throughout the Northeast has increased in the past 20 years (1). Alfalfa is adapted to deep, well-drained soils. Although grasses provide some protection to alfalfa on imperfectly drained soils, considerable loss of stand from winterkilling usually results. If grown on carefully selected soils where it is adapted and under good management, alfalfa produces the highest yeld and quality of nutrients of the perennial forage crops. In contrast to the cool-season grasses, it produces considerably more summer growth (3).

A significant advantage of alfalfa is that it does not require nitrogen, the most expensive fertilizer element. For maximum yield it requires more potassium than other legumes and adapted grasses. It is also more sensitive to low pH. Success often depends on proper adjustment of pH before seeding (7).

Unfavorable weather at harvest time can substantially reduce quality of alfalfa hay. Harvesting and storing as hay-crop silage (haylage) helps to insure preservation of the high nutritive value of alfalfa.

Timothy

Timothy was first found growing in this country along the Piscataqua river, near Portsmouth, N.H. It is the most extensively grown forage species in the Northeast, although acreage has declined as other species have been improved and introduced. Timothy is well adapted to the cool, humid northeastern U.S. climate. It does poorly under droughty conditions, as on shallow and sandy soils (5).

Timothy is grown primarily for hay or hay-crop silage in clear-seeded stands or with legumes; although, it can be used in rotationally grazed pastures. The

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maturity of timothy more closely matches that of red clover and birdsfoot trefoil than alfalfa. The chief disadvantage of timothy is the poor regrowth following initial harvest in comparison to other cool-season grasses.

Smooth bromegrass

Smooth bromegrass *(Bromus inermis)* is a leafy, very hardy, perennial grass which is also tolerant to drought and heat. It is a deep-rooted grass which spreads by rhizomes to form a dense sod. It is fully as palatable, nutritious, and high yielding as timothy in New Hampshire and merits wider usage especially on the lighter soils in the southern part of the state. Its recovery growth following the first harvest is often superior to timothy under these conditions. Timothy has a more shallow root system but may, under certain conditions, out-yield bromegrass especially in the northern part of New Hampshire where summer rainfall is usually more evenly distributed during the growing season. Bromegrass is more compatible than timothy in a mixture with alfalfa.

Bromegrass does have some disadvantages in that the seed are light and chaffy, resulting in some difficulty in sowing and establishment. Timothy can usually be seeded somewhat later in September than bromegrass in southern New Hampshire. A mid-August seeding of either of these grasses is preferred to a spring seeding, especially if the land can be disked frequently for 1-2 months prior to seeding. Although bromegrass has been successfully established here as late as mid-September, yields are greatly reduced in the first harvest year. Seeding either bromegrass or timothy by August 15 is recommended if possible.

METHODS AND MATERIALS

Rainfall and temperature data for the growing season are summarized in Table 1. Data are from a standard weather station located about 2.5 miles from the experimental plots. Winters were not severe; however, there was no continuous snow cover during any of the years of the trials.

The soil type for all the trials was Charlton fine sandy loam. This soil is characterized as fairly deep and well drained, with a water table generally deeper than three feet and with moderately rapid water movement through the soil.

Alfalfa

The experimental area was previously in corn (1971) and was summer-fallowed in 1972. Two and one-half tons of dolomitic lime, 1000 lbs. of 0-20-20, 330 lbs. of 0-0-60, and two lbs/A of boron in the form of Solubor were applied. Seed was inoculated immediately before planting. Twelve varieties of alfalfa were broadcast-seeded without grass at the rate of 17 lbs./A on August 10, 1972. Three check varieties ('Saranac', 'Iroquois', and 'Vernal') were included. These are currently recommended varieties and serve as standards of comparison. No herbicide was applied since a weed problem was not evident. Each variety was planted in 5-x 16-foot plots and replicated five times in a randomized block design.

Characteristics of varieties entered are shown in Table 2. All varieties but 'Team' have good resistance to bacterial wilt, a soil-borne disease which is

prevalent in this area, especially on imperfectly drained soils. It should be noted that there probably is not complete resistance to the organism and that even among varieties described as resistant there is varying degrees of bacterial wilt incidence.

Annual fertilizer application consisted of 150 lbs/A of K_2O after the first and third cuttings. Three lbs/A of boron was applied in July 1974. Three cuttings per year were taken. Plots were harvested with a Jari mower. Yields were based on harvested areas of 3 x 13 feet.

Timothy

The timothy performance trial was established in a field adjacent to the alfalfa trial. Establishment procedure was similar to that for alfalfa, except that before seeding, 750 lbs. of 5-20-20 was applied. Ten timothy varieties and synthetics were broadcast-seeded at 8 lbs/A on August 17, 1972, in a randomized complete block experiment with 5 replications. 'Climax' was the standard early- and "Essex' the standard late-maturing entry in the trial. Four late-maturing experimental lines provided by Dr. C. C. Lowe, Dept. of Plant Breeding and Biometry, Cornell University, were included. In early spring and after the first cutting 330 lbs. of 15-10-10 was applied. The harvesting procedure and yield determinations were the same as those for alfalfa.

Smooth bromegrass

Test I

This experiment was seeded August 12, 1969. It included six experimental synthetics available in both the first and second generation of synthetics, plus the six varieties 'Blair', 'Carlton', 'Fox', 'Manchar', 'Sac' and 'Saratoga', the latter variety including the first, second and third generation of synthesis. The single cross, 2017 x 4228, plus four N.H. synthetics were all developed from only six parental clones. These were originally selected for leafiness and resistance to brown leaf spot caused by *Pyrenophora bromi.*

The land was fallowed in late 1968, then seeded to winter rye which was turned under in spring 1969, followed by fallowing until August. It was fertilized with 700 lbs/A of 10-20-10 prior to seeding. Seed was drilled at approximately 12 inches between rows into 5-x 10-foot plots, with four replicates of each entry. The single cross 3017 x 4228 germinated poorly for syn 1 generation, and was reseeded with the variety Sac on September 15, 1969. Plots were cut twice/year on approximately June 10 and August 10. Fertilization after establishment consisted of 400 lbs/A of 15-10-10 applied three times/year in early spring and again after the first and second harvests.

Test II

This trial was seeded August 11, 1971. It included four New Hampshire experimental synthetics, two of them in both syn 1 and syn 2 generations plus the five varieties 'Blair', 'Carlton', 'Fox', 'Polar', and 'Saratoga', the latter in the syn 1 and syn 3 generation.

The land was fallowed in 1971 and fertilized with 600 lbs/A of 10-20-10 prior to seeding. Seed was broadcast by hand into 5 x 10' plots, with four replicates of each entry. Harvesting and fertilization after establishment was the same as in Test I.

Test III

This test was seeded August 14, 1973. It included one New Hampshire synthetic, the two Wisconsin synthetics B-6 and B-7, plus the following varieties: 'Baylor', 'Blair', 'Bromage', 'Fox', Magna', 'Polar' and 'Saratoga'.

A crop of winter rye was plowed under in spring 1973 and the land was fallowed until August. Fertilization, seeding, and harvesting were the same as in Test II.

RESULTS AND DISCUSSION

Alfalfa

Insect occurrence

Incidence of the leaf blotch miner, a relatively new insect in this area, was quite high in 1973, very low in 1974, and moderate in 1975. The occurrence was not serious enough to warrant insecticide application, however. There was a moderate infestation of alfalfa weevil with the first cutting, 1974, but damage was not extensive. 'Team' and 'Weevlcheck' are reported to have high resistance to alfalfa weevil, an insect presently under control in this region as a result of predators (6). Observations during the 1974 weevil attack were that 'Team' was the only variety with any significant degree of resistance to feeding of the alfalfa weevil. There was a moderate attack of the potato leafhopper on the third cutting in 1974. The symptoms and effects of this insect are similar to those of drought and of boron deficiency.

Winter survival

There was no significant overwintering loss of stand. It has been found that the amount of growth during the fall period is closely associated with the degree of winter hardiness (4). 'Vernal', the standard of winter hardiness, had the least fall growth, while 'K1-10' had the most fall growth. 'K1-10', however, maintained a good stand, even after three years. This could possibly be explained by the fact that none of the winters during the trial was severe enough to test for winter hardiness. 'Kanza' and 'KO-6' suffered the greatest loss of stand during the trial.

Yields

Yields by harvest are shown in Table 3. Varieties are ranked in order of average 3-year, seasonal yields. Three-year average yields are shown on a moisture-free basis as well as on a 12% moisture basis. Fall regrowth was not included in seasonal yields. Although variable with year and variety, as much as one-half ton of forage might be harvested after fall frost. Yields were higher with the first cutting in 1973 than in 1974 because the first harvest was later in 1973. Seasonal yields were higher in 1974 than in 1973, though, largely because about one acre-inch of water was applied after both first and second cuttings. The 1974 growing season was one of the driest on record. Although the irrigation applications were not adequate to maintain maximum yields, the water applied was quite effectively utilized. The alfalfa root system was likely developed to the point where moisture was being drawn from several feet below the surface.

'Saranac' and 'Iroquois', two of the standard varieties in the trial, were equivalent in seasonal and 3-year average yields. 'K1-10' and 'W-309' outyielded 'Saranac'; however, the differences were not statistically significant (i.e., since the LSD was .45/tons/A, the yields would have to be at least this much greater). Both 'K1-10' and 'WL-309' were superior in yield to 'Saranac' and 'Iroquois' in the third year of the trial. These varieties seemed to have more vigorous regrowth and generally higher second and third cutting yields. With more severe winters, the survival and yielding ability, especially for 'K1-10' compared to 'Saranac' and 'Iroquois' might not be as great.

'Vernal', an old variety and the current recommendation where maximum winter hardiness is desired, ranked eighth in this trial, being outyielded by both 'Saranac' and 'Iroquois' in all three years. In more northerly locations or in years where winters are more adverse, 'Vernal' might be expected to have higher relative yields.

Although lower in yield the first year, 'AT 530' and 'Weevlchek' had higher yields in comparison to standard varieties the second and third years of the trial. 'Kanza' appeared to be poorly adapted in that it was lowest yielding in two of the three years of the trial and in the three-year average yield. The stand began thinning out the first year and continued to decline over the three-year period. 'WL-307' also yielded poorly, mainly because the stand lacked vigor.

Timothy

Varietal characteristics

The varieties reached the heading stage at quite different times. Harvesting of spring growth is generally recommended when half the plants have an emerged head. Cutting at this stage is a desirable compromise considering yield, quality, and persistence (2). This recommended date varied from June 14 for the earliest variety, 'Toro', to July 6 for the latest entry, TM 64-24, Syn 3 (Table 4). Harvesting later than recommended would tend to increase first cutting yield and insure stand survival, while sacrificing somewhat on forage quality, and possibly decreasing second cutting yields. The first growth of the four earliest entries was cut between June 18 and 20, and the last four latest entries were cut between July 5 and 10, varying somewhat with the year.

Yields

Entries are ranked in order of 3-year seasonal yields (Table 4). As with alfalfa, highest yields were obtained in 1974. Although rainfall during the early part of the 1974 season was considerably less than in 1973, reserve moisture was adequate for forage growth. Regrowth yields in 1974, compared to those in 1973, were higher, even though the season was drier and the trial was not irrigated. Timothy is a cool-season grass and goes dormant in hot weather. The cooler mid-summer weather in 1974 may explain the superior regrowth that year.

'Timfor', common, 'Itasca', TM 64-23 syn 1 (now called 'Champlaign') were all higher in yield (3-year average) than the standard entry 'Climax'. 'Essex', the other standard, was lowest in average yield over the 3-year period. However, there were no statistical differences in yield among the 10 entries when

considering the 3-year average yield. Common was consistently high in yield all three years. Regrowth contributed substantially to seasonal yields. Three-year average yields of 'Itasca' and 'Climax' were lowered considerably due to low yields in 1973. TM 64-23 syn 1('Champlaign') was relatively high yielding all three years of the trial and was the highest yielding of the late entries in 1975 because of considerably higher first-cutting yields. 'Toro' was highest in yield in 1973, but lowest in yield in 1975. Although the stand was not substantially reduced, the initial growth in 1975 was not vigorous.

An important aspect of timothy yielding ability is vigor of regrowth. Common timothy had the greatest regrowth as indicated by the highest second cutting yields all three years of the trial. Except for TM 64-23 syn 1 ('Champlaign') the earliest entries were higher in seasonal yield than the latest entries, largely as a result of superior regrowth. This might be expected, since the earlier cutting would allow for regrowth before the onset of higher temperatures.

Late-maturing varieties have been suggested for soils where timely harvest of earlier varieties might be hindered by prolonged wetness or where other farm operations prevent harvest of earlier varieties at the proper stage. Under these conditions and where quality is considered, the late-maturing varieties might compare more favorably.

Lodging of the initial growth of timothy is common with high nitrogen fertility. With the rates applied in this trial (50 lbs N/A in early spring) lodging was not a problem in 1973 or in 1975; however, in 1974 lodging was quite extensive and occurred, to some extent, on all entries.

Stand survival, as indicated in Table 4, was generally good and continued high yields could be expected among the earliest entries, however, later entries thinned to a greater extent. In the more thinned out plots broadleaf weeds were quite prevalent. Greater loss of stand among the later entries might have resulted from poorer regrowth and more competition from weeds during the mid-summer.

Smooth bromegrass

Test I (Table 5 and 6)

Yields given in tons/acre at 12% moisture, were reasonably good from this trial in 1970 and 1971, but were unusually low in 1972 and 1973, despite the fact that the stand was still good on most entries in 1973. During 1972 and 1973, there were deficits in rainfall in mid-summer which may have been a factor, especially since the soil at this site is relatively thin and inclined to be droughty. Also, vigor of the grass seemed rather low, despite heavy fertilization, and the area may have become sod-bound.

Relatively small differences in yield were noted between the syn one and syn two generations. Synthetics based on relatively few parental clones, as here, often tend to express maximum heterosis in the first generation of synthesis, with a decrease in yield in generation two. In two different trials, the five clone synthetic yielded slightly more in the second than in the first generation of synthesis, contrary to expectation.

Relatively few significant differences were obtained among entries in mean yields. The very low yield of Sac in 1970 is due to the late (September 15)

seeding of this variety in 1969. Among the varieties, Saratoga and Blair yielded well, but were not significantly better than most entries.

As shown in Table 6, the experimental synthetics seemed appreciably more resistant to brown leaf spot than most of the varieties. The syn two generation seemed to be about as resistant as the syn one. Most currently used varieties such as Saratoga are fairly susceptible to this disease.

Test II (Table 7)

Good establishment was obtained in this trial, and reasonably good yields were obtained over the four year period. The stand was maintained well with this management, and averaged about 80% bromegrass in 1975. Relatively high infection with brown leaf spot occurred in 1972, averaging about 3.2 on the experimental synthetics and about 4.2 on the varieties. Polar and Carlton appeared to be more susceptible than most other entries.

Relatively few significant differences in yield were obtained over the four-year period. Blair, Fox, Saratoga and the five-clone synthetic were somewhat higher than most other entries, but none of these differed significantly in yield. Polar and Carlton yielded significantly less than most other entries. No significant differences were obtained between syn 1 and later generations of synthesis.

Test III (Table 8)

Although a good stand was obtained originally in these plots, and this was maintained well during the three harvest seasons, forage yields were quite low in this trial. In June 1974 very poor top growth was obtained with relatively little heading. It was observed that Polar, selected in Alaska, was particularly slow in growth in the spring. It is not quite clear why, despite a good fertilization program, that vigor and yield were so low on this site, especially in 1974 and 1975.

Relatively few significant differences in yield were obtained among entries for the poor performance of Polar and Magna. Slightly higher yields were obtained by Saratoga, Baylor, and the Wisconsin synthetic B-7, but these did not differ significantly from three or four other entries.

In June, 1976, Saratoga and Polar were most susceptible to a medium infection with brown leaf spot (average rating - 3.8) whereas the other entries ranged from 1.8 (B-7) to 2.8 (Magna).

Table 1. Monthly rainfall and temperature for the growing seasons 1970-75 at Durham, N.H.

Rainfall

	[1]30-year mean	[2]1970	1971	1972	1973	1974	1975
April	3.80	3.73(-0.07)	2.39(-1.41)	2.89(-0.91)	13.35(+9.55)	3.82(+0.02)	2.98(-0.82)
May	3.32	2.91(-0.41)	3.47(+0.15)	3.87(+0.55)	6.32(+3.00)	4.41(+1.09)	1.67(-1.65)
June	3.22	3.55(+0.33)	1.87(-1.35)	6.88(+3.66)	2.38(-0.84)	2.99(-0.23)	3.93(+0.71)
July	3.50	1.81(-1.69)	4.33(+0.83)	2.55(-0.95)	2.10(-1.40)	0.67(-2.83)	4.71(+1.21)
August	3.22	3.06(-0.16)	1.57(-1.65)	1.16(-2.06)	3.11(-0.11)	1.30(-1.92)	6.42(+3.20)
September	3.57	3.49(-0.08)	2.30(-1.27)	4.20(+0.63)	2.15(-1.42)	6.12(+2.55)	5.24(+1.67)
Season	20.63	18.55(-2.08)	15.93(-4.70)	21.55(+0.92)	29.41(+8.78)	19.31(-1.32)	24.95(+4.32)

Temperature

	[1]30-year mean	[3]1970	1971	1972	1973	1974	1975
April	43.8	44.5(+0.7)	42.1(-1.7)	40.9(-2.9)	47.8(+4.0)	49.5(-4.3)	40.5(-3.3)
May	54.6	58.3(+3.7)	54.3(-0.3)	56.1(+1.5)	53.6(-1.0)	51.4(-3.2)	59.8(+5.2)
June	63.4	64.6(+1.2)	65.1(+1.7)	64.2(+0.8)	66.9(+3.5)	62.7(-0.7)	64.7(+1.3)
July	68.6	71.1(+2.5)	69.7(+1.1)	70.8(+2.2)	72.2(+3.6)	69.1(+0.5)	72.6(+4.0)
August	66.7	69.6(+2.9)	68.9(+2.2)	67.3(+0.6)	72.4(+5.7)	69.7(+3.0)	69.5(+2.8)
September	59.3	61.7(+2.4)	63.9(+4.6)	61.0(+1.7)	59.8(+0.5)	60.8(+1.5)	58.7(+0.6)

[1]Based on mean of period 1931-60.

[2]Total for the month, followed in parentheses by departure from the 30-year monthly mean.

[3]Mean for the month, followed in parentheses by departure from the 30-year monthly mean.

Table 2. Several characteristics of alfalfa varieties tested.

Entry	Origin	[1]Winter hardiness	[2]Fall growth	[1]Bacterial wilt resistance	[3]Stand survival
Kl-10	Northrup-King & Co.	U	6.7	R	5.5
WL-309	Waterman-Loomis Co.	U	5.4	R	4.5
Saranac	New York	Moderate	5.5	R	5.0
530	Arnold-Thomas	U	3.9	R	6.2
Iroquois	New York	High	4.0	R	6.0
Weevlchek	Farmers Forage Res. Coop.	High	4.5	R	4.5
Team	USDA	High	4.6	S	5.2
Vernal	Wisconsin	U	3.5	R	4.7
KO-6	Northrup-King & Co.	U	5.8	R	3.5
520	Arnold-Thomas	High	4.4	R	5.5
WL-307	Waterman-Loomis & Co.	U	4.7	R	4.7
Kanza	Kansas	Moderate	5.6	R	3.0

[1]Based on varietal registration information; U = unknown, R = resistant to bacterial wilt, S = susceptible to bacterial wilt.

[2]Based on scoring of 1 to 10 (1 = least regrowth, 9 = most regrowth after third cutting).

[3]Evaluated at end of 3-year period; 1 = complete loss of stand, 9 = excellent stand.

Table 3. Forage yields of alfalfa performance trial, Kingman Farm, Madbury, N.H.

	Dry matter yields, tons/acre						3-year average seasonal yields	
	1973		1974		1975			
Entry	First Cutting	Seasonal	First Cutting	Seasonal	First Cutting	Seasonal	d.m.	12% mois.
K1-10	1.94	3.69	1.71	4.58	2.06	4.63	4.25	4.83
WL-309	1.92	3.52	1.65	4.63	1.89	4.33	4.21	4.78
Saranac	2.02	3.64	1.72	4.29	1.80	4.05	3.99	4.53
530	1.63	3.11	1.52	4.36	1.88	4.19	3.92	4.45
Iroquois	2.11	3.56	1.38	4.01	1.89	4.13	3.88	4.41
Weevlchek	1.61	3.04	1.57	4.39	1.85	4.19	3.88	4.41
Team	1.85	3.36	1.51	4.01	1.76	4.23	3.85	4.38
Vernal	2.08	3.42	1.37	3.63	1.79	4.05	3.71	4.22
KO-6	1.66	3.13	1.49	4.12	1.56	3.77	3.67	4.17
520	1.69	3.09	1.09	3.87	1.71	4.19	3.66	4.16
WL-307	1.74	3.11	1.49	3.87	1.69	3.79	3.52	4.00
Kanza	1.51	2.59	1.28	3.51	1.90	3.88	3.44	3.91
Mean	1.81	3.27	1.48	4.11	1.82	4.11	3.83	4.34
LSD, 5%	.40	.51	.23	1.01	.33	.26	.40	.45
CV, %	17.3	12.1	11.9	22.3	14.4	7.6	4.3	4.3

Table 4. Forage yields of timothy performance trial, Kingman Farm, Madbury, N.H.

		Dry matter yields, tons/acre											
		1973			1974			1975			3-year average seasonal yields		
Entry	Ave. date 50% headed	[1]First cutting	Second cutting	Total	[1]First cutting	Second cutting	Total	[1]First cutting	Second cutting	Total	d.m.	12% mois.	[2]Stand survival
Timfor	6/23	2.41	.82	3.23	3.27	1.28	4.55	2.54	1.34	3.88	3.89	4.42	70
Common	6/18	2.44	1.09	3.53	3.01	1.31	4.32	1.71	1.54	3.26	3.70	4.20	75
Itasca	6/23	1.91	.92	2.83	3.32	1.00	4.32	2.15	1.25	3.43	3.53	4.01	60
[3,4]TM 64-23, Syn 1	7/7	2.32	.77	3.09	3.03	.95	3.98	2.75	.71	3.46	3.51	3.99	35
Toro	6/14	2.60	.95	3.55	2.90	1.29	4.19	1.24	1.44	2.68	3.47	3.94	75
Climax	6/23	1.86	.93	2.79	3.23	1.27	4.50	2.07	1.14	3.21	3.44	3.91	70
[4]TM 64-24, Syn 3	7/6	2.71	.60	3.31	2.85	.90	3.75	2.25	.90	3.14	3.40	3.86	40
[4]TM 64-22, Syn 3	7/4	2.48	.64	3.12	2.83	.92	3.75	2.25	.99	3.24	3.37	3.83	50
[4]TM 64-23, Syn 4	7/4	2.41	.68	3.09	3.24	.94	4.18	1.92	.90	2.83	3.37	3.83	60
Essex	7/4	2.47	.63	3.10	2.96	.96	3.92	1.99	.98	2.97	3.33	3.78	55
Mean		2.36	.80	3.16	3.06	1.08	4.15	2.09	1.12	3.19	3.50	3.98	
LSD, 5%		.62	.31	.67	.35	.33	.49	.69	.29	.72	.54	.60	
CV, %		20.8	30.5	16.6	8.9	23.5	9.2	26.1	19.8	17.6	11.7	11.7	

[1]June 18-20 for the five earliest and July 5-10 for the five latest entries.

[2]Visually rated at end of third year as percentage of original stand.

[3]TM 64-23 has been released as 'Champlaign'.

[4]Synthetics or experimental lines provided by Dr. Carl Lowe, Dept. of Plant Breeding and Biometry, Cornell University.

Table 5. Forage yields (Tons/Acre/12% M) for 13 bromegrass synthetics and varieties, Kingman Farm, Madbury, New Hampshire, 1970-1973.

Entry	Gen.	Origin	1970	1971	1972	1973	Mean
3017 x 4228	2	N.H.	3.54	2.79	2.29	1.48	2.52
3 Clone Synthetic	1	"	3.79	2.81	2.67	1.69	2.74
" "	2	"	3.63	3.33	2.14	1.50	2.65
4 Clone "	1	"	4.03	3.54	2.60	1.93	3.01
" "	2	"	3.86	3.39	2.52	1.68	2.86
5 Clone "	1	"	3.96	3.68	2.42	1.51	2.89
" "	2	"	4.23	3.58	2.57	1.75	3.03
6 Clone "	1	"	3.74	3.26	1.98	1.34	2.58
" "	2	"	3.44	3.17	2.37	1.47	2.61
Syn D		U.S. Pasture					
	1	Lab, PA	3.64	3.69	1.91	1.75	2.82
" "	2	"	3.04	3.44	2.64	1.36	2.62
Syn E	1	"	3.25	3.38	2.07	1.24	2.48
" "	2	"	3.04	3.29	2.12	1.44	2.47
Carlton	2	Canada	3.55	3.11	2.19	1.28	2.53
Blair	2	Iowa	3.78	3.45	2.50	1.74	2.87
Fox	2	Minn.	3.42	3.34	2.20	1.51	2.61
Manchar	2	Wash	3.05	3.04	1.95	1.95	2.50
Sac	2	Wisc	1.77	3.23	2.35	1.55	2.23
Saratoga	1	N.Y.	4.58	3.56	2.63	1.75	3.13
"	2		3.90	3.45	2.08	1.61	2.76
"	3		3.77	3.51	2.31	1.79	2.85
Mean			3.57	3.34	2.31	1.59	2.70
LSD (5%)			0.75	0.49	0.67	0.69	0.43
C.V. (%)			14.9	10.3	20.3	27.0	11.2

Table 6. Visual scores for reaction to brown leaf spot (*Pyrenophora bromi*) for 13 bromegrass strains, Kingman Farm, Madbury, New Hampshire 1970.[1]

Entry	Gen.	Score	Entry	Gen.	Score
3017 x 4228	1	2.1	Syn E	1	2.4
3 Clone Syn	1	2.2	" "	2	2.6
" "	2	2.6	Carlton	2	3.9
4 Clone "	1	2.9	Blair	2	3.0
" "	2	2.5	Fox	2	3.2
5 Clone "	1	2.2	Manchar	2	4.0
" "	2	2.5	Sac	2	3.4
6 Clone "	1	2.0	Saratoga	1	3.9
" "	2	2.4	"	2	4.0
Syn D	1	2.1	"	3	4.0
" "	2	2.0			

[1] Average rating for four reps, based on 1 = very resistant to 5 = very susceptible.

Table 7. Forage yields (tons/acre/12% M) for 9 bromegrass synthetics and varieties, Kingman Farm, Madbury, New Hampshire, 1972-1975.

Entry	Gen.	1972	1973	1974	1975	Mean
4-Clone Synthetic	1	3.59	3.28	3.16	3.03	3.25
" "	2	2.65	3.21	3.26	3.38	3.12
5 Clone "	1	3.74	2.90	2.99	3.12	3.21
" "	2	3.64	3.12	3.00	3.47	3.30
Hort Farm "	1	3.40	2.52	2.84	2.85	2.89
Elliott Field "	1	3.06	2.84	2.97	3.56	3.12
Fox	2	3.81	3.20	2.96	3.43	3.34
Polar	2	3.02	2.09	2.50	2.32	2.49
Blair	2	3.62	3.24	3.29	3.21	3.34
Carlton	2	3.18	2.44	2.44	2.23	2.58
Saratoga	1	3.56	2.94	2.79	3.56	3.21
"	3	3.56	3.05	2.89	3.21	3.16
Mean		3.40	2.90	2.92	3.11	3.08
LSD (5%)		0.39	0.74	0.60	0.74	0.37
C.V. (%)		8.0	15.3	14.4	16.7	8.3

Table 8. Forage yields (tons/acre/12% M) for 10 bromegrass synthetics and varieties, Kingman Farm, Madbury, New Hampshire, 1974-76.

Entry	Gen.	Origin	1974	1975	1976	Mean
Fox	2	Minn.	2.06	2.54	3.32	2.64
Magna	2	Canada	1.95	2.14	2.56	2.22
Baylor	2	Iowa	2.28	2.63	4.01	2.97
B-6	1	Wisc.	2.53	2.18	2.66	2.46
B-7	1	Wisc.	2.54	2.54	3.70	2.93
5 Clone Syn	2	N.H.	2.36	2.72	3.57	2.88
Polar	2	Alaska	1.34	1.78	2.56	1.89
Blair	2	Iowa	2.30	2.45	3.73	2.83
Bromage	2	Iowa	2.24	2.09	3.01	2.45
Saratoga	2	N.Y.	2.48	2.81	3.64	2.98
Mean			2.20	2.39	3.28	2.62
LSD (5%)			0.58	0.67	0.76	0.43
CV (%)			18.2	19.4	16.4	

SUMMARY

1. Species cannot be accurately compared because they were tested separately, on different sites, with different fertility levels, and in some cases, in different years. Species and varieties should be selected on the basis of local recommendations, soil and field characteristics, and how the forage is to be utilized in the feeding program.

2. Only two alfalfa varieties, 'K1-10' and 'WL-309', outyielded 'Saranac', a standard variety, over the 3-year period of the trial. 'Team', a variety developed for and exhibiting alfalfa weevil tolerance in this study, showed promise in that the yield in the third year of the trial was quite good.

3. There was little winter loss of alfalfa stands, even with 'K1-10', which exhibited the greatest amount of fall growth. Varieties were grown on a well-drained soil and did not endure a severe winter during the trial.

4. Heading date and, therefore, recommended cutting date of timothy varieties tested varied considerably (June 23 to July 6).

5. Timothy varieties did not differ significantly in the 3-year average yields. Later-maturing varieties had lower regrowth yields than earlier varieties.

6. Yield of the newly released timothy variety, 'Champlaign' was equivalent to 'Climax', but slightly outyielded the other late-maturing timothy varieties. The stand of 'Champlaign', however, as with all the late-maturing varieties, thinned substantially by the end of the third year of the trial.

7. Bromegrass stands can be maintained successfully for several years on a two-cut system with good fertilization.

8. Most commercial varieties of smooth bromegrass which have been tested in New Hampshire are susceptible to brown leaf spot.

9. Relatively few significant differences were found among strains and varieties of bromegrass for forage yields.

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