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**COVER: A bromegrass trial on the Young farm, Dover, New Hampshire, May, 1954.**

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# Forage Variety Trials in New Hampshire 1951-1956

By Gerald M. Dunn and Paul T. Blood*

## Introduction

FORAGE crops are the foundation for a balanced agriculture in New England. In New Hampshire, farmers derive over 80 percent of their total cash income from livestock and livestock products, and in 1954, approximately 80 percent of the cropland was in hay and pasture crops. Because of soil, climatic, and economic factors, much of the cropland is more suitable for forage than for row crops.

Farmers are becoming increasingly aware of the value of high quality grasses and legumes for nutritious feed and in soil improvement. Unfortunately, the many species of forage crops have generally been considered as one, and research support has been inadequate in comparison to the attention given many cash crops. There is a great need for more research on methods of establishing and maintaining forage crops, and in the development of more persistent varieties which will better resist the major disease, insect, and climatic hazards that seriously interfere with efficient production.

A number of new varieties of forage crops have been developed recently. Several have been tested by the New Hampshire Agricultural Experiment Station, and yield data are presented for varieties of alfalfa (*Medicago sativa*), bromegrass (Bromus inermis Leyss), and Ladino white clover (*Trifolium repens*).

## Alfalfa

Alfalfa is undoubtedly one of our most productive legumes in areas where it is adapted. It can be grown successfully on deep, well-drained soils on many farms in New Hampshire, provided that sufficient limestone and plant nutrients, especially potash, are supplied.

### Material and Methods

A test plot was seeded August 15, 1950, on the Whenal farm at Greenland, New Hampshire. The soil, formerly known as Stratham, now classified as Warwick, is a gravelly-silt loam, and is probably one of the best alfalfa soils in the State.

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The land had previously been in a clover-timothy sod for several years. It was manured at about 10 tons per acre and plowed in the spring, then summer-fallowed until August. Approximately 600 pounds of a 5-10-10 fertilizer and 3 tons of limestone per acre were applied at seeding.

A randomized block planting plan was used with 5 replications. The following alfalfa varieties were included:

*Ranger* — A bacterial wilt-resistant variety released by the Nebraska Experiment Station.

*Narragansett* — A variety released by the Rhode Island Station, dark green, with superior seedling vigor and resistance to leaf diseases.

*Atlantic* — A vigorous variety developed by the New Jersey Station.

*Buffalo* — A wilt-resistant variety developed by the U. S. Department of Agriculture and the Kansas Experiment Station.

*Ontario Variegated* — A hardy variety selected in Canada.

*Grimm* — A hardy variety long used in northern areas.

These varieties were seeded alone at the rate of 15 pounds per acre. The following additional plots were also seeded: five plots to a New Hampshire selection of smooth bromegrass, and five plots to a mixture of New Hampshire bromegrass and Ranger alfalfa. The bromegrass was seeded at 15 pounds and the alfalfa in the mixture at 10 pounds per acre.

All plots were top-dressed twice each year during 1951-1955, once in early spring and after the first harvest. Each top-dressing was at approximately the following rate per acre: Alfalfa alone, 500 pounds of 0-20-20 fertilizer; alfalfa-bromegrass, 500 pounds of 5-10-10; and bromegrass alone, 500 pounds of 10-10-10.

The plots were cut for hay twice each year, on approximately June 15 and August 20. Botanical separations were made on a subsample taken from each plot in order to eliminate undesirable grasses and weeds from the yield estimates.

## Experimental Results and Discussion

Results of this test for the five-year period are given in Table 1. The five-year average of each variety is given in the right-hand column. The bottom row of figures indicates the pounds required for statistical significance between varieties.

Narragansett alfalfa was the highest in yield for each of the five consecutive years, and its five-year average was significantly higher than any other variety. It has also produced outstanding yields in other northeastern states.

Some workers have indicated that Narrangansett is also superior to other varieties on imperfectly drained soils. In this test, on well-drained soil, Narragansett produced the highest comparative yields in the first two seasons.

This variety is susceptible to bacterial wilt, and should not be seeded in areas where this organism is present. In this trial, there was no evidence of bacterial wilt.

Table 1. Forage Yield (Pounds of Dry Matter Per Acre) for Six Alfalfa Varieties, Greenland, New Hampshire, 1951-1955*

| Variety | 1951 | 1952 | 1953 | 1954 | 1955 | Average |
|---|---|---|---|---|---|---|
| Narragansett | 5563 | 4860 | 4196 | 4737 | 3577 | 4587 |
| Atlantic | 3845 | 4191 | 3601 | 4648 | 3130 | 3883 |
| Ontario Variegated | 3734 | 3503 | 3683 | 4259 | 3569 | 3750 |
| Ranger | 3875 | 2985 | 3109 | 3621 | 2861 | 3290 |
| Buffalo | 3206 | 3934 | 3007 | 3053 | 2448 | 3130 |
| Grimm | 1576 | 2867 | 3109 | 3894 | 2922 | 2874 |
| Average | 3633 | 3723 | 3451 | 4036 | 3084 | 3586 |
| L.S.D. (.05)† | 479 | 913 | 1007 | 824 | 781 | 347 |

* Average of 5 replications.

† Pounds per acre required for difference between varieties to be significant statistically.

Grimm alfalfa was lower in yield than any other variety. The stand obtained for Grimm was relatively poor, and may partially account for these results. However, recent yield data from other northeast states have also shown that several new varieties are definitely better than Grimm.

The varieties did not maintain the same relative rank in different years. For example, Ontario Variegated was fourth in yield in 1951 and 1952, second in 1953, third in 1954, and second in 1955. Highest average yields were obtained during the wet season of 1954. Figure 1 shows that the stand was still good in the fifth season.

As previously mentioned, five plots were seeded to bromegrass alone, and an additional set of five plots to a bromegrass-alfalfa mixture. Yields of these plots were not included in the analysis since the chief purpose of

**Figure 1. The second harvest of the alfalfa trial at Greenland, August, 1955.**

this experiment was to compare the alfalfa varieties when seeded alone. However, these yields are given in Table 2.

Bromegrass alone produced more dry matter than any alfalfa variety. This is not surprising since grasses in general have a higher proportion of stems to leaves than legumes and, therefore, a higher percent of dry matter. The bromegrass-alfalfa mixture exceeded the best alfalfa variety or bromegrass alone by more than a ton of dry matter per acre. Many experiments have shown that mixtures of compatible, adapted species generally produce significantly higher yields than any single species seeded alone.

Table 2. Forage Yields (Pounds of Dry Matter Per Acre) of Bromegrass and Bromegrass-alfalfa Plots, Greenland, New Hampshire, 1951-1955*

| | Year | | | | | |
|---|---|---|---|---|---|---|
| Seeding | 1951 | 1952 | 1953 | 1954 | 1955 | Average |
| Bromegrass and Ranger Alfalfa | 5117 | 7815 | 6572 | 8190 | 6241 | 6787 |
| Bromegrass | 3858 | 6138 | 5604 | 5548 | 2078 | 4645 |
| Difference | 1259 | 1677 | 968 | 2642 | 4163 | 2142 |

* Average of 5 replications.

Alfalfa is usually seeded in a mixture in New Hampshire. The question may logically be raised whether yields of alfalfa varieties seeded alone can be compared to their yields in a mixture. Extensive research throughout the Northeast recently has indicated alfalfa varieties seeded alone maintain about the same relative rank as they do in a simple mixture with one grass (2). Many research workers have also pointed out that a relatively simple mixture is more desirable than a complex mixture of several grasses and legumes. Complex mixtures should be avoided particularly on land well adapted for a high yielding species such as alfalfa.

Another new variety, Vernal, has been released by the Wisconsin Station. This variety apparently has more wilt resistance than Ranger, and its yield performance has been excellent in the North Central states. Yield trials were established in 1956 with Narragansett, Vernal, and other varieties at Colebrook, New Hampshire.

## Smooth Bromegrass

Bromegrass has become a popular pasture and hay grass in the Northeast within the past 10 years. It is a palatable, nutritious grass, adapted to fertile, well-drained soils, and is superior in production to timothy, especially in midsummer. It is about 10 days earlier than timothy, and usually flowers about June 20-22 at Durham. Bromegrass can apparently be maintained quite satisfactorily with three or four harvests per season.

Southern types of bromegrass, such as Fischer, Lincoln, and Achenbach, have generally been superior in the United States, but northern types are favored in Canada. In this country, southern types are usually somewhat

more productive, start growth earlier in the spring, and seem to be slightly more resistant to leaf diseases.

Until recently, most of the breeding work in the United States with bromegrass has been done in the Mid-west. Within the past few years, several states in the Northeast have initiated breeding programs. Several varieties are now available, and a number of new strains are being tested.

Many farmers have had difficulty in obtaining satisfactory stands of bromegrass. This is partially due to the light, chaffy seeds which are difficult to sow at the proper depth. A firm seed bed with ¼- to ½-inch coverage is recommended. Excellent results have recently been obtained with the cultipacker-type seeders.

### Materials and Methods

The New Hampshire Station has tested a number of new strains of bromegrass developed at Cornell for the Northeast. The first test was seeded on the Whenal farm at Greenland, New Hampshire, on August 15, 1950. The soil and preparation for planting were the same as indicated for the alfalfa test. Six New York strains with the two check varieties, Lincoln and Canadian commercial, were seeded alone in three replications and with Ranger alfalfa in three replications. Seeding rate was: 15 pounds per acre for bromegrass alone, and 12 pounds of bromegrass with 8 pounds of alfalfa in the mixture.

During 1951 and 1952, two harvests were made per year on approximately June 15 and August 20. All plots were top-dressed twice each year, once in early spring and after the first harvest. Approximately 600 pounds per acre of 10-10-10 were applied at each top-dressing on the brome plots and 600 pounds of 5-10-10 on the mixture.

The second bromegrass test was seeded on a Worthington soil at the Coffin Field at Colebrook, New Hampshire, on May 28, 1952. Potatoes had been grown the previous year in this area. Approximately 2½ tons of limestone and 500 pounds of 5-10-10 per acre were applied at seeding.

Eight varieties of southern type bromegrass and two of northern type, Parkland and Canadian commercial, were included in this test. The design was a split plot with three plots of each variety seeded to bromegrass and three to a mixture of bromegrass and Ladino clover. The bromegrass was seeded at 15 pounds per acre alone and at 12 pounds in the mixture with 2 pounds of Ladino Clover. Harvests were made twice each year during 1953, 1954, 1955, and 1956 on approximately June 30 and August 20. Two top-dressings were applied each year, once in early spring and after the first harvest. The rate of each top-dressing was approximately 500 pounds per acre of 10-10-10 on the grass plots and 500 pounds of 8-16-16 on the mixture. In both tests, botanical separations were made on all plots after each harvest to determine the percentage of grass and legume, and to eliminate the weeds from the yield estimates.

### Experimental Results and Discussion

Yields are given in Table 3 for the bromegrass test at Greenland. It can be seen that strain B was superior to any other strain tested. This strain produced 724 pounds more than the better check variety, Lincoln. The average yield of Canadian commercial was about 1,100 pounds less than Lincoln.

Table 3. Forage Yield (Pounds of Dry Matter Per Acre) for Six New York Bromegrass Strains and Two Check Varieties, Greenland, New Hampshire, 1951-1952*

| Strain | 1951 | 1952 | Average |
|---|---|---|---|
| A | 6570 | 5930 | 6250 |
| B | 7079 | 7137 | 7108 |
| E | 6180 | 6645 | 6412 |
| F | 5954 | 6644 | 6299 |
| G | 5635 | 6142 | 5888 |
| H | 5928 | 6089 | 6008 |
| Lincoln | 6714 | 6054 | 6384 |
| Canadian commercial | 5222 | 5370 | 5296 |
| Average | 6160 | 6251 | 6206 |

* Three replications alone and three with Ranger alfalfa for each strain. Yields include the alfalfa fraction.

In more recent trials near Dover, New Hampshire, strain B has also produced high yields, especially in midsummer. This strain has been named Saratoga by the New York Experiment Station, and plantings have been made to increase seed supplies.

Results are given in Table 4 for the test at Colebrook, New Hampshire. An excellent stand of bromegrass and Ladino clover was obtained in this test. Figure 2 shows that the stand of bromegrass was still good in the third season.

Fischer was highest in yield for the 4-year period. The strain from Oklahoma and the two northern types was significantly lower in yield in 1953, but Canadian commercial and Parkland produced good yields after 1953.

**Figure 2. First harvest of the bromegrass trial at Colebrook in June, 1955.**

Table 4. Forage Yields (Pounds of Dry Matter Per Acre) for Ten Bromegrass Varieties, Colebrook, New Hampshire, 1953-1956*

| Variety | 1953 | 1954† | 1955 | 1956 | Average |
|---|---|---|---|---|---|
| Achenbach | 6759 | 5902 | 5249 | 3000 | 5228 |
| Lincoln | 5504 | 5400 | 5135 | 3410 | 4862 |
| Southern Commercial | 6258 | 5654 | 5909 | 3392 | 5303 |
| Elsberry | 6301 | 5406 | 5006 | 2935 | 4912 |
| Fischer | 6502 | 6220 | 6156 | 4297 | 5794 |
| Lancaster | 5720 | 4735 | 4299 | 3080 | 4458 |
| Lyon | 6172 | 5399 | 5104 | 4025 | 5175 |
| Oklahoma Synthetic | 5181 | 5125 | 4923 | 2662 | 4473 |
| Parkland (Northern Type) | 5071 | 5757 | 6440 | 3881 | 5287 |
| Canadian Commercial (Northern Type) | 5349 | 5865 | 6212 | 4049 | 5369 |
| Average | 5882 | 5546 | 5443 | 3473 | 5086 |
| L.S.D. (.05) | 768 | N.S.‡ | 1044 | 1039 | |

* 3 plots seeded alone and 3 with Ladino clover for each variety. Yields include the Ladino fraction.

† Analyzed as a random block for the 3 plots of each variety seeded alone.

‡ Not significant.

By the spring of 1954, most of the Ladino clover had died. Similar results have been obtained elsewhere in that the second winter appears to be critical for survival of Ladino clover. For this reason, a random block instead of a split plot analysis was calculated for the 1954 data, considering only those plots originally seeded to bromegrass.

Table 5 shows the comparison in yield between the bromegrass plots and the plots seeded to the mixture. In the first harvest season, when the Ladino clover was present, the plots in the mixture produced almost twice as much forage. In 1954, plots seeded to bromegrass alone yielded about as much as the mixture. The bromegrass in the latter plots was noticeably darker in color, however, and it appeared that the grass was still obtaining appreciable nitrogen due to the heavy growth of Ladino the previous season or the decaying organic matter.

A considerable amount of Ladino was present in 1955 and 1956 in the plots originally seeded to the mixture. It is believed that most of this clover resulted from natural reseeding in 1953. Small, bare areas in the plots in 1954, where the original Ladino plants had died, provided an opportunity

Table 5. Forage Yields (Pounds of Dry Matter Per Acre) of Bromegrass Plots and Bromegrass-Ladino Plots, Colebrook, New Hampshire, 1953-1956*

| Seeding | 1953 | 1954 | 1955 | 1956 | Average |
|---|---|---|---|---|---|
| Bromegrass — Ladino Clover | 7834 | 5633 | 5890 | 3816 | 5793 |
| Bromegrass | 3929 | 5460 | 4997 | 3130 | 4379 |
| Difference | 3905 | 173 | 893 | 686 | 1414 |

* Average of 30 plots for each combination.

for seedlings to become established. Since the plots were cut only twice per year, a large amount of seed was undoubtedly produced in 1953. It did not appear that establishment of clover plants from surviving young stolons of the original seeding occurred to any great extent in this test. Stands of clover obtained in this manner are variable, and yields are much lower than from the original seeding.

Significantly higher yields were obtained for the mixture for all years except 1954. The interaction of varieties times combinations was significant only in 1955.

One purpose of this experiment was to determine whether northern types of bromegrass, which are somewhat less aggressive than southern types, will support larger percentages of Ladino clover in a mixture. Unfortunately, almost all of the Ladino in the original seeding was dead by the spring of 1954. Apparently, most of the Ladino clover after the 1954 season resulted from natural reseeding. Table 6 shows the average percent of Ladino clover in the mixture for the four seasons. In this test, there was no evidence in any year for a larger percentage of Ladino in mixtures with northern types of bromegrass.

Table 6. Average Percent Ladino Clover in Bromegrass Plots, Colebrook, New Hampshire, 1953-1956.*

| Variety | Percent Clover in | | | | Average |
|---|---|---|---|---|---|
| | 1953 | 1954 | 1955 | 1956 | |
| Achenbach | 51 | 3 | 6 | 15 | 19 |
| Lincoln | 65 | 7 | 18 | 18 | 27 |
| Southern Commercial | 55 | 4 | 8 | 9 | 19 |
| Parkland | 65 | 6 | 3 | 4 | 20 |
| Elsberry | 53 | 3 | 4 | 11 | 18 |
| Fischer | 47 | 2 | 4 | 12 | 16 |
| Lancaster | 70 | 8 | 17 | 16 | 28 |
| Lyon | 58 | 8 | 8 | 10 | 21 |
| Oklahoma Synthetic | 61 | 4 | 10 | 14 | 22 |
| Canadian Commercial | 61 | 3 | 3 | 10 | 19 |
| Average | 59 | 5 | 8 | 12 | 21 |

* Based on dry weights of botanical separates made for each harvest, with 3 plots per variety.

In addition to the varieties mentioned in these tests, one other variety, Manchar, has recently given excellent production in a test near Dover, New Hampshire. It has produced significantly higher yields than Achenbach, Lincoln, or Canadian commercial for the past two years.

A breeding program is now underway at the New Hampshire Station on the improvement of bromegrass. Figure 3 shows a breeding nursery where selection is being made for: (1) resistance to brown leaf spot (*Pyrenophora bromi*), the major leaf disease in New Hampshire, (2) better recovery, (3) improved leafiness, and (4) vigor. Some progress has been made in this program, and it is hoped that within a few years varieties more suitable for this region will be available.

**Figure 3. The bromegrass breeding nursery at Dover, July, 1956. Some of the plants have been covered with bags in order to obtain self-pollinated seed.**

## Ladino White Clover

Ladino clover is the best pasture legume for New England. Since its introduction into the region about 1930, the acreage has increased rapidly, and it is now commonly grown on most dairy farms. It provides very palatable, nutritious forage, has excellent ability to fix nitrogen, and makes a rapid recovery after clipping in midsummer when many grasses are practically dormant.

Ladino will do well in most soil types providing there is a good supply of moisture, and an adequate supply of potash, phosphorus and calcium. A pH of 6.5 with annual applications of 75 to 100 pounds of phosphoric acid and 100-200 pounds of potash per acre are generally recommended for New Hampshire. Ladino is not suitable for droughty soils because of its shallow root system.

Relatively little work has been done on improvement of Ladino clover. In 1953, a variety of Ladino clover was released by the United States Department of Agriculture. This variety was developed from selections made in the northeast, and was named Pilgrim. At present, this is the only variety available. Various experiment stations in the Northeast have now tested Pilgrim in comparison with other seed lots of Ladino clover, and results since 1951 are presented for the New Hampshire Station.

### Materials and Methods

On August 23, 1949, a Ladino test was seeded on the Bunker field in Durham. This Charlton loam soil was limed at 1,500 pounds and fertilized with 600 pounds per acre of 5-10-10 at seeding. Seven seed lots were planted, including commercial Ladino, Pilgrim, and five lots from the west, in a random block design with three replications.

The plots were quite weedy in 1950, and yields were not taken. During 1951-1954, yields were taken for two to four harvests per year. Botanical separations were made on a subsample from each plot for each harvest to eliminate grasses and weeds.

All plots were topdressed twice each year, once in early spring and after the first harvest. Each topdressing was at the rate of 500 pounds per acre of 0-20-20.

Another Ladino test was planted at the Young Farm, Dover, New Hampshire, on July 15, 1953. The soil was also Charlton loam, but somewhat more droughty than the test area at the Bunker field. The land was plowed in the spring, summer-fallowed until July 15, and fertilized with 600 pounds of 5-10-10 and limed with 2500 pounds per acre at seeding. Previous pH determinations had indicated that this area was in the range of 5.8 to 6.0.

The design was a split plot, with three plots seeded to Ladino and three to a mixture of Ladino and bromegrass for each seed lot. Nine seed lots were planted in this test, including three sources of Pilgrim, a very large type of polyploid Ladino developed in Vermont, and five other sources of Ladino clover.

All Ladino sources were seeded at three pounds per acre, except Vermont polyploid which was seeded at five pounds to compensate for the larger seed size of this strain. The bromegrass in the mixture was seeded at 15 pounds per acre. Here, as on many small experimental plots, seeding rates were considerably higher than would be recommended to farmers.

All plots were topdressed twice each year, once in early spring and after the first harvest. Approximately 400 pounds per acre of 0-15-30 were used for each topdressing on the Ladino plots and 400 pounds of 8-16-16 on the mixture.

Because of a heavy infestation of sheep sorrel in 1954 and the severe drought in 1955, only two yield harvests were made each year. Botanical separations were made from each plot as in previous tests.

A third Ladino test was also seeded on Charlton soil at the Young Field, Dover, New Hampshire, June 4, 1955. The land had previously been fertilized in 1954 with 600 pounds per acre of 5-10-10, 10 tons of manure, and limed at 3 tons per acre. In 1955, 2 additional tons of limestone were applied plus 600 pounds of 8-16-16 per acre at seeding.

Eleven seed lots were planted in this test, including four sources of Pilgrim, Commercial Ladino, Vermont Polyploid, New Zealand white clover, and four other lots. The design was a split plot, with three plots seeded to Ladino and three to a Ladino-bromegrass mixture for each seed source. However, four of the seed lots were planted only in three plots of Ladino alone because of an inadequate seed supply. The clover was seeded at three pounds per acre except for Vermont Polyploid which was seeded at six pounds. Fifteen pounds of bromegrass per acre were seeded in the mixture.

Two topdressings were made in 1956, each at approximately 500 pounds per acre of 8-16-16 on the mixture and 500 pounds of 0-15-30 on Ladino alone. Three harvests were made in 1956.

### Experimental Results and Discussion

Results for the test on the Bunker field are given in Table 7. Certified Oregon and Pilgrim were the highest in yield in this test. These two lots did not differ significantly, but both were significantly higher in yield than commercial non-certified Ladino.

Certified seed performed more satisfactorily than non-certified seed; this has also been observed in other Northeast states. Lowest yields were obtained in the very dry season of 1953. In the combined analysis for the

four years, differences between blocks, varieties, and years were highly significant as well as the interaction between blocks and years. The interaction between varieties and years was not significant.

Table 7. Forage Yields (Pounds of Dry Matter Per Acre) for Seven Ladino Seed Lots, Durham, New Hampshire, 1951-1954*

| Seed Lot | Year | | | | Average |
|---|---|---|---|---|---|
| | 1951 | 1952 | 1953 | 1954 | |
| | 4 cuts | 3 cuts | 2 cuts | 3 cuts | |
| California strain | 2010 | 2895 | 781 | 849 | 1634 |
| FC 23449 (Ladino from Oakdale, Calif.) | 1693 | 3610 | 1424 | 1593 | 2080 |
| FC 23036 (Certified Calif. Ladino) | 2566 | 3612 | 1211 | 1486 | 2219 |
| FC 22956 (E. Oregon Ladino) | 2792 | 3847 | 1452 | 1299 | 2348 |
| FC 23596 (Certified Oregon Ladino) | 2661 | 4206 | 1673 | 1602 | 2536 |
| FC 23608 (Pilgrim) | 2970 | 4137 | 1416 | 1473 | 2499 |
| Commercial Ladino | 1529 | 3707 | 1447 | 1802 | 2121 |
| Average | 2317 | 3716 | 1343 | 1443 | 2205 |
| L.S.D. (.05)† | N.S.‡ | 747 | 355 | N.S.‡ | 362 |

* Average of three replications.
† Pounds per acre required for difference between strains to be statistically significant.
‡ Not significant.

Table 8. Forage Yields (Pounds of Dry Matter Per Acre) for Nine Ladino Seed Lots, Dover, New Hampshire, 1954-1955*

| Seed Lot | Year | | Average |
|---|---|---|---|
| | 1954 | 1955 | |
| 1. FC 24128 (Cert. S. California) | 2557 | 2810 | 2684 |
| 2. FC 24127 (Cert. C. California) | 2152 | 3288 | 2720 |
| 3. FC 24126 (Cert. N. California) | 1354 | 2456 | 1904 |
| 4. FC 24074 (First Generation, Pilgrim, Washington) | 2245 | 2831 | 2538 |
| 5. FC 24075 (First Generation, Pilgrim, California) | 2354 | 3068 | 2712 |
| 6. FC 24363 (Second Generation, Pilgrim, Washington) | 2560 | 2804 | 2682 |
| 7. FC 24657 (Italian) | 1836 | 2768 | 2302 |
| 8. FC 24818 (Composite of Western Seed) | 2650 | 3029 | 2840 |
| 9. Vermont Polyploid | 1841 | 2643 | 2242 |
| Average | 2172 | 2855 | 2514 |

* Three plots seeded alone and three with bromegrass for each seed lot. Yields include the bromegrass fraction.

Results for the second Ladino test are given in Table 8. These data were not analyzed statistically because a poor stand was obtained on a few of the plots. Some of the seed lots were grown in southern and northern areas of the west. It was thought that seed grown in northern areas of the west might be higher yielding in the Northeast. Definite conclusions cannot be obtained from this test because of the variability in stand. Most of the lots were not widely different, and Pilgrim yielded about as well as any other seed source. The yield of the polyploid strain was lower than most of the Ladino types. This strain is a giant type of Ladino with very large stolons, petioles, and leaves. However, in both field and greenhouse tests, it produces a relatively small number of stolons, and consequently somewhat sparse growth in solid seedings. Figure 4 shows a plot of Pilgrim in comparison with polyploid Ladino clover.

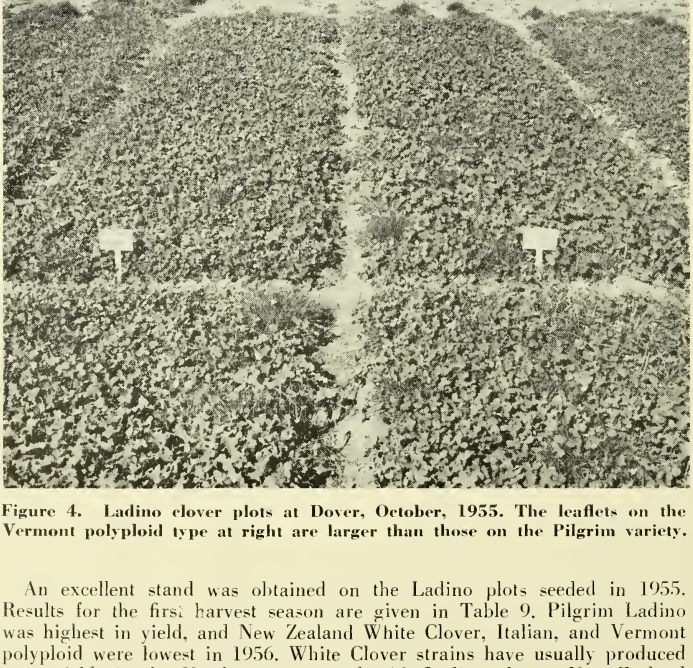

**Figure 4. Ladino clover plots at Dover, October, 1955. The leaflets on the Vermont polyploid type at right are larger than those on the Pilgrim variety.**

An excellent stand was obtained on the Ladino plots seeded in 1955. Results for the first harvest season are given in Table 9. Pilgrim Ladino was highest in yield, and New Zealand White Clover, Italian, and Vermont polyploid were lowest in 1956. White Clover strains have usually produced poor yields in the Northeast compared with Ladino clover. New Zealand White Clover appears to be unable to compete successfully with bromegrass. This is indicated in the second column of Table 9. Very little clover was present in the three plots of this strain seeded with bromegrass, although a good stand of clover was obtained originally on these plots.

Table 9. Forage Yields (Pounds of Dry Matter Per Acre) and Percent Clover in Mixture for Eleven Seed Lots, Dover, New Hampshire, 1956*

| Seed Lot | Yield | Percent Clover† |
|---|---|---|
| 1. Commercial Ladino | 3449 | 58 |
| 2. FC 24998 (Registered Pilgrim) | 4047 | 52 |
| 3. FC 24126 (N. California) | 3433 | |
| 4. FC 32620 (Certified Pilgrim) | 3996 | 51 |
| 5. FC 31985 (Cert. New Zealand White Clover) | 2134 | 4 |
| 6. FC 23851 (Pilgrim) | 3811 | |
| 7. FC 24657 (Italian) | 3259 | |
| 8. Vermont Polyploid | 3304 | 41 |
| 9. FC 24669 (Pilgrim) | 4025 | 65 |
| 10. FC 24818 (Composite of Western Seed) | 3871 | 50 |
| 11. FC 24128 (S. California) | 3769 | |
| Average | 3554 | |
| L.S.D. (.05)‡ | 779 | |

* Yields based on three plots of clover seeded alone for each source, three harvests.

† Percent clover based on dry weights of botanical separations made on three plots of clover-bromegrass mixture.

‡ Pounds required for significant difference between seed lots.

Significantly higher yields were obtained in the Ladino-bromegrass mixture which averaged 5,697 pounds of dry matter compared to 3,554 pounds in the Ladino plots.

Results at most stations in the Northeast have indicated that at present there is no outstanding variety of Ladino clover (2). Basic research is needed on the life history and physiology of Ladino clover. Research is also needed on the pathological organisms and insects which attack the plant, and their interaction with various environmental conditions in reducing stands. Definite breeding objectives cannot be determined until such information is available. Recent research (1) (3) at Michigan and Wisconsin has indicated that the taproots and stolons of individual plants rarely live more than two or three years. It is believed that death of the taproot of the original plants is directly associated with the reduced yield often encountered after one or two harvest seasons. A critical problem in Ladino research is to determine the nature of the taproot, when and why death occurs, and, if possible, to develop more persistent varieties.

It is known that various crown and root rots, viruses, and many leaf diseases occur on Ladino clover in New Hampshire. Their relative importance has not yet been determined. A breeding program is now underway at the New Hampshire Station to obtain disease resistance and persistence. Figure 5 shows a breeding nursery in the second year of growth. Recent support on the pathological phases by the United States Department of Agriculture will aid greatly in this work.

Since Pilgrim has produced somewhat higher yields in New Hampshire than most other sources of Ladino clover, the Experiment Station has recommended its use when available. Also, use of a known variety provides an assurance of genetic identity not found when commercial Ladino seed is purchased. The buildup of seed supplies of this variety has been slow

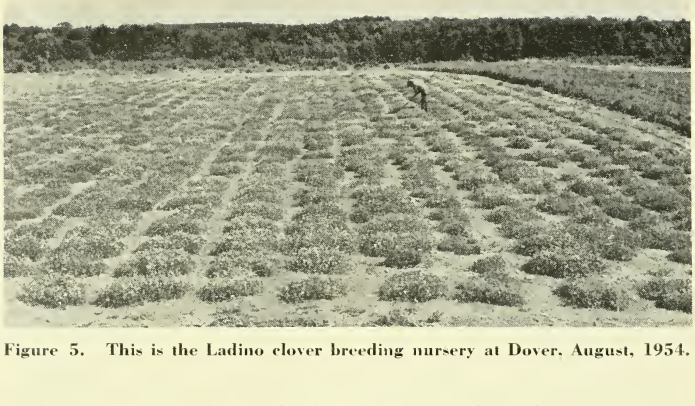

**Figure 5. This is the Ladino clover breeding nursery at Dover, August, 1954.**

in the West, largely due to the fact that farmer demand for the variety has been small. If the recommended variety is unavailable, certified seed is still strongly recommended over non-certified seed for all forage crops.

## Conclusions

1. Narragansett alfalfa appears to be an outstanding variety for New Hampshire. It is not recommended in areas where bacterial wilt is known to be present.

2. Fischer bromegrass was somewhat higher in yield than Achenbach, Lincoln, Parkland, or Canadian commercial in the test at Colebrook. Southern varieties, such as Fischer and Achenbach, were definitely superior to northern types in the southern part of the state.

3. Pilgrim Ladino clover usually gave more dependable performance than other seed sources tested in New Hampshire.

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