# MANAGING FORAGE CROPS FOR HIGHER YIELDS

C. M. Harrison, Farm Crops Department
Michigan State College
East Lansing, Michigan

The legumes and grasses sown alone or in mixture have long been considered as an essential part of a good crop rotation. Commonly known as forage crops, they constitute a diverse group of plants both as to habit of growth and number of plants represented. Because of this, much of the emphasis on improvement has been on introduction and adaptation of new species, value in terms of quantity and quality of feed produced as hay or pasture or their usefulness as green manure crops. The comparative value of different mixtures subjected to various management practices, has received little attention to date.

In an attempt to study the management of different forage mixtures, a series of plots were laid out on a Conover soil type on the College farm at East Lansing, Michigan in the summer of 1938. Three phases were to be studied, namely: the production of four different forage mixtures when used as hay alone, hay and pasture, and pastured continuously; the effect of the four mixtures and their management on the subsequent yield of corn; and the effect of these practices on the stand and productivity of alfalfa when reseeded after the corn.

The land was fitted and fertilized with 400 lbs. per acre of 0-20-20 fertilizer previous to sowing the four forage mixtures. Of the four mixtures, one was straight grass, one straight legume, and two were mixtures of both grasses and legumes and were made up of the following species:

1. Timothy, Kentucky bluegrass, red clover, alsike clover and white clover.

2. Timothy, smooth bromegrass, perennial rye grass, Kentucky and Canada bluegrass.

3. Alfalfa, smooth bromegrass, red clover, alsike clover and white clover.

4. Alfalfa, red clover, alsike clover and white clover.

All of the seedings were successfully established in August 1938 and pasturing was started in the spring of 1939.

The three systems of management were carried on over a three year period after which the area was plowed and planted to corn. Following the corn, one-half of each original plot was refertilized with 400 lbs. per acre of 0-20-20 fertilizer, the remaining half received no fertilizer, and the entire area was reseeded to alfalfa in small grains.

The plots, which were used for straight pasture, were grazed by sheep and days of grazing were used as the index of productivity except

in 1940 when weight gains were also recorded. The data for the three years of grazing on the four mixtures is shown in table 1.

Table 1 - RETURNS FROM STRAIGHT PASTURE Ave. of 4 Replications

| Forage Mixture | 1939 Sheep Days Per acre | 1940 Sheep Days Per acre | Gain Lbs. Per Acre | 1941 Sheep Days Per acre | Total 3 years Sheep Days Per acre |
|---|---|---|---|---|---|
| I | 1200 | 954 | 170 | 348 | 2502 |
| II | 1218 | 996 | 141 | 348 | 2562 |
| III | 1812 | 2112 | 262 | 1296 | 5220 |
| IV | 1812 | 2256 | 311 | 1296 | 5364 |

There was considerable difference in the production of the different mixtures under grazing treatment. This was largely due to two factors: namely, the inherent productivity of the various mixtures and their drouth resistance which made a longer grazing season possible with mixtures III and IV when compared to I and II. The difference in drouth resistance was particularly noticeable during 1941 when a drouth season of several weeks duration cut the grazing season of all mixtures but particularly mixtures I and II.

The second system of management, that of removing the first crop for hay and pasturing the second, showed differences in the yielding ability of the mixtures not only in terms of hay produced but also in grazing days in the second crop season. This difference in grazing days was a reflection of the drouth resisting qualities of the plants in the mixture. In totals, over the three year period, mixture I produced 9079 pounds of hay and 828 sheep days per acre, mixture II, 8213 pounds and 774 days, mixture III, 14,703 pounds and 2058 days and mixture IV, 11,689 pounds and 2022 days. The third system of management was that in which both cuttings where available were removed as hay. The results of the hay yields are shown in table 2.

Table 2. RETURNS FROM PLOTS HARVESTED ONLY FOR HAY TAKING TWO CUTTINGS PER SEASON IF AVAILABLE Ave. of 4 Replications

| Forage Mixture | Hay Yield, Pounds Per Acre at 15 Per Cent Moisture 1939 | 1940 | 1941 | Total |
|---|---|---|---|---|
| I - 1st Cutting | 2804 | 3213 | 2719 | |
| 2nd Cutting | 1304 | None | None | |
| Total | 4108 | 3213 | 2719 | 10,040 |
| II - 1st Cutting | 3764 | 2313 | 2728 | |
| 2nd Cutting | 309 | None | None | |
| Total | 4073 | 2313 | 2728 | 9,114 |
| III - 1st Cutting | 4440 | 4758 | 6619 | |
| 2nd Cutting | 2413 | 2693 | 263 | |
| Total | 6853 | 7451 | 6882 | 21,186 |
| IV - 1st Cutting | 4394 | 3974 | 4206 | |
| 2nd Cutting | 2835 | 3360 | 205 | |
| Total | 7229 | 7334 | 4411 | 18,974 |

The above table shows that mixtures III and IV not only produced approximately twice as much hay per acre over the three year period as did I and II but that mixtures I and II failed to produce any harvestable growth in two of the three years.

Following the three years of variable forage management, the entire area was plowed, fitted and planted to corn on May 20, 1942 with no fertilizer or manure being added. The corn was harvested both for silage and grain on September 22 and October 7, respectively, from the same areas as those originally in the different forage mixtures under the three systems of management. The corn yields are shown in table 3.

Table 3 - CORN YIELDS IN 1942, FOLLOWING THE THREE YEARS OF GROWING FOUR MIXTURES UNDER THREE SYSTEMS OF MANAGEMENT. Ave. of 4 Replications

| Mixture | Management | Silage Sept. 22 Tons Per Acre Green Wt. | Grain Yield Oct. 7 Bus. Per Acre at 15.5% Moisture |
|---|---|---|---|
| I | Pasture | 9.7 | 71.84 |
| | Hay & Pasture | 8.7 | 62.63 |
| | Hay | 8.4 | 59.54 |
| II | Pasture | 10.7 | 71.88 |
| | Hay & Pastures | 7.8 | 57.53 |
| | Hay | 9.0 | 61.24 |
| III | Pasture | 10.7 | 80.27 |
| | Hay and Pastures | 9.2 | 62.86 |
| | Hay | 11.1 | 72.82 |
| IV | Pasture | 11.4 | 80.06 |
| | Hay & Pasture | 10.3 | 72.36 |
| | Hay | 8.3 | 66.26 |

Table 3 shows that there were small differences in the yield of corn silage following the four different mixtures but the grain yields were noticeably better where alfalfa was included in the mixtures. There also was a general tendency for the continuous pasture practice to yield the most silage and grain when compared with the other two forages practices.

In order to show any existing differences in silage and grain yields between the four previous mixtures and three previous treatments, the yields were averaged and compared as to mixture without regard to treatment and likewise as to treatment without regard to mixture. These averages are shown in table 4.

Table 4 - A COMPARISON OF CORN YIELDS IN 1942 AS TO MIXTURE AVERAGES WITHOUT REGARD TO TREATMENT & TREATMENT WITHOUT REGARD TO MIXTURE

| Previous | Mixture Averages | | | Previous | Treatment Averages | | |
|---|---|---|---|---|---|---|---|
| | | Grain | | | | Grain | |
| Mixture | Silage-Tons | Bu. | % Moisture | Treatment | Silage-Tons | Bu. | % Moisture |
| I | 8.9 | 64.7 | 39.6 | Pasture | 10.6 | 76.0 | 37.6 |
| II | 9.2 | 63.5 | 39.8 | Hay & Pasture | 9.0 | 63.8 | 40.7 |
| III | 10.3 | 72.0 | 39.1 | Hay | 9.2 | 65.0 | 40.5 |
| IV | 10.0 | 72.9 | 39.9 | | | | |

The figures in table 4, show that the pasture treatment was highly significant in affecting corn yields when compared to continuous hay or the hay-pasture combination. The significance in favor of the pasture treatment of the previous mixtures is apparent in yields of corn silage and grain and in the moisture content of the grain at harvest time. There is no difference between the continuous hay or hay-pasture treatments of the previously grown mixtures.

The differences between mixtures as to their effect on the subsequent yield of corn are not as definite as are the differences between the three different treatments. However, the figures show a significant difference between mixtures I and II, and III and IV. The mixtures containing alfalfa show a significant increase in yield of grain over the mixtures not containing alfalfa.

Following the year of corn, the area was again plowed, fitted and reseeded to alfalfa in oats. However, only one-half of each original plot was refertilized with 400 pounds per acre of 0-20-20 fertilizer, the remaining half was left as a check area. Hay yields were taken from each half of each plot during 1944 and 1945 to attempt to measure the effects of the previous treatment of the original mixtures as well as the effects of the additional fertilizer. The results are shown in table 5 and 6.

Table 5 - COMPARISON OF HAY YIELDS IN POUNDS PER ACRE AT 15 PER CENT MOISTURE, AS INFLUENCED BY PREVIOUS MIXTURE, FORAGE TREATMENT AND FERTILIZER - Average of two years

| TREATMENT | | P | H&P | H |
|---|---|---|---|---|
| Previous Mixture | Fertilizer | | | |
| I | Fertilized | 5118 | 4307 | 3392 |
| | Unfertilized | 4797 | 3303 | 3139 |
| | Difference | 321 | 1004 | 1353 |
| II | | | | |
| | Fertilized | 4326 | 4568 | 4503 |
| | Unfertilized | 4028 | 3655 | 2804 |
| | Difference | 298 | 913 | 1699 |
| III | Fertilized | 4954 | 3754 | 4600 |
| | Unfertilized | 4512 | 2268 | 3527 |
| | Difference | 442 | 1486 | 1073 |
| IV | Fertilized | 4960 | 4367 | 3787 |
| | Unfertilized | 4313 | 2772 | 3097 |
| | Difference | 647 | 1595 | 690 |

Table 6 - COMPARISONS BETWEEN PREVIOUS FORAGE TREATMENT AND ADDITIONAL FERTILIZER ON THE YIELD OF HAY FOLLOWING RESEEDING OF ORIGINAL PLOTS

| Previous Treatment | Fertilizer | 1944 | 1945 | Ave. |
|---|---|---|---|---|
| Pasture | Fertilized | 4561 | 5117 | 4839 |
| | Unfertilized | 3902 | 4923 | 4412 |
| | Difference | 659 | 194 | 427 |
| Hay & Pasture | Fertilized | 4056 | 4442 | 4249 |
| | Unfertilized | 2405 | 3594 | 2999 |
| | Difference | 1651 | 848 | 1250 |
| Hay | Fertilized | 4088 | 4602 | 4345 |
| | Unfertilized | 2631 | 3653 | 3142 |
| | Difference | 1457 | 949 | 1203 |

A study of tables 5 and 6 shows that the previous forage mixtures had no significance in the yield of hay following reseeding but that the management practices of the previous forage and use of additional fertilizer were highly significant. The removal of the original forage mixtures as pasture gave the least increase in hay yield following additional fertilizer and reseeding. Additional fertilizer seemed particularly beneficial in establishing a productive alfalfa stand on those areas from which the forage had been previously removed as either hay or hay and pasture.

## SUMMARY


1. Four different forage mixtures were subjected to three systems of management over a three year period.

2. The yield of hay, gains made by sheep in one year, and sheep days per acre were approximately doubled during the three year period where alfalfa was present in the mixture when compared to a straight grass or red clover-grass mixture.

3. Corn yields, either as grain or silage were significantly higher where a given preceding mixture was pastured rather than cut for hay or used for hay and pasture both.

4. The differences among treatments in respect to their effect on the subsequent yield of corn were more definite than the differences among the mixtures.

5. The mixtures containing alfalfa show a significant increase in yield of grain over the mixtures not containing alfalfa.

6. The kind of preceding mixture had little effect, but previous management and additional fertilizer were highly significant in affecting the yield of alfalfa after reseeding.