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SUMMARY

Milking Jersey cows were used to evaluate hay made from a pure stand of orchardgrass and a mixture of alfalfa and orchardgrass in four feeding trials at the Dairy Experiment Station. In trial I, orchardgrass cut in the boot stage of maturity was compared with an alfalfa-orchardgrass mixture cut when alfalfa was in the bud stage of maturity. In later trials, orchardgrass was to be harvested in the boot stage and an alfalfa-orchardgrass mixture in the bud stage and again about 2 weeks later. Weather conditions forced a 3-week delay in harvesting late-cut alfalfa-orchardgrass in trial II and late-cut orchardgrass in trial IV. Early-cut alfalfa was not harvested in trial IV because of weather conditions. Except for stands in trial I, the pure stands of orchardgrass were fertilized in early spring with 200 pounds of ammonium nitrate per acre (112 kg. NH_3NO_4/ha.).* Specific findings of this study were as follows:

1) Crude protein content of pure stands of orchardgrass fertilized with 200 pounds of ammonium nitrate per acre (112 kg.NH_3NO_4/ha.) was equal to that of a good alfalfa-orchardgrass hay.

2) An alfalfa-orchardgrass mixture harvested when alfalfa was in the bud stage of maturity resulted in hay of higher milk-producing potential than the same crop cut at a later date, with no significant effect on yield per acre.

3) Dry matter yield per acre of orchardgrass was substantially higher when the hay was harvested about 2 weeks after the early boot stage of maturity, without a consistent effect on the feeding value for milk production. Therefore, in this study, the optimum time to cut orchardgrass to maximize hay yield without a serious effect on milk production was soon after first heads emerge.

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*Metric terms used often in this bulletin are ha., the abbreviation for hectare, or about 2½ acres, and kg., the abbreviation for kilogram, or about 2-1/5 pounds.

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INTRODUCTION

Frequently, the difference between a highly successful dairy herd and a marginal herd is in the forage program. Forage is normally grown on the farm where it is fed, and the farmer tends to consider yield per acre more important than quality of forage produced. Although hay can be purchased, high-quality hay is difficult to find.

Alfalfa and orchardgrass are two of the important hay crops grown in Tennessee. Generally, the two are grown as a mixture. However, because of the alfalfa weevil and other management problems, the use of pure stands of orchardgrass has increased. Knowledge of the comparative nutritive value of alfalfa-orchardgrass mixtures and of pure stands of orchardgrass is economically significant to dairymen.

This study at the Dairy Experiment Station had two purposes: 1) to compare the nutritive value of a mixed alfalfa-orchardgrass hay with that of nitrogen-fertilized orchardgrass hay as the only forage for milking cows, and 2) to determine the effect of stage of maturity at harvest on quality of hay produced.

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LITERATURE REVIEW

The nutritive value of most forage crops declines with advancing stages of maturity. Decline in digestibility with advancing maturity has been clearly shown in numerous trials with alfalfa (2, 4, 7, 12, 24, 29-31, 45, 47, 51, 52), orchardgrass (5, 6, 8, 18, 34, 35, 47), and other species (2, 6, 10, 11, 20, 21, 25, 27, 32, 41, 44, 49). A number of research workers (4, 9, 11, 12, 26, 36, 44-47, 49, 51) have reported a marked increase in daily milk production when cows were fed early-cut forage as compared with production when cows were fed the same crop cut at a more mature stage. Cornell University research workers (49) reported that the optimum period for harvesting a hay crop usually does not extend beyond a 2- or 3-week interval.

A comparison of results from widely-separated locations clearly shows a different effect of maturity on nutritive value due to location. Homb (20), testing sheep in Norway, reported that the nutritive value of timothy declined 0.47 percentage units daily as maturity increased. Reid (41) in New York advanced the idea that the nutritive value of first-growth forage could be computed from the days elapsing after April 30. In the Reid formula, the nutritive value declined 0.48 percentage units daily after April 30. Mellin et al. (32) in Maine reported results similar to those of Reid. Kane and Moore (21) studied 14 forages at Beltsville, Md., and reported results that did not agree with Reid's formula. Minson et al. (34) in the British Isles reported data in close agreement with date of Kane and Moore. Conrad et al. (11), studying forages harvested in northern Ohio, reported that forage nutritive value declined at the rate of 0.29 percentage units per day as maturity increased. Krueger et al. (24) studied the nutritive value of first-growth alfalfa-bromegrass hay cut on four cutting dates at two locations in Wisconsin. These workers reported a difference between the nutritive value of hays cut on the same date at the Marshfield Station (44°44') and the Arlington Station (43°20').

Most research on the proper time to harvest hay has been conducted at latitudes quite different from those of Tennessee and with varieties or species not adapted to this region. In most of these studies, date of cutting has been based on calendar dates; therefore, these results apply less to Tennessee because of the effect of latitute on the beginning of the growing season.

Although maturity affects all cuttings, the effect seems to be more critical with the first cutting. Baumgardt and Smith (2), Dent (13, 14), and Miles et al. reported that changes in forage composition are more pronounced on the first than on later cuttings.

Research (3, 16, 19, 22, 23, 39, 43) has shown that the yield of grass can be substantially increased by liberal applications of nitrogen. Crude protein content of grasses has been increased (1, 3, 10, 15, 17, 22, 23, 28, 38, 40, 42) with moderate to heavy use of nitrogen. Blaser (3) reported that although adding nitrogen resulted in increased yield and crude protein content, it did not increase the energy value of the crop. Colovos et al. (10) reported that the nutritive value of bromegrass hay was not significantly affected by four levels of nitrogen fertili-

zation. Minson et al. (34) reported that adding nitrogen had little effect on digestibility of orchardgrass. Poulton et al. (37) reported no difference in total digestible nutrients and digestible energy among three lots of orchardgrass hay produced with additions of 100, 200, and 300 pounds of nitrogen per acre (112, 224, 236 kg. of N/ha.). Reid et al. (42) reported no significant difference in digestible dry matter from adding four levels of nitrogen to tall fescue. Markley et al. (28), in contrast, reported that 200 pounds of nitrogen per acre (224 kg. of N/ha.) significantly increased the feeding value of orchardgrass and bromegrass.

Results of milk production trials with forages produced with moderate to heavy additions of nitrogen have been somewhat mixed. Ramage et al. (40) compared orchardgrass fertilized at 50 and 200 pounds of nitrogen per acre (56 and 224 kg. of N/ha.) and reported higher milk production on the hay produced with the higher level of nitrogen. In an earlier study (38), these workers reported no difference due to nitrogen level. Derbyshire et al. (15) compared silages from unfertilized orchardgrass and from the same crop fertilized with 400 pounds of ammonium nitrate per acre (448 kg. of NH_3NO_4/ha.), and reported slightly higher milk production due to nitrate fertilization. Gordon et al. (18) fed orchardgrass silages produced with the addition of 0 and 400 pounds of ammonium nitrate per acre (0 and 448 kg. of NH_3NO_4/ha.) and harvested at two stages of maturity. They reported higher milk production on the nitrogen-fertilized silage that was harvested early. However, there was no difference in milk production due to nitrogen level on late-cut silage.

EXPERIMENTAL PROCEDURE

Trial I (1967-68). Twenty milking Jersey cows were used in a continuous feeding trial to compare a pure stand of orchardgrass hay cut in the boot stage with an alfalfa-orchardgrass mixture cut when alfalfa was in early bud. Boot stage of orchardgrass was considered to be the time when heads could be first felt within the leaf sheath. Bud stage in an alfalfa-orchardgrass mixture was considered to be the time when early blossom buds could be clearly seen on most stems of alfalfa. A 2-week standardization period preceded a 6-week experimental period. Data collected during the standardization period were used to assign cows to treatments and also to analyze the results by the covariance method as outlined by Steel and Torrie (48).

Alfalfa hay was harvested on April 18, and orchardgrass hay was harvested on April 19. Hay was the only source of forage, and individual feed weights were recorded daily for hay fed and refused. Moisture determinations were made biweekly on hay samples. Dried samples from the moisture determination were saved for chemical analyses by the Van Soest method (50).

A 16% crude protein concentrate mixture was fed to each cow individually in the milking parlor. Concentrate allowance was based on production of each cow during the standardization period. Grain allowance was initially set at the rate of 1 pound for each 4 pounds of 4% fat-corrected milk (FCM) daily (1 kg.

for each 4 kg FCM), and then reduced at 2-week intervals at the rate of 2% per week.

Daily milk weights were recorded for each animal. Composite samples of morning and afternoon milkings were taken weekly for fat, solids-not-fat (SNF), and protein analysis. Body weights were taken for 3 consecutive days at the beginning and at the end of the experimental period.

Trial II (1968-69) and Trial III (1969-70). Twenty-eight milking Jersey cows were used each year to evaluate hay made from a pure stand of orchardgrass and an alfalfa and orchardgrass mixture. A 2 x 2 factorial design feeding trial was used each year.

Treatments planned were 1) alfalfa-orchardgrass mixture cut when alfalfa was in the bud stage; 2) alfalfa-orchardgrass cut 2 weeks later; 3) orchardgrass cut in boot stage; and 4) orchardgrass cut 2 weeks later.

Comparisons were made by using continuous feeding trials and covariance analysis as described in trial 1. Cows were assigned to groups of four on the basis of daily milk production and stage of lactation. Cows were assigned to treatment at random from these groups of cows. The length of the experimental period was 12 weeks in trial II and 10 weeks in the trial III.

Forage consumption and sampling data were collected and analyzed in the same manner as that described for trial 1. Boot stage orchardgrass was harvested on April 24 in 1968, and the late orchardgrass was cut on May 7. Bud stage alfalfa-orchardgrass was cut on April 30 in 1968; however, because of rainy weather, the late-cut alfalfa-orchardgrass was not harvested until May 20. The next year orchardgrass was harvested on April 21 and May 5 and alfalfa-orchardgrass was harvested on April 30 and May 12.

Pure stands of orchardgrass used in these studies were fertilized in early spring with 200 pounds of ammonium nitrate per acre (224 kg. NH_3NO_4/ha.). Phosphate and potash were applied according to soil test. Alfalfa-orchardgrass was fertilized with 200 pounds of muriate of potash (224 kg. of $KC1$/ha.), with 2% borax, annually. Other plant nutrients were supplied according to soil test.

Dry-matter yield per acre was estimated in 1969 by drying and weighing hay cut from representative 9- x 10-foot areas (8.36 square meters). Yields were estimated on the day of harvest at four random locations in the field.

Trial IV (1971-72). The experimental plan for trial IV was the same as that for trials II and III. However, bud stage alfalfa hay was not harvested because of inclement weather. Thirty milking Jersey cows were used to compare the following treatments: 1) alfalfa-orchardgrass cut 2 weeks after alfalfa was in the bud stage; 2) orchardgrass cut in boot stage; and 3) orchardgrass cut 2 weeks later. Orchardgrass was harvested on April 28 and May 17. Alfalfa-orchardgrass was harvested on May 17. Crop yield and feeding trial data were collected and analyzed in the same manner as that for trials II and III.

RESULTS

Figure 1 shows the boot stage orchardgrass at cutting in 1969. Figure 2 shows the late-cut orchardgrass in 1969. Contrast in emergence of head between Figure 1 and Figure 2 is quite evident and is typical of that of the other years.

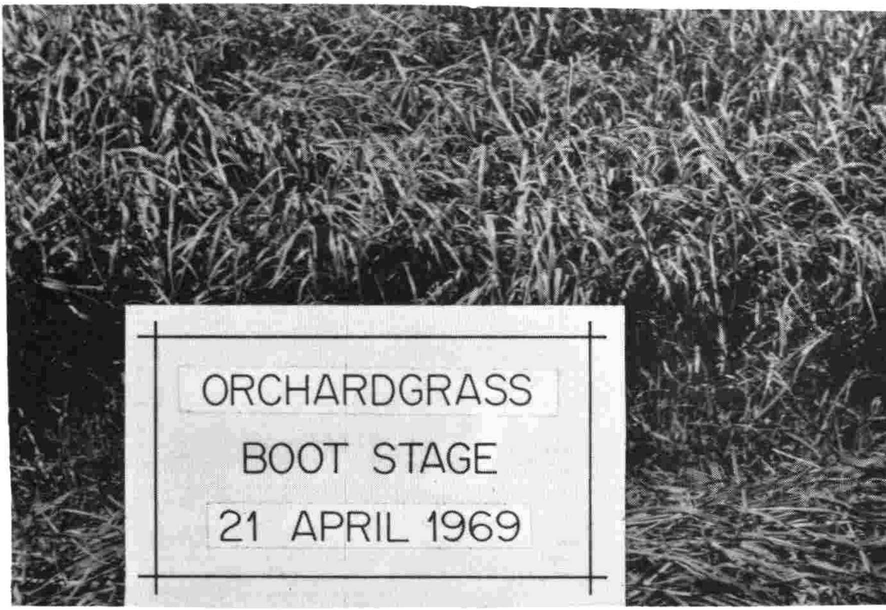

Figure 1. Boot stage orchardgrass hay harvested April 21, 1969.

Figure 2. Late-cut orchardgrass hay harvested May 5, 1969.

Decision on when to harvest the alfalfa-orchardgrass mixture was based solely on the maturity of the alfalfa. Bud stage is shown in Figure 3. Late-cut alfalfa-orchardgrass is shown in Figure 4. Delay of about 2 weeks between bud and late cut resulted in the appearance of an occasional bloom and secondary tillers at the base of the alfalfa plants.

Hay maturity stages shown in Figures 1 through 4 conform to the objectives of the study and are generally descriptive of the respective stages throughout the study with three exceptions: 1) in trial I, bud stage alfalfa-orchardgrass hay may have been 5 to 7 days more immature than that shown in Figure 3; 2) in trial II, late-cut alfalfa-orchardgrass was harvested 7 days later than planned; and 3) in trial IV, late-cut orchardgrass was about 5 days more mature than that shown in Figure 2.

Chemical Composition:

Chemical composition of hay is shown in Table 1. Hay fed in trial I was harvested in April 1967 and fed the next winter. In contrast to hay in the later

Table 1. Chemical composition of hay

Stage of growth and year of harvest	Date cut	Dry matter constituents			
		Crude protein	CWC[1]	ADF[2]	Lignin
		Percent			
Alfalfa-orchardgrass					
Bud Stage					
1967	April 18	20.3	54.3	34.9	-----
1968	April 30	21.4	45.3	33.0	5.4
1969	April 30	19.5	59.9	42.1	-----
Late cut					
1968	May 20	17.1	55.6	39.2	6.6
1969	May 12	15.7	57.8	40.7	-----
1971	May 17	15.5	45.3	38.4	5.6
Orchardgrass					
Boot stage					
1967	April 19	14.5	62.7	36.6	-----
1968	April 24	22.1	61.8	32.1	2.9
1969	April 21	23.0	66.1	37.4	----
1971	April 28	20.5	55.4	37.0	4.8
Late cut					
1968	May 7	15.7	63.8	38.2	5.1
1969	May 5	14.6	68.5	35.5	----
1971	May 17	13.7	63.7	42.3	6.4

1 CWC = Cell wall constituents.
2 ADF = Acid detergent fiber.

Figure 3. Bud stage alfalfa-orchardgrass hay harvested April 30, 1969.

Figure 4. Late-cut alfalfa-orchardgrass hay harvested May 12, 1969.

trials, the pure stand of orchardgrass harvested in 1967 did not receive an application of nitrogen fertilizer in the spring before the first harvest. This lack of nitrogen resulted in a substantially lower crude protein value for boot stage orchardgrass in trial I than was observed in subsequent trials.

Crude protein values of boot stage orchardgrass hay were 22.1 in trial II and 23.0 in trial III, and were slightly higher than the values on bud stage alfalfa-orchardgrass. These relatively high crude protein values for the pure stand of orchardgrass were probably due to the level of nitrogen fertilization and generally agree with results in the literature. Delay in harvesting caused a greater decline in crude protein content of the orchardgrass hay than in the alfalfa-orchardgrass mixture. For example, in 1968, the protein content of late-cut alfalfa harvested 3 weeks after bud stage alfalfa was higher than that of late-cut orchardgrass harvested 2 weeks after boot stage orchardgrass.

Animal Responses:

Results of feeding trial I (1967-68) are shown in Table 2. Alfalfa-orchardgrass hay was superior ($P < 0.05$) to the pure stand of orchardgrass hay when both were harvested at a relatively immature physiological stage and on approximately the same calendar date. Cows fed the alfalfa-orchardgrass hay consumed significantly ($P < 0.05$) more forage dry matter and produced 3.6 pounds (1.63 kg.) more milk and 2.5 pounds (1.13 kg.) more fat-corrected milk (FCM) than their mates on pure stand orchardgrass hay. Percentage of butterfat was higher ($P < 0.05$) when orchardgrass was fed.

Table 2. Feeding Trial I, 1967-68

Item		Alfalfa-orchardgrass mixture	Orchardgrass
Date cut		**April 18**	**April 19**
Actual milk	(lb.)	39.7[a]	36.1[b]
	(kg.)	18.0	16.4
Fat corrected milk	(lb.)	47.2[a]	44.7[b]
	(kg.)	21.4	20.3
Milk constituents (%)			
Butterfat		5.2[b]	5.5[a]
Protein		4.26[a]	4.20[a]
Solids-not-fat		9.42[a]	9.36[a]
Forage dry matter consumed (% body weight)		1.95[a]	1.60[b]
Body weight change	(lb./day)	+0.21[a]	−0.17[a]
	(kg./day)	+0.10	−0.08

[a]Values followed by the same superscript are not significantly different ($P > 0.05$).

Results of feeding trial II (1968-69) are shown in Table 3. Late-cut alfalfa-orchardgrass mixture was harvested 1 week later than planned because of inclement weather. As a result, consumption was significantly lower ($P < 0.05$) when cows were fed late-cut alfalfa-orchardgrass than when they were fed other types of hay. Milk production was lower ($P < 0.05$) on late-cut than on early-cut alfalfa-orchardgrass. A delay in the harvesting of both crops resulted in a highly significant ($P < 0.01$) decline in FCM production. Milk production from cows fed orchardgrass and alfalfa-orchardgrass hays did not differ significantly at either early or late stages of maturity in this trial. Milk constituents or body weight change did not differ significantly in this trial. Stage of maturity X hay crop interactions did not differ significantly for any data studied.

Results of feeding trial III (1969-70) are shown in Table 4. Cows fed early-cut alfalfa-orchardgrass hay consumed significantly ($P < 0.05$) more dry matter as percentage of body weight and produced more ($P < 0.05$) milk and FCM than their mates on the other types of hay. Milk production, FCM, and dry matter intake on boot stage orchardgrass, late-cut orchardgrass, and late-cut alfalfa-orchardgrass were not significantly different. There is no logical explanation for the poor performance of early-cut orchardgrass in this trial. Late-cut alfalfa was harvested as planned in 1969; however, the decline in feeding value from early-cut alfalfa was much greater than in 1968 when harvest of late-cut material was delayed 1 week longer than planned because of rains. Protein and solids-not-fat (SNF) content of milk were significantly lower ($P < 0.05$) when cows were fed late-cut alfalfa-orchardgrass than when they were fed the other types of hay.

Results of feeding trial IV (1971-72) are shown in Table 5. The experimental design of trial IV was planned to be identical to that in trials II and III; however, 2 weeks of rainy weather made harvesting alfalfa-orchardgrass in the bud stage impossible. Milk production was at a higher level in trial IV, but results were similar to those in trial III in that cows fed early-cut orchardgrass and late-cut alfalfa-orchardgrass were not significantly different in milk production, FCM, and forage dry matter intake. Forage dry matter intake ($P < 0.05$) and FCM production ($P < 0.05$) were significantly lower for cows fed the late-cut orchardgrass than for their mates fed the other two types of hay. We need to point out that harvest of late-cut orchardgrass in 1971 was delayed 5 days longer than planned because of rain, and yield per acre increased about 100 percent during this period.

Yield Per Acre:

Dry matter yield per acre of the first cutting of each type of hay harvested in 1969 (trial III) and in 1971 (trial IV) are shown in Table 6. Delay of cutting of orchardgrass in 1969 and 1971 considerably increased dry matter yield per acre, particularly in 1971, when rainy weather prevented the harvest of bud stage alfalfa-orchardgrass and delayed cutting of late orchardgrass by 5 days. Increase in yield of alfalfa-orchardgrass was approximately 10 percent in 1969, but no comparison was possible in 1971 because of weather.

The rapid rise in dry matter yield per acre of orchardgrass in this study

Table 3. Feeding Trial II, 1968-69

Item		Bud stage alfalfa-orchardgrass	Boot stage orchardgrass	Late-cut alfalfa-orchardgrass	Late-cut orchardgrass
Date cut		**April 30**	**April 24**	**May 20**	**May 7**
Actual milk	(lb.)	34.1[a]	33.7[ab]	31.4[b]	32.3[ab]
	(kg.)	15.5	15.3	14.2	14.6
Fat corrected milk	(lb.)	40.3[a]	39.9[a]	36.8[b]	36.9[b]
	(kg.)	18.3	18.1	16.7	16.7
Milk constituents (%)					
Butterfat		5.3[a]	5.5[a]	5.1[a]	5.1[a]
Protein		4.35[a]	4.37[a]	4.31[a]	4.34[a]
Solids-not-fat		9.5[a]	9.3[a]	9.4[a]	9.4[a]
Forage dry matter consumed					
(% body weight)		1.89[a]	1.91[a]	1.79[b]	1.96[a]
Body weight change	(lb./day)	+.24[a]	–.05[a]	–.03[a]	–.01[a]
	(kg./day)	+.11	–.02	–.01	–.01

[a]Values followed by the same superscript are not significantly different ($P > 0.05$).

Table 4. Feeding Trial III 1969-70

Item		Bud stage alfalfa-orchardgrass	Boot stage orchardgrass	Late-cut alfalfa-orchardgrass	Late-cut orchardgrass
Date cut		**April 30**	**April 21**	**May 12**	**May 5**
Actual milk	(lb.)	32.0^{a}	27.8^{b}	26.2^{b}	27.7^{b}
	(kg.)	14.5	12.6	11.9	12.6
Fat corrected milk	(lb.)	39.4^{a}	33.7^{b}	32.0^{b}	34.8^{b}
	(kg.)	17.9	15.3	14.5	15.8
Milk constituents (%)					
Butterfat		5.5^{a}	5.4^{a}	5.5^{a}	5.7^{a}
Protein		4.42^{a}	4.51^{a}	4.27^{b}	4.40^{a}
Solids-not-fat		9.6^{a}	9.6^{a}	9.3^{b}	9.6^{a}
Forage dry matter consumed (% body weight)		2.44^{a}	2.26^{b}	2.19^{b}	2.26^{b}
Body weight change	(lb./day)	$+.40^{a}$	$+.33^{a}$	$+.26^{a}$	$+.27^{a}$
	(kg./day)	+.18	+.15	+.12	+.12

^{a}Values followed by the same superscript are not significantly different ($P>0.05$).

Table 5. Feeding Trial IV, 1971-72

Item	Boot stage orchardgrass	Late-cut alfalfa-orchardgrass	Late-cut orchardgrass
Date cut	**April 28**	**May 17**	**May 17**
Actual milk (lb.)	35.7[a]	35.6[a]	32.9[b]
(kg.)	16.2	16.1	14.9
%Fat	4.84[a]	4.86[a]	4.97[a]
Fat corrected milk (lb.)	40.5[a]	40.2[a]	37.1[b]
(kg.)	18.4	18.2	16.8
Forage dry matter consumed (% body weight)	2.07	1.82	1.66
Body weight change (lb./day)	+0.03[a]	+0.01[a]	–0.03[a]
(kg./day)	+0.01	+0.00	–0.01

[a]Values followed by the same superscript are not significantly different ($P > 0.05$).

Table 6. Dry matter yield per acre of first cutting in 1969 and 1971

Stage of growth and year of harvest	Date cut	Dry matter per acre
		Pounds
Alfalfa-orchardgrass		
Bud stage		
1969	April 30	2907
1971	- - - - -	- - - - -
Late cut		
1969	May 12	3196
1971	May 17	3213
Orchardgrass		
Boot stage		
1969	April 21	2163
1971	April 28	2501
Late cut		
1969	May 5	3465
1971	May 17	5022

generally agreed with published data on ryegrass as reviewed by Blaser (3). This relatively large increase in yield per acre on first cutting must be balanced against a decline in potential for milk production and decrease in number of cuttings per year. Minson et al. (34) reported that digestibility of orchardgrass declined most rapidly after the heads emerged. Emergence of heads in the 1969 orchardgrass hay cut 2 weeks after bud stage can be seen in Figure 2. Delay of 2 weeks in harvesting in 1969 resulted in 60 percent greater yield per acre and no significant difference in milk production; whereas, milk production decreased significantly ($P < 0.05$) in 1971, when yield was increased 100 percent from early to late cut.

DISCUSSION

Alfalfa-orchardgrass hay was clearly superior in milk production to pure stand orchardgrass hay in trials I and III when both were harvested at a relatively immature (bud or boot) physiological stage. However, the comparison of the early-cut stages in trial II was not significantly different. Delay of 2 weeks in cutting significantly affected quality of the alfalfa-orchardgrass mixture, with a relatively low increase in yield the 1 year it was measured. Based on an earlier study at this location (33), a delay of 2 weeks in harvesting the first cutting of alfalfa-orchardgrass reduced the yield of subsequent cuttings more than that gained in the first cutting. Actual milk production was not significantly different between late-cut alfalfa-orchardgrass and early-cut orchardgrass in feeding trials II, III, and IV; however, FCM was greater ($P < 0.05$) for boot stage orchardgrass in trial II.

Milk production was significantly higher ($P < 0.05$) on early-cut orchard-

grass than late-cut in 1971 when per acre yield of late-cut grass increased by 100 percent and cutting was delayed 5 days longer than planned. In 1969, yield of orchardgrass increased 60 percent during the 2-week period; but, milk production was essentially equal. Yield differences were not measured in 1968 but the difference in milk production was not significant ($P>0.05$).

These results should be considered in light of the fact that the cows were receiving one-third to one-half of their nutrient requirements from grains. Because of economic considerations, this is a common practice among good commercial dairymen. The feeding trials were designed with this in mind, and the results apply to many similar feeding situations. The results do not, however, preclude the possibility that greater and more consistent differences in the nutritive value of such forages might appear in a ration more heavily dependent on them.

Research at the Tennessee station (16) has shown that harvesting first growth of orchardgrass in the early joint or the late boot stage may be less detrimental to the stand than harvesting in the bloom stage. British research (34) has shown that the most rapid decline in feeding value of orchardgrass began with the emergence of heads.

Results of these trials agree with those of previous research and indicate that orchardgrass should be cut as soon as possible after first heads appear in order to maximize yield per acre without a serious decline in quality hay. Apparently, the early cutting in these trials (April 22-28) was at least 1 week or 10 days too early. Yield per acre increased after this date with little effect on quality; therefore, the optimum time for harvest probably was about May 1-8. If cutting is delayed past this date, quality of hay produced may be affected too much to offset the increase in yield, such as that in the 1971 trial.

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