The daily consumption of high-moisture alfalfa wafers, with or without forced-air drying, averaged 3½ lbs per cow more than baled hay in a recent trial at Davis. There was no significant difference in milk production between conventionally stored wafers and baled hay, but on aerated wafers FCM (4% fat-corrected milk) was increased 2 lbs per cow daily.

High- and Low-Moisture ALFALFA WAFERS FOR MILK PRODUCTION

G. A. HUTTON, JR. · MAGNAR RONNING · J. B. DOBIE

DAIRYMEN ARE paying a premium for the 10 to 15 thousand tons of alfalfa wafered yearly in northern California and likely would buy more if it were available. The dairymen feeding wafers claim the premium paid is offset by reduced waste, storage space and feeding labor, and by increased feed consumption and milk production.

In recent trials at Davis, wafered alfalfa hay resulted in increased intake and production over baled hay when fed to dairy cows, with no effect upon milk fat. Water added to windrowed alfalfa hay during wafering may increase the moisture content of wafered hay above optimum storage levels under some conditions. This work was undertaken to compare baled with wafered alfalfa hay stored at low-moisture (aerated wafers) and high-moisture content (conventional wafers) when fed to dairy cows.

In the fall of 1963, two of each three windrows of alfalfa in each irrigation check were wafered in the afternoon using a roller-die-type wafering machine. The third windrow was baled in the morning on the same day wafers were made. Moisture content in the windrow at time of wafering was 7.5 to 8.0%. The wafers contained from 18.9 to 20.8% moisture as they emerged from the machine and 18.0 to 19.1% as delivered into storage. The wafers were 2 × 2.5 inches and from 0.5 to 6.0 inches long. Fines, consisting of disintegrated wafers and material that did not bind in the wafering process or break off during handling, amounted to 42% of the total weight.

Both lots of wafers were stored in 10 × 10 ft wire mesh bins at a settled depth of 6 ft. One bin was lined with polyethylene sheeting on four sides and fixed with a false floor so air could be forced upward through the wafers for drying. Temperatures were measured using a probe-type thermometer inserted 3 ft into each bin. Temperature of the wafers averaged 93°F as they were placed in storage. The aerated (A) wafers cooled to ambient temperature within 1 hr after storage and remained at this level. The conventional (C) wafers cooled gradually for the first 11 days, after which a rapid temperature rise to a maximum 129°F on the 23rd day was observed. The C-wafers turned brown from the center to within 1 ft of the outside surface of the pile, whereas the A-wafers retained a bright green color. Very little mold was noticed in the C-wafers.

Six Jerseys and six Holsteins were assigned to three groups of four cows each, averaging 62 days post-calving. The cows were rotated at six-week intervals so that all received each of the three types of hay free choice. The last period was only three weeks because the supply of wafers was depleted. All three groups were fed baled hay the remaining three weeks of the last period.

Weighed amounts were offered twice daily to insure leftover hay, which was weighed back weekly. Composite samples of hay fed and refused during each period were collected for dry matter determinations and proximate analyses. The

TABLE 1. COMPOSITION OF HAY OFFERED AND REFUSED

Alfalfa	Offered				Refused		
	Dry matter	Crude protein	Crude fiber	Carotene	Dry matter	Crude protein	Crude fiber
	(%)	(% of dry matter)		(mg/lb)	(%)	(% of dry matter)	
Baled	86.2[e]	21.2	25.9	3.2	77.4[b]	15.2[e]	37.0[e]
A-wafer	89.2[d]	20.7	25.5	3.4	82.4[a]	21.5[d]	25.4[d]
C-wafer	87.1[e]	20.9	26.3	2.7	78.5[b]	22.0[d]	24.4[d]

[a, b] Values with different superscripts are significantly different in each category ($P < 0.05$).
[c, d] Values with different superscripts are significantly different in each category ($P < 0.01$).

TABLE 2. RESPONSE OF COWS TO BALED HAY, AERATED AND CONVENTIONALLY STORED WAFERS

	Baled	Aerated wafer	Conventional wafer
Milk, 4% FCM (lb/day/cow)	32.6[b]	34.6[a]	33.2[a, b]
Milk fat (%)	4.8	4.7	4.6
Solids-not-fat (%)	9.0[b]	9.1[a]	9.0[b]
Dry matter intake (lb)	28.5[b]	31.8[a]	32.1[a]
Avg daily liveweight gain (lb)	.9	1.5	1.2

[a, b] Values with different superscripts are significantly different in each category ($P < 0.05$).

TABLE 3. EFFECT OF DRY MATTER INTAKES AND 4% FCM YIELDS OF COWS DURING THE THIRD PERIOD

Period	Baled	A-wafer	C-wafer	Baled	A-wafer	C-wafer
	Mean daily DM intake/cow (lb)			Mean daily FCM yield cow (lb)		
Period 3a[1]	28.5	33.7[a]	33.4[a]	27.1[a]	32.5[a]	29.9[a]
Period 3b[1]	27.5	28.4[b]	26.8[b]	24.1[b]	26.6[b]	24.6[b]
Difference	−1.0	−5.3	−6.6	−3.0	−5.9	−5.3

[a, b] Difference significant ($P < 0.05$).
[1] 3a—First three weeks of Period 3 cows on different treatments; 3b—last three weeks of Period 3, all cows fed baled alfalfa hay.

cows received an average of 15.4 lbs daily of the herd mix concentrate, on the basis of individual cow size and potential production. Milk produced was weighed daily and a two-day composite sample taken weekly for milk fat and solids-not-fat determinations.

No significant differences were found in crude protein, crude fiber, carotene, ash and ether extract in the hay offered (table 1). The C-wafers and the baled hay offered and refused contained approximately the same amount of dry matter during the trial.

Both Jerseys and Holsteins readily accepted the different wafers even when abrupt changes were made at the beginning of each period. The cows were observed to select wafers over fines when both were available.

The crude protein content was higher and the crude fiber content lower in the wafered hay refusals than in that offered, whereas the opposite was true for baled hay—indicating that cows had less tendency to reject the stems in favor of leaves with wafers than with baled hay.

Daily dry matter intake of the wafered alfalfa hay averaged 3½ lbs more per cow than baled hay. As shown in table 2, a significant difference amounting to 2 lbs per cow, was found in daily production of 4% FCM between cows fed A-wafers and baled hay. For C-wafers, a difference of 0.6 lb was not significant. C-wafers were consumed as well as A-wafers, but production was not increased accordingly, compared with baled hay. This indicates that some nutrients may have been lost due to heating which may even have been more obvious in a larger storage volume, where the natural surface drying would have been proportionately less.

There were no effects upon milk fat and average daily gains. The significant difference of the solids-not-fat percentage for the cows receiving A-wafers compared to the other forms of alfalfa hay was obviously too small to be of any importance.

In the last period, when cows fed wafers for three weeks were changed to baled hay, there was a significant drop in daily dry matter intake and FCM yield (table 3). Part of this drop in yield could be attributed to advancing lactation, as indicated in the group receiving baled hay for both three-week periods.

G. A. Hutton, Jr., is Farm Advisor, San Joaquin County; Magnar Ronning is Associate Professor of Animal Husbandry, University of California, Davis; and J. B. Dobie is Agricultural Engineer, U. C., Davis.

SOIL ANALYSIS Aids Grazing In Humboldt

D. W. COOPER • H. F. HEADY

Animal grazing preferences, soil nitrogen, soil moisture, and herbage production were studied over a seven-year period in Humboldt County in an attempt to explain differential grazing. Animals obviously were selecting and sometimes overgrazing forages on certain soil series more than others. The less preferred areas frequently were undergrazed.

The soil-vegetation survey (the first ecological inventory of wildlands in Humboldt County) served as the guide to soils and locations used in this study. As a basic inventory, it was found indispensable for the range and forest field studies and for implementation of intensive wildland management. This mapped inventory describes the soil series with their variations, associated species in order of abundance, and timber or grass productivity.

Herbage clippings representing total yield were made on nine major grassland soil types once a year in September. These groups of three plots each were protected from grazing by small round wire cages. Sampling points extended across the county in two transects from south to north and from east to west (allowing recognition of changing climatic effects with increasing distance inland from the coast). The yield data are expressed as average oven-dry weights of herbage for the seven-year period, 1957 to 1963 (see graph).

Although many factors contribute to productive capacity of grassland soils, the only two discussed here are: 1. total nitrogen in tons per acre and 2. water storage capacity expressed as the difference between the field capacity and the permanent wilting point converted to inches of water—both to a depth of 4 feet. Corrections were made for density and stoniness of the soil.

Productive capacities of the Humboldt County grassland soils vary considerably. The Zanone, Mattole, and McMahon soil series averaged over 5 tons of herbage per acre. Wilder produced less than a ton per acre. Many of these soils occur locally within areas of similar climate and topography. For example, Wilder and Kinman soils are often found adjacent to each other. Kinman, McMahon, Yorkville, and Laughlin soils may occur in a mosaic of types on the same ridge.

Annual rainfall ranges from 35 to 85 inches and occurs from November to May. Water for growing forage between May and November must be supplied by stored soil moisture. In general, a greater moisture storage capacity was associated with more herbage production. Yorkville and Weitchpec were exceptions. The former is a heavy clay that holds more water than any of the other soils measured. It is intermediate in both herbage production and in total nitrogen in the soil. Weitchpec has a moderately high water-holding capacity and very low nitrogen content.

Total nitrogen content is also indicative of productive capacity. The very high-producing soils have more than 24,000 lbs total nitrogen per acre to a depth of 4 feet. The lowest production was found generally on soils with the least nitrogen. Tyson was one exception with lower production than six other soils, although it had more nitrogen than two of them. Wilder was another exception found to be higher in nitrogen but lower in production than Weitchpec. Low forage production on Wilder was related to very acid conditions and unbalance among other minerals as

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William W. Paul .... *Manager* Agricultural Publications

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