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cattle. Hay grinding is a very dusty operation unless fat is added to the hay at time of grinding. Usually a 1% addition of fat will adequately control dust in dry hay. The 4% addition controls all dust and produces more satisfactory results regarding the consumption of the fine parts in the ration. The third aspect is less wear and tear on feed mixing equipment when fat is added to the ration.

Several experiments have been conducted at the Arizona Experiment Station over the last five years to determine the value of fat when added to high concentrate rations and to all-roughage rations. Table 1 gives the results of nine trials in which 4% fat had been added. The average values showed an 8.4% improvement in gain, with an 8.5% improvement in feed efficiency. Feed intake was only slightly affected by the addition of fat.

#### Used Both Milo and Barley

The rations in this series of studies included both milo and barley as a source of grain, with ration protein levels of 11 to 13%. The rations averaged approximately 70% concentrate and 30% roughage. Studies to date suggest that rations to which 4% fat has been added should not contain over 13% protein. At higher protein levels the fat appears to depress the rate of gain.

The largest response to fat has been noted on high milo rations with a somewhat lower response on high barley rations. This is probably due to the fact that steers on barley rations normally gain faster than on

milo rations. Fat levels up to 8% have been added to high concentrate rations with satisfactory results; however, at the higher levels the economics of fat additions become questionable.

Results of fat additions to all alfalfa hay rations are presented in Table 2. The addition of 10% fat to ground alfalfa hay improved performance by 14% and improved feed efficiency by 21%. Apparently the addition of 20% fat was too high, based on performance and general observations of the animals.

At present there are no suggestions that the fat additions, over the normal ration fat, contribute any nutrient or factor other than energy. The use of fat sufficient to contribute significantly to the energy content of the ration ultimately becomes one of economics.

#### Is Highly Digestible

Digestion studies have indicated that added fat is at least 90% digestible. If the conventional conversion factor of 2.25 is applied to the digestible fat, then the TDN value of fat is at least 202%. Using an 80% TDN value for grains, the fat then contains two-and-one-half times the TDN of grain, and on this basis is worth two-and-one-half times the cost of grain. For example, if milo is selling for \$45 per ton, fat would be worth \$101-105 per ton. When added as an energy source, the features such as dust control are automatically included.

Fat additions usually are made as a substitute for grain and therefore reduce the protein content of the ration to a point where recalculation of the latter is necessary.



NAVAJO WOMAN with her flock of sheep.

## Arizona's Sheep Prices Vacillate

Clarence D. Edmond  
and John W. Wildermuth

*Due to differences in prices between ewes and lambs, and between Indian-owned and white-owned sheep and lambs, it would be desirable to analyze prices according to class, ownership, trend and seasonal variations. Such a refinement of analysis, however, is impossible for two reasons. First, there are no time series data for prices of ewes in Arizona. Second, there are no time series data on difference in prices of Indian-owned and white-owned sheep or lambs.*

For these reasons the price analysis will be as follows: First, for historical background, comparison, and trends, annual prices for "sheep" and for "lambs" will be analyzed for the period 1910 (the beginning of price data) to 1963. Next, indicated differences in price of Indian-owned and white-owned lambs will be discussed, and finally, seasonal variations of lamb prices will be statistically analyzed.

The year 1910 marked the beginning of recorded price series for sheep and lambs in the United States. Although there are some price data prior to 1910, due to incompleteness and

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Third article of a series. Dr. Edmond is Farm Management Specialist in the Extension Service while Mr. Wildermuth is a former student in the Department of Agricultural Economics.

Table 1. Summary of 9 Trials With 4% Fat Addition to Fattening Rations

Ration	Number of steers	Av. days on feed	Av. daily gain lb.	Av. daily feed lb.	Feed/100 lb. gain
Control ration	145	136	2.61	22.0	854
Control ration + 4% fat	145	136	2.83	21.8	781
Percent improvement, %			8.4		8.5

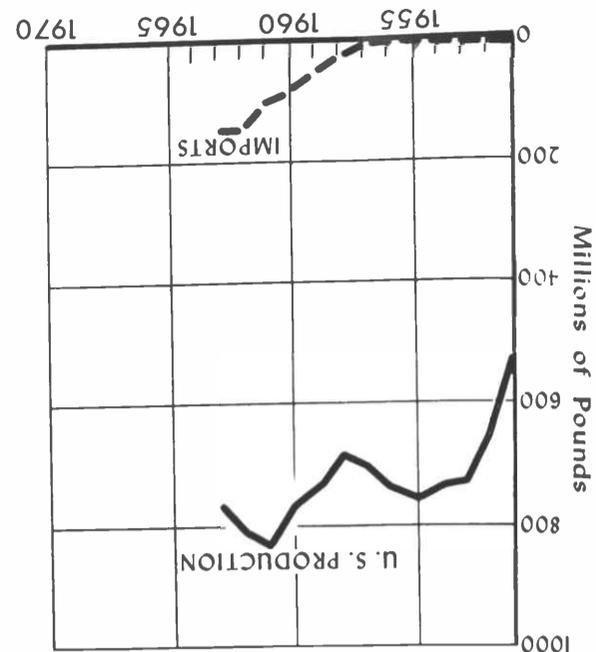
Table 2. Addition of Fat to a Ground Alfalfa Hay Ration

	(128 days)		
	Fat level		
	1% <sup>a</sup>	10%	20%
Number of steers	18	18	18
Average initial weight, lb.	492	489	484
Average daily gain, lb.	1.48	1.69	1.58
Average daily feed, lb.	17.1	15.4	13.4
Feed/100 pound gain, lb.	1155	911	848

<sup>a</sup> 1% fat added to control dust.



the  
 ← Navajo Reservation in northern  
 Arizona.



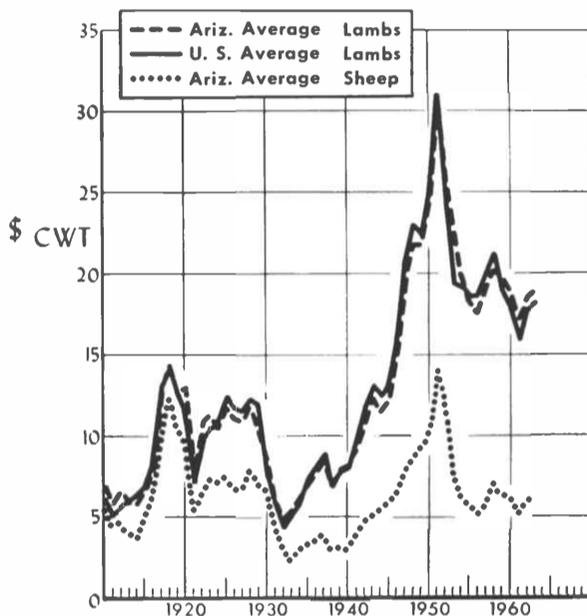
**FIG. 3 — U.S. PRODUCTION and U.S. imports of lamb and mutton carcass weight equivalent, 1951-63.**

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non-comparability they are not suited to price analysis work.

### Wide Price Range

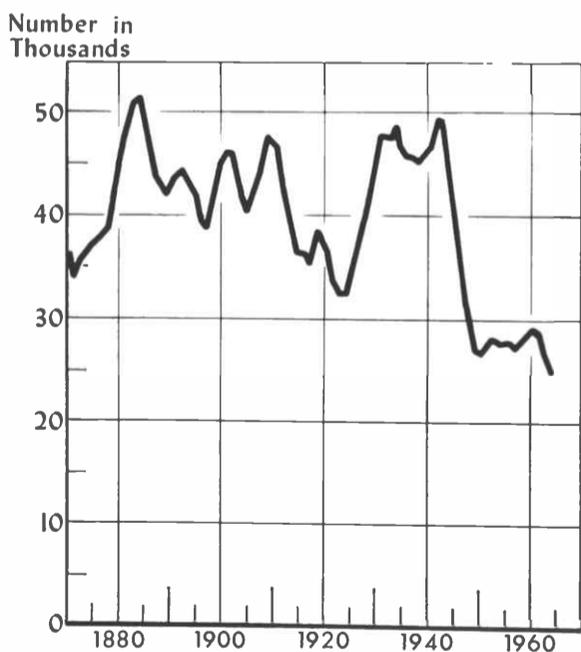
Weighted average annual prices for sheep and lambs in Arizona since 1910 are shown in Figure 1. Prices during this period have varied widely. For example, the average annual prices for sheep fell to \$2.30 per hundred weight in 1933, then rose to \$14 in 1951, then fell again to around \$5 to \$6 per cwt. during most of the 1956-63 period. Lamb prices in Arizona followed the same general pattern: higher during World War I, lowest during the depression (\$4.75 in 1932), rising during the late '30's, and reaching a peak of \$30.90 in 1951. Then sharply lower until 1961 when a low of \$17 per cwt. was reached. Since then there has been improvement as the present liquidation phase has run its course.



**FIG. 1 — NOTE ups and downs of sheep prices in Arizona and nationally.**

How long the improved situation will last is unknown. An examination of prices (Figure 1) indicate that there have been no price cycles in the past, thus history is of little benefit except for understanding. There are, however, some trends taking place that add some light to the situation.

The number of stock sheep on hand January 1 in the U. S. has varied widely since 1870, reaching an all time peak of 51 million head in 1884, then trending generally downward through 1923 when 32½ million head were on hand (Figure 2). A buildup in numbers then followed, reaching a peak of 49.3 million head in 1942. Numbers then fell sharply through 1950 and have leveled off somewhat in recent years. However, the trend continues downward and in January, 1964 stock sheep in the U. S. numbered 24½ million, just about half the 1942 figure.



**FIG. 2 — STOCK sheep on hand in the U.S. Figures for each Jan. 1, from 1870 to 1964.**

But the rapid fall in numbers between 1942 and 1950 cannot be attributed to imports of lamb and mutton, for the drop in numbers had already spent its course before imports began to climb in 1958 (Figures 2 and 3).

Imports of lamb and mutton have been called a major problem in the sheep industry, and certainly have had an effect on prices in recent years.

### Imports Important Recently

Imports were insignificant until 1957 when Australia and New Zealand began to increase shipments of high quality lamb to the United States. By 1963 imports furnished 16 percent of the total U. S. lamb and mutton market. Imports will be down in 1964, but they are likely to increase again unless American producers find ways to decrease costs of production. The imports grew to present size during a period of increased production and lower prices in the U. S. (Figures 3 and 1). This indicates that prices in the U. S. would have to be lower than in 1961 in order to discourage imports.

Another factor which has had an effect on the sheep industry is the increased use of man-made fibers. In 1920 the production of man-made fibers in the U. S. was insignificant, but it has since climbed steadily. In 1963 the production of man-made fibers was four times the U. S. wool production plus imports. Perhaps new discoveries in the better use of wool will help recover some of the lost market.

As mentioned earlier, there are no statistical data for comparing prices of Indian- and white-owned lambs in Arizona. Estimates have been made, however, and sales at public auctions have been noted.

### Indian Sheep Priced Lower

Professional people working closely with Indian-owned sheep feel that prices of Indian sheep run about one

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# Grain Sorghum in Poultry Diets

B. L. Reid and B. J. Hulet

*Poultry rations in the Southwest ordinarily contain 50 to 70 percent grain sorghum, since these grains serve as the most economical source of energy and protein in this section of the United States. Sorghum is well adapted to semi-arid areas, but it can make good use of additional water and is grown extensively under irrigation in dry areas. As a cereal crop in the United States, sorghum is currently exceeded in production only by wheat and corn.*

Within the past two years much interest has developed among poultry nutritionists relative to the evaluation of grain sorghum utilization in comparison with corn. Corn serves as the main grain component of poultry rations in other sections of the U.S.

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to two cents per pound less than for white-owned sheep at the same time of year. Indians have taken lambs to the public auction at Cortez, Colo., where they sell for 1½ to 2 cents less per pound than do white-owned lambs. Some persons with knowledge of the Arizona sheep industry feel that the price differential is even wider. One man says that Indians receive 3 to 5 cents less, while another feels they receive about 2 cents less.

The tribal councils and the Bureau of Indian Affairs are working on improving Indian sheep. Projects include buying and disposing of old ewes, furnishing high quality rams, and stressing better production and marketing practices. As a result, some of the Indian sheep are of high quality. As these improvement programs become more widespread in their effect, the price discount for Indian lambs probably will continue to decline.

Prices of lambs in Arizona tend to be highest during April and May and lowest during the October-January period. Keep in mind that these are average prices for all lambs. Thus, these prices reflect any seasonal variations in prices within grades as well

simply because it is plentiful, locally grown and economically priced.

## Must Know Them Better

With the development of the various hybrids and numerous strains of grain sorghums, an evaluation of the nutrient content and utilization of them has become of vital concern to poultry feed manufacturers and poultrymen. Commercial feed operations ordinarily do not segregate their various shipments of grains with regards to nutrient content or strain.

It is possible, however, that the presence of sorghum of low nutritive value would not produce any dramatically adverse effects on total egg production, but would result in lowered production efficiency, poor feed utilization or reduced egg size.

One problem associated with the use of grain sorghums is the great variability in their protein contents. Our analyses have indicated values as low as 6 percent crude protein while

as seasonal variation in the grade make-up of lambs sold. The months characterized by higher prices correspond to the period of marketing of milk fat lambs by white producers. Months which have lower prices include the months during which the Indians market their feeder lambs.

## Hit Different Markets

Factors which contribute to this large seasonal variation in prices are: (1) Whites sell their lambs during the time when prices of lambs are seasonally high for the state and the nation, while the Indians sell their feeder lambs in the fall when lamb prices are generally lower; (2) Indian lambs tend to be smaller, less meaty, and more variable in quality of wool than do white produced lambs; (3) Sales of Indian lambs occur in more remote areas and they are sold in smaller lots.

We can conclude that in general Indian producers do receive a lower price for their lambs than do white producers. The size of the difference is probably near 1 to 3 cents in any one year. About half of this difference appears to be due to differences in prices of fat and feeder lambs and in time of year when marketed. The other half of this difference is due probably to quality and distance to market.

## Turn to Channel Six For Interesting Fare

We recommend to our readers in southern Arizona a discovery we have made — if you turn to Channel 6 you get interesting adult television, both network and local programs.

Channel 6, of course, is the University of Arizona "educational network" channel. This station — KUAT-TV — is accessible to viewers within 20 miles of the U of A campus, also to cable-serviced viewers on other channels at Nogales, Bisbee, Douglas and Fort Huachuca.

Dr. Ben Markland, head of the U of A Radio-TV Bureau, tells us if you'll write him you will receive a free monthly program guide, so you can plan ahead to watch the programs you will enjoy.

other samples have been found with protein contents as high as 15 percent. The crude protein content of corn generally varies to a lesser extent than grain sorghum, with values ranging from 6.5 to 10 percent.

One of the obvious differences between grain sorghum and corn is the lack of yellow xanthophyll pigments in the grain sorghums. The xanthophylls are deposited in the skin and egg yolks and result in the yellow pigmentation in these products. Birds fed a grain sorghum-based diet, without addition of a source of xanthophylls, produce eggs with creamy white yolks. Poultrymen and feed manufacturers, therefore, rely upon dehydrated alfalfa meal to a greater extent as a source of xanthophylls in diets containing large amounts of grain sorghums.

## Sorghum Alone is Deficient

Experiments conducted by Dr. J. H. Quisenberry of Texas A & M University have indicated that the use of grain sorghum as the sole grain component in laying diets results in lowering of egg production and egg size when compared with similar diets containing corn. One theory which has been advanced to explain these results is based on the differences in linoleic acid content of corn and grain sorghum. Linoleic acid is one of the polyunsaturated fatty acids which is required by all animal species in small amounts. This fatty acid is present in the egg to the extent of 8 to 10 percent of the fat.

Workers at Washington State University have shown that the feeding of linoleic acid or vegetable oil

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