ers. This was done to concentrate the subsequent calving season and eliminate late calving heifers. However, the results suggest that PMS injections had a detrimental effect on fertility.

The multiple birth response of the heifers conceiving at the first post-PMS estrus (25 percent) was approximately one half what has been observed in older cows in previous studies. The reason for this poor performance of PMS injected heifers cannot be determined from the observations made in this study, but more detailed data that is currently being collected may suggest some reasons.

Publications

The following articles have been published from the project during the past year.

Hallford, D. M., E. J. Turman, G. E. Selk, L. E. Walters and D. F. Stephens. 1973. Influence of birth type on carcass composition. J. Animal Sci. 37:245 (abstract).

Hallford, D. M. 1973. Carcass composition in single and multiple birth cattle. M.S. Thesis, Oklahoma State University Library.

Selection for Increased Weaning and Yearling Weight in Beef Cattle

R. R. Frahm, T. A. Stanforth, M. A. Omar and R. J. O'Hanlon

The beef cattle selection study initiated in 1964 at the Ft. Reno Livestock Research Station involves both purebred Angus and Hereford cattle. The objective of this study is to determine the direct and correlated genetic responses to selection based on weaning weight and yearling weight, respectively.

The study consists of six selection lines of 50 cows each: two Hereford lines (one selected for increased weaning weight and the other selected for increased yearling weight) and four Angus lines (one selected for increased weaning weight, one selected for increased yearling weight, one selected for increased weaning weight based on progeny test information and one serves as an unselected control line). A more complete experimental design for this study is presented in Okla. Agr. Exp. Sta. Misc. Pub. 85:150.

Lancaster, L. R., R. R. Frahm and D. R. Gill. 1973. Comparative feedlot performance and carcass traits between steers allowed a post-weaning growing period and steers placed on a finishing ration at weaning J. Anim. Sci. 37:632.

Use of K^{40} Net Count as a Monitor of Body Composition Changes in Growing and Fattening Beef Cattle

Lowell E. Walters, Dennis Stiffler and R. F. Queener

Animal researchers have sought improved methods for the live evaluation of meat animals with respect to muscling during recent years because of consumer pressures for higher ratios of lean to fat and lean to bone in meat products at the retail counter. The K^{40} whole-body scintillation counter has attracted our interest in such an endeavor because of the capability of this instrument in measuring radiation arising from the element potassium,—known to be present in muscle in a quite constant concentration. From measurement of the amount of this radiation from the live animal followed by slaughter, lean separation and chemical analyses techniques, the association between K^{40} count and fat-free muscle can be established and, in turn, from these values equations developed for the estimation of the amount of muscle present in living animals. Fat-free lean prediction equations for use in live animal evaluation have been determined for 1000 pound "conventional" type beef bulls and for 220-240 pound market barrows.

Among known sources of variation in results from the application of radiation technology to test samples of a biological nature, as with meat animals, are included such variables as sample to detector geometry, size of the test animals, as well as the age, sex and condition of the animals at the time of evaluation. Previous research at the Oklahoma Agricultural Experiment Station has been conducted with groups of animals that were as uniform in age, breeding, weight and condition as was possible to obtain, in order to subject the O.S.U. K^{40} whole-body counter to a critical test of its capability to estimate differences in muscling among meat animals from a similar population and environment.

sium in the boneless closely trimmed muscle mass from the right half of each carcass are in progress. Fat-free lean is determined by substracting total ether-extractable materials from the weight of the boneless, closely trimmed muscle mass from the right carcass half.

Correlation and regression studies of the association between net K^{40} count and fat-free lean in the animals at different ages and weights will then be made. These studies also include an attempt to describe possible changes in the pattern of potassium concentration in selected beef muscles over a range of ages and live weights in each of the two types. For this purpose, chemical analyses for potassium are being conducted on the longissimus dorsi, trapezius, supraspinatus, semitendinosus and biceps femoris muscles from each carcass. Slaughter and carcass evaluation is complete for Replication I for both types of cattle. Replication II is in progress and will be completed in the spring of 1974. A full report of the results will be made at a later date.

Association Between Live EMME Count and Measures of Carcass Leanness in Market Weight Hogs

Dennis M. Stiffler, Lowell E. Walters, R. K. Johnson and R. F. Queener

The need for an accurate estimate of the amount of muscle in the live meat animal is of major interest to the animal breeder, feeder and packer as the livestock industry *"gears"* itself for maximizing quality muscle production with minimal waste. The development of such techniques should play a significant role in assessing the muscle production potential of breeding and market animals; therefore, contributing to more rapid advancement in meat animal improvement.

Previous work at this station has shown the K^{40} Whole Body Scintillation Counter (with plastic scintillation capability) to be a reliable instrument for estimating the amount of lean in market weight cattle and

Since statistical analyses of the data are not complete, certain mean values and their ranges in the data are presented in Table 1.

These data represent a typical "market run" of hogs with regard to live weight, carcass weight, degree of fatness and proportionate components of carcass lean, fat and bone. The ranges in EMME values is greater than expected and points to the inability of the machine to repeat itself closely and to be of significant value in predicting the lean body mass of these animals alive.

Simple correlation coefficients were determined between average EMME readings and certain characteristics in the carcass. Positive highly significant ($P<.01$) correlations, of 0.28 and 0.31, were found between EMME readings and pounds of fat-free lean and pounds of closely trimmed lean, respectively. While these values are "highly significant" statistically, it should be emphasized that such a relationship is inadequate for use in meaningful equations for the prediction of muscle composition in live market weight hogs.

These preliminary results are less promising than the data from similar but less discriminating studies at another station involving earlier models of the EMME machine. Inasmuch as this particular model has certain "new" electronic components previously untested for this purpose, it is hoped that further studies will be possible after the manufacturer replaces certain components and thus restores the machine to the level of an earlier, less sophisticated model.

Table 1. EMME Values and Carcass Composition Means

	RANGE	MEAN
Live Weight (lbs.)	192-230	211.8
Carcass Weight (lbs.)	136.8-168.6	151.4
Backfat Thickness (in.)	0.82-1.67	1.25
Closely Trimmed Lean (lbs.)	64.8-71.4	80.5
Fat Trim (lbs.)	37.4-69.0	51.3
Bone (lbs.)	14.8-33.8	19.6
Fat-Free Lean (lbs.)	52.5-72.3	68.2
EMME (count)	141-620	406

A Preliminary Report on Biochemical Growth Parameters of Bovine Muscle Tissue

J.R. Escoubas, J.J. Guenther and K.K. Novotny

Cellular metabolism and its pattern of development has been observed to exhibit a unique relationship with muscle fiber types in the adult mammal. Investigators have shown that there exists three primary fiber types; the red or type I fiber rich in oxidative activity, the white or type II fiber rich in glycolytic activity and the intermediate fiber having similar oxidative and glycolytic metabolic activities. These fiber types are dissimilar in size or area and have different contraction rates, work capacities and energy substrates.

It has been demonstrated that in the developing fetus, motorneural innervation establishes and controls differentiation of muscle cells. Moreover, it has also been proposed that at term, depending upon the specie, all muscles are equally slow (type I fibers) and physiologic conditions postnatally dictate a second, motorneural controlled, differentiation to the white, red or immediate fiber types. Elucidation of the mechanism for these phenomena are not complete although some workers have reported that fiber modification was due to the amount and type of neural stimulation.

Skeletal muscle tissue in the bovine purportedly undergoes fiber development as discussed above. The muscle fibers at or shortly after parturition have reportedly reached their maximum state of hyperplasia but after birth, continue in growth by hypertrophy. Realizing this, it can be assumed that during the normal course of muscle growth in the bovine, fibers grow by protein synthesis at the myofibril level, and depending upon the type of neural stimulation, adaptation occurs to establish the three fiber types which differ in substrate specificity. Knowing the metabolic state that exists in the muscle would then allow an investigator to index the physiological state which exists in the animal. In addition, the growth potential could be identified considering several parameters of physiological and metabolic capacities.

Aerobic and anaerobic metabolic pathways have been extensively studied in muscle tissue of several species common to the laboratory with key enzymes or enzyme complexes regulating or identifying these pathways. Muscle tissue lactate dehydrogenase (LDH) catalyzes the final step in glycolysis using pyruvate as the primary substrate in the adult. However, in the young animal while red fiber types predominate, lactate exists as the primary substrate just as in cardiac muscle. Such evidence

organisms were no different when grown in cottage cheese whey than when grown in other media as reported in the literature (3). Thus, assumptions could be made that the factors which controlled the growth of these organisms in cottage cheese whey were similar to those reported in the literature for growth on other media. On the basis of these assumptions, the original work with *S. fragilis* has been refined until now more than 80 percent of the BOD in cottage cheese whey can be removed by this yeast in 10-12 hours, and 90 percent or more in 24 hours.

This work is continuing, and it is hoped that the BOD of cottage cheese whey can be further reduced so that it would be possible to dispose of it in city sewer systems. Work on decreasing the time of BOD reduction also is under way. The work will continue to determine the costs of producing these yeasts under "semi-commercial" conditions and to determine the value of the product as human and animal foods.

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Lipid Metabolism in Laying Hens

E. T. Clemens, E. C. Nelson, John R. Miller, R. R. Johnson, A. L. Malle and Rollin H. Thayer

Commercial hybrid strains of laying hens currently being used in the production of market eggs have a genetic potential for egg production significantly higher than the standard bred layers commonly used 15 or 20 years ago. Substantial increases in the number of eggs laid per hen per year continue to be made through the efforts of poultry breeders. Under environmental conditions where laying hens are confined to cages, difficulties have been, and continue to be encountered, with lipid

Influence of Silage Additives on Mold Development in High Moisture Corn

E. C. Prigge and R. R. Johnson

At present there is increased interest in the use of chemical preservatives for high moisture grains, however, there is little information as to the effects these and other additives have on the spoilage of high moisture corn by molds.

In trial 1 of this investigation various levels of Chem-Stor (80:20 propionic:acetic acids), Amino isobutyric acid (AIB) and $CaCo_3$ were added to ground high moisture corn as described in Table 1. The samples of ground corn were exposed to air in unsealed plastic bags and daily visual observations were made to determine mold development. The results of trial I (Table 1) show that Chem-Stor at both the 1.5 and 1.0 percent levels was effective in preventing mold growth while the AIB was completely effective only at the 2.0 percent level. The $CaCo_3$ treated corn did not show any difference from the control and extensive mold development was observed at 3 days for both treatments. The Chem-Store treated samples had lower moisture contents at 28 days than the 2.0 percent AIB treatment. The dry matter contents of the other treatments were related to the time of sampling.

The reported pH depression for the 2.0 percent AIB treated and Chem-Stor treated corn indicate that the lack of molding is in part due to this decrease; however, the organic acids contained in these additives also have fungistatic activity. This is illustrated by the 1.0 percent AIB

Table 1. Mold Development of Ground High Moisture Corn After Air Exposure.

Sample No.	Additive	Level (%)	D.M	pH	Mold Development[2]
1	Chem-Stor	1.5	79.6	4.4	None[3]
2	Chem-Stor	1.0	80.8	4.5	None
3	AIB	2.0	74.9	4.8	None
4	AIB	1.0	75.0	6.1	18
5	$CaCO_3$	0.5	73.0	6.0	3
6	$CaCO_3$	1.0	72.9	5.9	3
7	Control	—	73.3	5.8	3

[1] Determined when mold developed or at 28 days if no spoilage occurred.
[2] Days after placed in bags.
[3] Observations terminated at 28 days.