THE EFFECT OF FATNESS ON SOME PROCESSING AND PALATABILITY CHARACTERISTICS OF PORK CARCASSES

By

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AN ABSTRACT

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In this study, 29 hogs having an average weight of 97.4 pounds were divided among 3 lots. Lot 1 was full fed, lot 2 was group limited fed to allow only an average of .80 pounds of gain per hog per day, and lot 3 was individual limited fed to allow only an average gain of .74 pounds per hog per day. These hogs were slaughtered at an average weight of 198.9 pounds and weights and measurements were taken to obtain average daily gain, average number of days on feed, feed per 100 pounds of gain, average backfat thickness and percent of both primal and lean cuts.

The mean values indicated that the number of days on feed were more than doubled for those hogs which were limited fed. Feed per 100 pounds of gain was about the same for the three feeding groups. Average backfat thickness was reduced by limited feeding with a corresponding increase in both primal and lean cuts.

An additional 46 hogs from the Animal Husbandry farm or from various experiments were also used for this study. This made a total of 75 carcasses which were evenly divided among 3 finish groups as follows: average backfat thickness of 1.0 to 1.3 inches, 1.3 to 1.6 inches and 1.6 to 1.9 inches.

Data from the 75 carcasses were obtained for the following items: carcass cut-out and measurements, cooler shrinkage, color as measured by disk colorimetry, cure loss, defrosting drip loss, specific gravity and chemical analysis of the Longissimus dorsi, muscle fiber extensibility, cooking loss, and taste panel acceptability.

Highly significant differences were found between the different finish groups in percent of both primal and lean cuts. As the amount of finished increased, the percent of both primal and lean cuts decreased. Cooler shrinkage differences were not significant between the different finish groups.

As the amount of finish increased, the hue of the lean changed from a low yellow red to a more yellowish red range. Value increased which indicated a lighter color, while chroma did not change. As the time after cutting increased, the hue of the lean changed to a more yellowish red range, value remained constant and chroma increased to some extent from the 2 hour reading to the 24 hour reading and then remained constant at the 48 hour reading.

Highly significant differences were found between bacon cure loss of the different finish groups, with a greater loss for those bacons from the leaner carcasses. Ham cure loss differences were not significant, but the mean values indicated that cure loss and degree of finish were inversely related.

Highly significant differences were found in defrosting drip losses of loin chops between the 3 finish groups. As the amount of finish increased, the amount of drip decreased. Although the mean values for drip loss of both the Boston butt and loin roasts indicated the same relation, the differences were not significant. Correlation coefficients between the amount of fat and drip of the loin chops, loin roast and Boston butt were highly significant in each case with "r" values ranging from .35 to .53.

Analysis of variance revealed highly significant differences in specific gravity, percent ether extract and a significant difference in percent moisture between the different finish groups. Correlation coefficients of -.83 and .71 were found for specific gravity vs. percent ether extract and specific gravity vs. percent moisture, respectively, which indicated that specific gravity may be used as an objective measure of marbling.

Significant differences were found in both muscle fiber extensibility and shear of the 8th and 9th rib chops between the three finish groups. Low but highly significant correlations were found between muscle fiber extensibility and the following: shear at both the 8th and 9th rib and at the 2nd lumbar vertebra, specific gravity and ether extract of the *Longissimus dorsi*, and taste panel scores.

Differences in total cooking loss were not significant between the 3 finish groups. An 8.68 percent higher cooking loss was obtained for deep fat fried chops as compared to roasted chops.

Highly significant differences were found in taste panel scores of loin chops between the 3 finish groups. No significant differences were found in either the bacon or the ham taste panel scores. Low but highly significant correlation coefficients were found between taste panel scores and the following: specific gravity, ether extract, shear, muscle extensibility, and ether extract x shear, which indicated a relationship between both marbling and tenderness with taste panel scores.

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INTRODUCTION

In recent years much attention and interest has been centered around the problem of producing a leaner hog. Fox et al. (1953) stated that a virtual loss of the lard market coupled with consumer protests against overfat cuts of pork were the main factors responsible for the interest in leaner carcasses. Kraybill (1953) showed that since 1938 the average price of lard has been below the price of live hogs with the exception of 1946. Also, in general, lean pork prices have advanced while fat prices (lard, plates and jowls) have declined relative to the average price of all pork products. This has resulted in lower prices being paid to the producer.

Birmingham et al. (1954) stated that results from a consumer preference study which they conducted suggested that retail cuts of hogs leaner than specified in the Choice No. 1 grade would meet with consumer acceptance. In this study a majority of the consumers interviewed preferred the leaner cuts of pork, however, the reason most frequently given by those persons choosing the cuts with more finish was the "apparent" freshness, but all cuts had been made at the same time. This brings up the question, will leaner cuts develop and maintain as desirable color and appearance as pork cuts from higher finished carcasses?

The most important single factor in the U. S. D. A. beef grade standards is marbling, as it is believed to be an indication, according to most workers, of juiciness, flavor and perhaps tenderness. If this is true, then we should take into account that the leaner cuts may not have the "eating qualities" when compared with more highly finished pork cuts.

It has long been recognized at the retail level that the leaner cuts will have higher drip loss than cuts containing more fat. No work has been published on the percent of cure and defrosting drip loss of lean versus fat cuts of pork. Perhaps the possibility of producing a carcass which is too lean should be considered.

Specifically, the objectives of this study were:

1. To observe the effect of limiting the feed of hogs on resulting carcass characteristics.
2. To observe the effect of finish on carcass cut-out.
3. To record the change in color of pork muscle from hogs with various degrees of finish over a period of forty-eight hours.
4. To correlate degree of finish with taste panel results on various pork cuts.
5. To correlate shear values of loin chops with amount of marbling.
6. To study the use of muscle extensibility as a measure of tenderness in pork.
7. To study the use of specific gravity as an objective measure of marbling in pork.

8. To compare cooler shrinkage, defrosting drip loss and cure loss with the degree of finish.

REVIEW OF LITERATURE

Nutrition

Considerable work has been done with the restriction of feed intake as it effects carcass leanness in hogs. McMeekan (1940) postulated that most of the muscular and skeletal growth of the pig was made during the first 116 to 120 days of age, after which mostly fat is deposited. McMeekan and Hammond (1940) reported that hogs which were limited fed for the whole growth period had the least amount of fat but the lean was not developed, whereas, hogs limited fed during the early growth period and then full fed were fattest, while those fullfed during the early growth period and then restricted produced the most desirable carcasses.

Merkel et al. (1953) found that by reducing the TDN content of the ration, leaner, higher grading carcasses were produced. As the feeding period was lengthened, backfat and dressing percentage was reduced and the length of the carcass was increased. Rust (1953) found that primal cut out and lean cut yields were increased by limiting the daily TDN intake. However, limiting the feed did not affect body length, leg length, average backfat thickness or dressing percent. Crampton (1940) reported that daily gain cannot be used to predict carcass leanness. Winters et al. (1949), and Crampton et al. (1954), found that leaner carcasses could be produced by limiting the daily intake of TDN. Zobrisky et al. (1953) reported that cooler and fasting shrink increased with total lean and decreased with total fat and carcass weight.

Backfat Thickness

Aunan and Winters (1949) reported a highly significant positive correlation of .659 between dressing percentage and average backfat thickness. This was in accord with work of Loeffel et al. (1943), Robison (1946), and Zeller and Hetzer (1944), who found that as weight and fat increased the dressing percentage increased. However, Bull and Longwell (1929) reported no significant differences in dressing percentage among chuffy, intermediate and rangy types of hogs of the same weight, but a great variation within each group.

Based on a study of 207 hogs, Zobrisky et al.(1953), found that total fat was highly associated with backfat thickness and to a lesser extent with body width and length. McMeekan (1941) found a correlation of .95 between weight of separable fat and backfat thickness. Hankins and Ellis (1934) found backfat thickness at the seventh vertebra and percentage of fat to be highly correlated, (r = .77). Pearson et al. (1956) showed that backfat thickness was a better measure of carcass leanness for lighter weight carcasses than for heavier carcasses.

Specific Gravity

Boyd (1933), Behnke *et al.* (1942) and Messinger and Steel (1949) concluded that specific gravity could be used to estimate the percent of fat of the human. Rathbun and Pace (1945), using fifty guinea pigs, found a positive correlation of .97 between carcass specific gravity and percent body fat.

Brown *et al.* (1951) were the first to use specific gravity for estimation of fatness in pork. These authors plus Whiteman *et al.* (1953), Pearson *et al.* (1956) and Price *et al.* (1957) have reported the use and validity of specific gravity as a measure of pork fatness. Breidenstein *et al.* (1955) stated that they found little relationship between the subjective evaluation of marbling and the specific gravity of the rib eye, whereas, the ether extract of the rib eye seemed to show positive relationship with marbling. Orme *et al.* (1958), working with the 9-10-11 rib section from 51 beef ribs, found correlation coefficients between specific gravity, and percent fat, water, protein and grade to the nearest one-third to be - .81, .76, .68 and -.68, respectively.

Color

The science of color of meat is a complex field due to the complicated chemistry and physiological factors which are involved. Voegeli (1952), Butler (1953), and Townsend (1958) have given an excellent review of most of the color work which has been done on meat. Mangel (1951) found no differences in the percent methemoglobin between ground and unground all lean beef samples. When ground samples contained more than fifteen percent fat, the methemoglobin content was higher than when the ground sample contained less than fifteen percent fat. This would indicate that fat has an influence on the color of meat in addition to the color of the fat *per se*. Voegeli (1952) showed that the color change of fresh beef was very rapid for the first one and a half to two hours and then the color change became more gradual.

Cure Loss

Very little information is reported in the literature on the effects of various degrees of finish on cure losses of hams and bacons. Johnson and Bull (1952) reported they obtained a shrinkage of 10.21% for bacons which had been dry cured for twenty-one days at 38° F. and then smoked. However, no mention was made as to the amount of finish of the bacons. Orme (1955), using underfinished, intermediate and overfinished pork carcasses (backfat of under 1.4 inches, 1.4 to 1.8 inches and over 1.8 inches respectively), found that shrinkage of dry cured bacons and country cured hams was inversely related to the degree of finish. The cure loss for hams was 26.0%, 24.7% and 23.0% for underfinished, intermediate and overfinished groups, respectively.

Consumer Preference

Vrooman (1952), in a study using fat, medium and lean pork shoulder steaks, loin chops, shoulder roasts, loin roasts, bacon slices and ham steaks, found that consumers expressed a clear cut preference for lean pork. The fat cut was placed in the last choice position by eighty percent or more of the respondents. Only one individual of the 221 replying placed the fattest pork chop in the first-choice position. Birmingham et al. (1954), using ham steaks, bacon slices and loin chops from Choice No. 1 (1.66" B. F.) and Medium (1.44" B. F.) grade pork carcasses, found that the majority of the 331 respondents preferred the medium grade bacon and chops but showed no preference between the two grades of ham. However, after cooking, a majority also preferred the medium grade of ham. The reason most frequently given by those persons who chose the medium grade was its leanness, while the reason for those choosing the Choice No. 1 grade was its "apparent" freshness, although both had been cut the same day. These authors stated that results of this study tentatively suggested that retail cuts of hogs leaner than specified in the Choice No. 1 grade will meet with consumer acceptance.

Branson (1957) found that when consumers viewed 8 x 10 inch colored pictures of rib eye cuts of beef grading U. S. Prime, U. S. Choice, U. S. Good and U. S. Commercial most consumers preferred U. S. Good even if Prime, Choice, Good and Commercial were offered at the same price. This author also found that consumers had little desire for marbling and that housewives mentioned bright red color and leanness of meat as the main points in their selection.

Meyer and Ensminger (1952) reported that when Choice, Good and Commercial beef steaks were offered at the same price more people chose Commercial. In each of these trials roasts followed a similar pattern. Lasley et al. (1955), using Prime in addition to Choice, Good and Commercial, found the trend to choose steaks and roasts of the lower grades even when all grades were priced the same. In a continuation of this study, most consumers were satisified with their selections. Consumers indicated preference for a creamy, white color of fat. Freshness and appearance were given as the reasons for preferring a particular color. Many indicated that they looked for marbling as they thought it was an indication of tenderness and good flavor. Seltzer (1955) showed that when consumers were asked to choose between pictures of steaks representing Choice, Good and Commercial forty-one percent selected Good, thirty-one percent Choice and twenty-seven percent Commercial. A limited amount of fat was desired by many of those interviewed.

Rhodes et al. (1954) found that, although preference was based upon tenderness, juiciness, flavor, texture, color of lean, amount of bone and amount of internal and external fat, there was a trend to choose the higher grades of meat.

When surveys were conducted in stores selling higher grades of beef, the customers chose the higher grades more often. People in the higher income brackets preferred the top grades. A larger percent of men than women showed a preference for the higher grades of beef, and as the educational level increased, the number of persons choosing the top three grades increased. Rhodes _et al_. (1956) studied 120 beef loins and reported that when Prime and Good were compared, some grade influence was noticed, but it was smaller than ideally desired. Grades showed a significant influence on shear values. These workers concluded that eating characteristics were not closely related to grade.

Brady (1957) found that most consumers were opposed to fat, and that tenderness was an important factor for complete satisfaction. Most consumers had very little knowledge about quality factors of beef. U. S. Good showed a high degree of acceptability.

Tenderness

Tenderness is of paramount importance in meat, and the quality most universally desired. It is effected by many factors, as Hiner _et al_. (1955), stated, "From this study and previous work, it is emphasized that tenderness in beef is a function of many interrelated factors; namely: breeding, feeding, management, age, period of aging raw meat, presence of collagenous and elastic fibers, size of fibers, the method of cooking the meat and probably many others."

Lehman (1907) was probably one of the first men who did considerable research on meat tenderness. He stated that tenderness was directly proportional to the amount of connective tissue. Also, the most active muscles which were subjected to the greatest strains contained the most connective tissue, therefore, were the least tender. He gave for an example that an active muscle from the round of the beef contained five times more connective tissue than the tenderloin, which is a much less active muscle. This was substantiated by Cover (1937), Hiner et al. (1955), Mackintosh et al. (1936) and Mitchell et al. (1928), all of whom found a relationship between connective tissue and tenderness. However, Mitchell et al. (1928), found no relation between the ordinary market grades of beef and the connective tissue content, nor did age cause a significant increase in the amount of connective tissue. For example, the total collagen nitrogen expressed as percent of total nitrogen was least in the Longissimus dorsi muscle of a 14-15 year old Canner grade cow and highest for a two year old Choice grade steer. The values were 4.6 percent and 9.4 percent, respectively.

Hammond (1940) believed that one of the main factors affecting tenderness was the size of the muscle bundles. The larger the muscle bundles, the less tender the meat.

Strandine *et al.* (1949), in a study of fifty beef and twelve chicken muscles, found a relationship between texture of the meat and tenderness, also between tenderness and connective tissue. On the basis of the size of the fasciculi and the amount of connective tissue, these workers were able to classify or rank beef and chicken muscles as to tenderness. Moran and Smith (1929) showed that the diameter of the muscle fiber, the area of the primary bundles and the area of the secondary bundles increased progressively in the following order: fillet (*Psoas major*), rib (*Longissimus dorsi*), top side (*Biceps femoris*) and inside (*Semimembranosus*). The number of fibers for each primary bundle decreased progressively in the same order. Thus, small muscle fibers, small primary bundles and small secondary bundles would appear to be correlated with tenderness, inasmuch as the muscles were listed in order of decreasing tenderness. Hiner *et al.* (1953) used nine samples of muscles from each of fifty-two beef animals which ranged in age from a ten week old calf to a nine year old cow. The diameter of the fibers classified themselves for tenderness in four general groups in increasing magnitude as follows: (a) tenderloin; (b) two chuck samples, eighth rib, shortloin and loin end; (c) round; (d) neck and foreshank. With increased age of the animal there was a consistent increase in average muscle fiber diameter for all samples studied. Correlation coefficients between tenderness, as measured by resistance to shear and

and diameter of the fiber for each muscle ranged from 0.75 for the neck sample to 0.31 for the shank. The preceding results are somewhat contrary to the findings of Brady (1937), who found no significant differences in the diameter of the fibers for the following muscles: Triceps brachii, Longissimus dorsi and Adductor. He found that the texture was dependent upon the size of the bundle; the larger the bundle, the finer the texture.

There is some evidence that nutrition of the animal affects the diameter of the muscle fibers. Robertson and Baker (1933) found the fiber diameter was largest in full-fed steers, intermediate for half-fed steers and smallest for those fed only roughage. Paul et al. (1944), found a change in muscle fiber when meat was aged. The muscle fibers were well defined and wavy after one day's storage, whereas, the fibers were broken and disintegrated at many locations after nine days of storage under refrigeration.

Wang et al. (1956) studied the possibility of using single muscle fiber extensibility to predict tenderness. Muscles from beef grading Prime through Commercial were used and the following correlations were found: extensibility vs. taste panel - 0.43 and -0.65, extensibility vs. shear force 0.36 and 0.45, shear force vs. taste panel - 0.80 and -0.51 for the Longissimus dorsi and the Semitendinosis, respectively. Orme (1958), found a significant correlation of 0.41 between muscle fiber extensibility and shear of hot, cooked muscles.

Many workers have studied the effects of freezing on tenderness, but there is no general agreement regarding this factor. Ramsbottom (1947) found that frozen storage of steaks at 10° F. for as long as seven years did not significantly affect tenderness. This was in accord with Shrewsbury _et al_. (1942), who found no change in tenderness of pork after freezing. On the other hand, Hall _et al_. (1949) reported that frozen pork roasts were less tender than fresh roasts. Hiner and Hankins (1951), and Hiner _et al_. (1945) reported that freezing had a tenderizing effect, but varied with the muscle and age of the animal.

Considerable research has been done with the effect of cooking on tenderness. Warner (1929) and Ramsbottom _et al_. (1945), and other workers have found a decrease in tenderness when meat is cooked. Cover (1943) reported that roasts which were always tender were obtained when the rate of heat penetration was slow enough so that it required thirty hours or more for the roasts to lose their pink color, and with less time the roasts were not always tender. She stated that there appeared to be two structures in meat which contribute to its toughness, muscle fibers and connective tissue. Both may be made "very tender" by cooking, if the cooking is slow enough. The chemical factors causing tenderness appeared to be the change of collagen into gelatin, but the one causing tendering in the muscle fiber was not identified. Satorius and Childs (1938) found that the Semitendinosus muscle increased in tenderness during cooking until an internal temperature of 67° C. was reached, then the muscle became less tender on further heating. Also, the diameter of the muscle decreased with increased coagulation at 67° C., but no difference was found between meat coagulated at 67° C. and that coagulated at 75° C. They concluded that shrinkage of muscle fibers due to coagulation was complete at 67° C.

Weir (1953) found that the Longissimus dorsi muscle of pork carcasses was less tender in the center portion than at either extreme as shown by both organoleptic and mechanical shearing tests. Blakeslee and Miller (1948) found that short loins were less tender at the rib end than at the porterhouse steak end.

Effect of Finish on Tenderness and Palatability

Armsby (1908, 1917), Bull (1916), Barbella et al. (1939) and Helser (1929) believed that fattening of an animal increased the tenderness and juiciness of the meat. The Bureau of Animal Industry Workers (1934) found that as the final feed-lot weight of hogs increased from approximately 145 to 225 pounds, accompanied by normal increases in degree of finish, there was a small but definite improvement in the palatability factors of tenderness, desirability of flavor of lean and quality and richness of the juice. However, the results suggested that when the hogs were fed on to more extreme finish, or to a weight of 300 pounds, there was a decline in palatability factors, or at least no further improvement. Brannan (1957), using U. S. Choice, U. S. Good, U. S. Standard and U. S. Commercial grades of steaks, found that juiciness, tenderness and flavor of lean scores decreased directly with grade, with the exception that the Commercial grade was ranked over the Standard for juiciness and flavor of lean. These results were obtained from both a trained test panel and from forty families. The results were highly significant in all cases for juiciness and flavor of lean and flavor of fat, and significant for tenderness using both methods of testing. Butler _et al_. (1956), showed that juiciness was more closely correlated with fatness in a broiled loin than in a braised loin or in a broiled or braised bottom round steak. Fatness was more closely correlated with tenderness in bottom round than in the loin. They suggested that breeding may have some influence on tenderness. Helser _et al_. (1930), found that beef from feeder cattle was less tender than from similar cattle after fattening, thereby, indicating that fat was a factor in improving tenderness. They stated, however, that this change in tenderness may have been due to other factors, such as a change in muscle fibers and connective tissue, and not from fat _per se_. Husaini _et al_. (1950), found a significant but rather poor correlation of 0.47 between tenderness and intramuscular fat (marbling).

Black *et al.* (1931), and Hankins and Ellis (1939) found that finish had little to do with tenderness.

Cooking Loss

Alexander (1930) reported that the ratio of evaporation loss to drip loss was less with higher finished beef roasts as compared to lower grade roasts, while the total cooking loss did not deviate to the same extent as the other two components, i. e., drip loss and evaporation loss. Brannan (1957) stated that with broiled beef loin steak there was a trend for higher total cooking loss as the grade decreased. However, the differences were not significant. Orme (1955) found no significant differences between degrees of finish of pork loin roasts and total cooking loss.

Johnston (1957) found a significant difference for total cooking loss between roasted pork loin and deep fat fried chops, with more loss occuring with the latter. Loeffel *et al.* (1929-1930), reported that the cooking evaporation loss was twice as great for ham slices as for loin roasts. They also reported that cooking drip losses increased with fatness. The preceding two authors were comparing two different cuts of meat which varied considerably as to amount of surface area per unit of weight. Lowe (1955) stated that the surface area of a cut of meat of a given weight depends upon its shape. Compact pieces with corresponding smaller surface area have smaller cooking loss than irregular-shaped pieces with greater surface area.

EXPERIMENTAL PROCEDURES

Animals Used and General Procedure

On January 21, 1957, twenty-nine pigs averaging 97.4 pounds were divided as evenly as possible according to weight, sex and litter among three lots. Lot 1 was given free access to feed at all times. Lot 2 was self fed in a group twice daily with feed regulated to allow only an average of one pound of gain daily per animal. Lot 3 was self fed individually twice daily with feed regulated to allow only one pound of gain per day per pig. Water was provided ad libitum. All hogs received a 14.3 percent protein ration which contained: 735 pounds corn, 100 pounds oats, 80 pounds soybean oil meal, 30 pounds meat and bone scraps, 15 pounds fish meal, 25 pounds alfalfa meal, 3 pounds limestone, 5 pounds dicalcium phosphate plus zinc, 5 pounds trace mineral salt, 1 pound vitamin mix 58 C, 0.5 pound vitamin A and D, 0.5 pound aurofac (chlortetracycline), 0.5 pound TM 10 (oxytetracycline) and 1 pound of NF 180 (furazoline).

The pigs were weighed weekly and tabulations of feed consumption were recorded for each week. These figures were used to calculate the feed efficiency and rate of gain.

The remaining forty-six hogs used in this study came from the Animal Husbandry farm or from various experiments, and were raised under varying feeding regimes.

All animals were taken off of feed twenty-four hours before slaughter when their feedlot weight reached 200 pounds, or as near to this weight as was practical with the weekly slaughter schedule of the Michigan State University Abattoir. Fresh water was provided ad libitum during the twenty-four hour pre-slaughter period. Weights were taken immediately after removal from feed and again prior to slaughter.

All animals were slaughtered packer style and then chilled at 34-36° F. for forty-eight hours prior to cutting. Both hot and forty-eight hour chilled carcass weights were obtained.

Average backfat and carcass length were measured by the procedure outlined by Strong (1951) with the exception that the measurement at the 7th thoracic vertebrae was included in the calculation of average backfat thickness. In this study twenty-five of the carcasses had an average backfat thickness of 1.0 to 1.3 inches, twenty-five had 1.3 to 1.6 inches and another twenty-five carcasses had 1.6 to 1.9 inches. Thus, three finish groups were obtained with the same number of carcasses in each group.

The carcasses were cut by the procedure outlined by Cole (1951). Planimeter readings on the area of the *Longissimus dorsi* muscle were made on tracings taken from the right side of the carcass at both the tenth and last ribs.

Color

A loin chop was cut at the location of the 10th rib of the right side and all bone and external fat removed from the <u>Longissimus dorsi</u>. The sample was put in a Cryovac bag and then placed in a $36^{\circ} \pm 2^{\circ}$ F. cooler. Color measurements were taken at the end of two hours, twenty-four hours and forty-eight hours after cutting the sample. The application of disk colorimetry for the measurement of the surface color of meats and the calculation of Munsell renotation were the same as described by Voegeli (1952).

The average Munsell renotation for each of the three finish groups at each time period was calculated by the following method: The hue of each sample was added together and divided by twenty-five, the number of samples in each group. This was considered the average hue for the group under study. The same procedure was employed to calculate the average value and the average chroma. Thus, the average hue, average value and average chroma made up the average Munsell renotation.

<u>Curing Procedure</u>

The basic curing formula used for both hams and bacons consisted of eight pounds of salt, two pounds of sugar, one and a half ounces of $NaNO_2$ and one ounce of $NaNO_3$. The fresh bellies were weighed immediately after cutting and three fourths of an ounce of the dry cure mixture per pound of belly was rubbed on the surface. The bellies were then placed in a standard metal bacon box and allowed to cure for eleven days. They were then removed and soaked in fresh water for one hour after which they were hung on bacon combs and allowed to dry in a $36^\circ \pm 2^\circ$ F. cooler for fifteen to sixteen hours. The bacons were smoked for approximately eight hours beginning with a 130° F. smokehouse until the internal temperature of the bacon was 120° F., which required approximately five hours. The temperature of the smokehouse was then reduced to 120° F. for the remaining smoking period. The bacons were then removed and hung in a $36^\circ \pm 2^\circ$ F. cooler for fifteen hours. Weights were recorded for the cooled bacons.

The hams were cured by injection of an eighty-five degree pickle into the femoral artery and pumped to an increase of ten percent over the initial weight. The pickle was made up by adding the dry cure mixture to 40° F. water and testing the pickle strength with a salimeter. After pumping, the surface was rubbed with the dry cure mixture and excess cure shaken off. The hams were placed on a shelf for thirteen days, after which they were soaked for one hour, and placed in stockinettes and hung in a $36^\circ \pm 2^\circ$ F. cooler for fifteen to sixteen hours. The smoking procedure was begun in a 130° F. smokehouse. The temperature of the smokehouse was raised ten degrees every two hours until a smokehouse temperature of 160° F. was attained. The hams remained in the smokehouse until 142° F. internal temperature was reached, which took approximately twelve hours. They were then removed and hung in a $36^\circ \pm 2^\circ$ F. cooler for twelve hours. The cooled ham and bacon weights were used in the calculation of cure loss. The right hams and right bacons were frozen after the cooling period for subsequent taste panel evaluation.

Defrosting Drip Loss

Defrosting drip loss was obtained for the Boston butt, 10th rib to last rib section of the loin and all of the 3/4 inch thick loin chops which could be cut from the 3rd rib to 10th rib section of the loin. All of these cuts were from the right side of the carcass. The frozen samples were weighed to the nearest gram and immediately placed in individual Cryovac bags which were then placed in a $36^{\circ} \pm 2^{\circ}$ F. cooler. The individual Cryovac bags were used so that evaporation and humidity would not affect the results. After allowing forty-eight hours to defrost, the cuts were re-weighed to the nearest gram and the difference in weight considered defrosting drip loss. Defrosting drip loss was calculated by the following formula:

$$\frac{\text{Difference in wt. of the frozen and defrosted cut}}{\text{wt. of frozen cut}} \times 100 = \%\ \text{Defrosting drip loss}$$

Specific Gravity

After defrosting for forty-eight hours at 36° F., the *Longissimus dorsi* was excised from the 10th to last rib portion of the right loin for determination of specific gravity. All fat and connective tissue was removed from the surface, and care was taken to insure that only the *Longissimus dorsi* was used. The muscle was weighed to the nearest 0.1 gram in air and weighed to the nearest .01 gram in distilled water at 36° $\pm$ 2° F.

Specific gravity was determined on the forty-eight hour defrosted Boston butt. Weight in air was determined to the nearest gram and weight to the nearest 0.1 gram in distilled water at 36° F. $\pm$ 2° F. was recorded.

Specific gravity was calculated according to the formula of Brown et al. (1951), which was as follows:

$$\frac{\text{wt. in air (gms.)}}{\text{wt. in air (gms.)} - \text{wt. in water(gms.)}} = \text{Specific Gravity}$$

Chemical Anslysis

After determining the specific gravity, the *Longissimus dorsi* was blotted dry and immediately ground five times through a two millimeter grinder plate. The ground sample was placed in a glass sample jar, sealed and frozen at -20° F. for subsequent analysis. Moisture was determined by the method described by Benne et al. (1956). Ether extract was determined on the same sample used in the moisture analysis which had been dried in a disposable aluminum dish. The edges of the aluminum dish were folded over the dried sample and the sample inserted in an Alundum cup. The cup was placed in a metal container and extracted for four hours with anhydrous ether on a Goldfish Fat Extractor. The excess ether was evaporated from the fat beaker, and the beaker dried at 100° C. to a constant weight. All samples were weighed to the nearest .0001 gram. Formulae for the calculation of percent moisture and fat were as follows:

$$\frac{\text{wt. of dried sample (gms.)}}{\text{wt. of fresh sample (gms.)}} \times 100 = \%\ \text{Moisture}$$

$$\frac{\text{wt. of ether extract}}{\text{wt. of fresh sample}} \times 100 = \%\ \text{Fat}$$

<u>Muscle Extensibility</u>

The procedure used was in general that described by Wang *et al*. (1956) for beef muscles. The detailed procedure was as follows: One loin chop from the left side was cut $1\frac{1}{2}$ inches thick at the 10th rib and was cooked to an internal temperature of 145° F. in deep fat (300° F.). The *Longissimus dorsi* was immediately removed and placed in a closed glass container and refrigerated for twenty-four hours. The browned surface of this muscle was then trimmed off and discarded. Four slices approximately 2 x 3 x 0.5 centimeters in size were placed in a Waring Blender with sufficient distilled water to cover the blades, which had been previously dulled by filing. The cooked sample was blended until small bundles of muscle fibers were evident, which required approximately twenty seconds. The speed of the blender was regulated by using a setting of 30 on a rheostat, type 116. The excess supernatant fluid was poured off and the small muscle bundles transferred to a petri dish containing distilled water. A transparent ruler graduated in millimeters was placed under the petri dish which in turn was placed on the light source. The light source consisted of a 150 watt light bulb in a $6\frac{1}{2}$ inch deep box covered with a frosted glass top.

Only single muscle fibers longer than five millimeters and free of all endomysial tissue were used. Generally, the single muscle fiber had to be carefully removed from small bundles of fibers. Much care was exercised to insure that the fibers were not damaged. The single muscle fiber was gripped firmly at two points exactly five millimeters apart with two fine watchmakers' forceps. A fiber at least five millimeters long selected at random was stretched by holding one forcep stationary and moving the other forcep slowly and parallel with the rule until the fiber broke. The length in millimeters in addition to the original five millimeters was termed the "muscle fiber extensibility" and twenty such readings were recorded for each sample. Occasionally, a fiber broke instantly upon applying force before one millimeter of stretch occured. This value was discarded on the assumption that such a break was due to mechanical injury. A ten power magnifying glass was used to observe the stretching of the muscle fibers.

Cooking Procedure

Samples for the shear test were taken at two different locations. The first was two loin chops cut one inch thick from the frozen loin at the 8th and 9th rib of the left side. The second sample was two loin chops cut one inch thick from the frozen loin at the last rib of the left side. These chops were defrosted for twenty-four hours and then deep fat fried at 300° F. to an internal temperature of 170° F. Weights immediately before and after cooking were recorded for determination of cooking loss. Seven one-half inch diameter core samples were removed from the *Longissimus dorsi* of the two chops at each location and tested for maximum shear force by the Warner-Bratzler shear.

The hams and bacons were frozen for at least two weeks but not over four weeks, while the loin chops were not frozen over three months. In all cases, the defrosting time was twenty to twenty-four hours. All samples tested by the taste panel were cooked by dry heat cooking. Two ham slices consisting of only the *Semimembranosus* muscle from the right frozen ham were cut one inch posterior and parallel to the aitch bone and one inch in thickness. Two loin chops were cut one inch thick at the second lumbar vertebra of the left frozen loin. After defrosting, both of these samples were roasted in an oven at 300° F. to an internal temperature of 170° F. Twelve bacon slices were cut approximately three millimeters thick, using the same setting on the slicer, from the anterior portion of the right defrosted bacon beginning at the last rib. The bacon slices were roasted in a 350° F. oven until medium done as estimated by visual observation. All samples cooked for the taste panel were weighed before and after cooking.

Taste Panel Procedure

The nine point hedonic scale (1 = dislike extremely and 9= like extremely) was used to rate the samples independently in terms of the degree of like or dislike. Twelve members picked at random served for each panel, however, the same twelve did not necessarily serve on each panel used in this project. Only one type of meat was tested on any one day, that is, bacon one day, ham a second day and loin chops a third day. Three to five samples were presented to each test panel. The samples were coded differently for each judge so that the scores could not be compared. The judges were given no information regarding the products, but were asked to circle the answer most accurately describing their taste sensation.

The specific instructions given to each judge were as follows: (1) Take a generous bite of the sample and carefully determine where the sample will fit in regard to your degree of like or dislike. (2) Take a drink of water between each sample and wait for at least one full minute before testing the next sample. (3) Do not compare samples as each sample is independent. (4) Do not talk to your neighbor or pay attention to his rating. (5) There is no right or wrong answer but only an indication of your preference. (6) Do not change your rating once you have determined where it fits. Under no conditions should a rating be changed after going to the next sample.

Statistical Analysis

Single and multiple correlation coefficients and analysis of variance were employed as outlined by Snedecor (1946).

RESULTS AND DISCUSSION

Feedlot Data

At the beginning of this project it was decided that if sufficient carcasses with an average backfat thickness of under 1.3 inches could be produced by limited feeding, a number of feeding trials would be conducted. The result of the initial feeding trial showed that only seven carcasses out of twenty-nine had a backfat thickness of 1.3 inches or less and five of the seven carcasses were at the upper limit, that is, from 1.25 to 1.3 inches. Therefore, only the one feeding trial was conducted.

Backfat thickness was reduced and carcass leanness increased to some extent by limiting the rate of gain (Table 1). It was noted that when average daily gain was reduced from 1.73 pounds per day to 0.74 pounds, the average backfat thickness was reduced 0.27 inches. The increase in leanness due to limited feeding also became more apparent when percentage primal cut and percentage lean cuts of limited fed hogs were compared with those of hogs which were full fed (Table 1).

By again observing Table 1 it was noticed that the number of days on feed was greatly increased for those hogs which were limited fed. Although there were some differences in amount of feed per hundred pounds of gain between the three lots, the differences were probably too small to be significant. Feed consumption for each pig could not be obtained as two of the lots were fed in groups and not individually, therefore, analysis of variance could not be calculated.

Table 1. Feedlot and Carcass Data for Feeding Trial.

Items Studied	Full Fed Group	Limited Fed Group	Individual Fed Group
No. of hogs per group	10	10	9
Ave. initial wt. (lbs.)	97.3	97.4	97.6
Ave. final wt. (lbs.)	200.9	196.2	199.7
Ave. no. of days on feed	59.9	122.9	139.1
Ave. daily gain	1.73	0.80	0.74
Feed per 100 lbs. gain (lbs.)	454.87	439.47	466.74
Ave. Backfat Thickness (Inches)	1.69	1.46	1.42
% Primal Cuts live basis	46.34	48.92	49.38
% Lean Cuts live basis	36.84	39.11	39.64

Those hogs which were full fed wasted some feed, while the limited fed groups wasted little or none. This would result to some extent in a lower feed efficiency for the full fed group. Although the average daily gain of the individual fed group and the limited fed group hogs were about the same, there was considerably more variation within the limited group fed hogs. The greater variability of within the group-fed hogs was probably due to the fact that some individuals were more aggressive, and therefore ate more feed and gained faster than the less aggressive ones. Therefore, the range of average daily gains in the limited group fed hogs was from .59 to 1.17 pounds per day, whereas, the range for those hogs fed individually was from .69 to .81 pounds per day. The reader is referred to Appendix A if individual gains are desired for the three groups.

<u>Carcass Cut-Out and Measurements</u>

The mean values for carcass cut-out and measurements of the seventy-five carcasses used in this study are presented in Table 2. For individual values see Appendix B and C. It was noted that as the degree of finish increased the percent of primal cuts and lean cuts decreased regardless whether based on live or carcass weights. These differences in cut-out proved to be highly significant in all cases (Table 3). This was in accord with the results reported by most workers in this field. It was also noted that higher "F" values were obtained when percent primal cuts and percent lean cuts were based on carcass weights. This was probably due to the fact that variation due to fill was eliminated.

Differences in carcass length and loin lean area at both the 10th and last rib proved to be highly significant (Table 4). The mean values (Table 2) indicated that as the

Table 2. Mean Values for Carcass Cut-Out and Measurements

Items Studied	Backfat Thickness (Inches) 1.0 - 1.3	1.3 - 1.6	1.6 - 1.9
% Primal Cuts Live Basis	51.04	49.28	47.14
% Primal Cuts Carcass Basis	69.73	66.81	63.86
% Lean Cuts Live Basis	41.69	39.44	36.64
% Lean Cuts Carcass Basis	56.96	53.46	49.69
Loin Lean Area 10th Rib (sq. in.)	4.09	3.90	3.28
Loin Lean Area Last Rib (sq. in.)	4.31	3.92	3.48
Carcass Length (Inches)	29.79	29.10	28.21
% Cooler Shrinkage	3.33	3.47	3.12
Ave. Backfat	1.23	1.49	1.78

Table 3. Analysis of Variance for Various Cut-Out

Item Studied	Source	DF	Sum of Squares	Mean Square	"F"
% Primal Cuts Live Basis	Finish	2	190.98	95.49	25.40**
	Error	72	270.54	3.76	
	Total	74	461.52		
% Primal Cuts Carcass Basis	Finish	2	431.36	215.68	45.12**
	Error	72	344.34	4.78	
	Total	74	775.70		
% Lean Cuts Live Basis	Finish	2	319.20	159.60	35.78**
	Error	72	320.13	4.46	
	Total	74	639.33		
% Lean Cuts Carcass Basis	Finish	2	660.97	330.48	51.32**
	Error	72	464.00	6.44	
	Total	74	1124.97		

** Denotes Significance at P=.01

amount of finish increased, carcass length and loin lean area decreased. The average loin lean area difference in square inches between the 10th and last rib for the total seventy-five hogs regardless of finish was only .15 square inches. This value was somewhat lower than that found by Kline and Hazel (1955) of 0.43 square inches, Pearson et al. (1956) of .51 square inches, and Price et al. (1957) of .61 square inches. No explanation can be given as to why this lower value was obtained.

Cooler shrinkage was not significant between the different degrees of finish (Table 4). Percent shrinkage was calculated as the difference in weight between the hot and chilled carcass divided by hot carcass weight x 100. It might have been reasoned that due to less moisture in the higher finished carcasses, cooler shrinkage would be less, however, this did not hold true for this study. It might be added that considerable variation occured within each of the groups, but the mean values did not show any trend for less shrinkage for the higher finished groups. This finding was not in agreement with results of Henning and Evans (1953) and many other workers in this field.

Color Data

There was a definite difference in the color of the *Longissimus dorsi* muscle between the three finish groups (Table 5). As the degree of finish increased the hue of

Table 4. Analysis of Variance for Various Carcass Measurement

Items Studied	Source	DF	Sum of Squares	Mean Square	"F"
Loin Lean Area 10th Rib	Finish	2	4.90	2.45	29.20**
	Error	72	6.04	0.0839	
	Total	74	10.94		
Loin Lean Area Last Rib	Finish	2	8.67	4.34	16.06**
	Error	72	19.41	.27	
	Total	74	28.08		
Carcass Length	Finish	2	31.15	15.58	20.96**
	Error	72	53.47	0.743	
	Total	74	84.62		
Cooler Shrinkage	Finish	2	1.55	0.775	0.83
	Error	72	67.10	0.932	
	Total	74	68.65		

** Denotes Significance at P=.01

the lean changed from a low yellow red to more yellowish red range. The value also increased which indicated a lighter color. There was little difference in chroma, or the amount of the respective colors.

As the time after cutting the samples increased, the change in color appeared to be as follows: Hue changed from a low red yellow range to a more yellowish red range. Value appeared to remain fairly constant. Chroma increased to some extent from the two hour reading to the twenty-four hour reading, but remained about the same at the end of forty-eight hours. For individual readings see Appendix D.

No attempt was made in this study to establish whether the differences in color between the different finish groups were due to marbling *per se* or whether there were chemical and/or physiological factors involved. No information was found in the literature pertaining to the color of pork muscle.

Table 5. Average Munsell Renotation

B. F. (In.)	Time after cutting		
	2 Hours	24 Hours	48 Hours
1.0 - 1.3	2.6 YR 5.4/4.0	3.5 YR 5.4/4.4	4.6 YR 5.1/4.3
1.3 - 1.6	2.7 YR 5.6/4.2	3.5 YR 5.6/4.6	4.8 YR 5.6/4.6
1.6 - 1.9	3.3 YR 5.7/4.2	4.1 YR 5.7/4.3	5.4 YR 5.7/4.3

Cure Loss

Cure yields are very important to meat packers as the maximum allowed in federally inspected plants is 100 percent, yet competition forces the packer to obtain yields as close to the maximum as possible. The method of ham curing used in this study was similar to that used commercially. However, bacons for this project were dry cured, whereas, in commercial practice curing brine is needle injected into the green belly. Therefore, because of the differences in bacon curing methods, the results obtained in this study can only give an indication of what might happen under commercial practices for bacon.

The mean values for curing loss of hams are presented in Table 6. There was almost two percent difference in amount of curing loss between the hams from the carcasses having 1.0 to 1.3 inches of backfat and those from carcasses having 1.6 to 1.9 inches of backfat. However, this difference was not statistically significant. It was noted that considerable variation was found within each of the groups. This was at least partially due to difficulty in injecting exactly the proper amount of curing brine per ham.

Highly significant differences were found between the different finish groups and percent cure loss of bacon (Table 7). The higher the degree of finish, the less was the cure loss (Table 6). This was what might have been expected due to less moisture in fatty tissue, thus, less moisture was lost during the curing and smoking process in the higher finish groups. For individual cure loss values of both hams and bacons see Appendix E.

Table 6. Mean Values of Percent Cure Loss for Hams and Bacons Between Different Degrees of Finish

Items Studied	Average Backfat Thickness 1.0 - 1.3	1.3 - 1.6	1.6 - 1.9
Hams	-.98	-.67	+.92
Bacons	13.89	12.84	10.68

Table 7. Analysis of Variance for Cure Loss of Hams and Bacons

Items Studied	Source	DF	Sum of Squares	Mean Square	"F"
Bacon Cure Loss	Finish	2	134.15	67.08	15.75**
	Error	72	306.62	4.26	
	Total	74	440.77		
Ham Cure Loss	Finish	2	11.59	5.80	1.28
	Error	72	326.91	4.54	
	Total	74	338.50		

** Denotes Significance at P = .01.

<u>Defrosting Drip Loss</u>

The mean values of the defrosting drip loss expressed as percentage are presented in Table 8. Analysis of variance showed highly significant differences between the drip loss

Table 8. Mean Values of Percent Drip Loss Between Different Degrees of Finish and Various Pork Cuts.

Items Studied	Average Backfat Thickness 1.0 - 1.3	1.3 - 1.6	1.6 - 1.9
Loin Chops 3rd to 10th Rib	2.80	2.29	1.57
Loin Roast 10th to last Rib	0.70	0.64	0.51
Boston Butt	0.58	0.54	0.40

Table 9. Analysis of Variance for Percent Drip Loss of Loin Roasts, Loin Chops and Boston Butts.

Items Studied	Source	DF	Sum of Squares	Mean Square	"F"
% Drip Loss of Loin Chops, 3-10th Rib	Finish	2	18.17	9.085	14.33**
	Error	72	45.66	.634	
	Total	74	63.83		
% Drip Loss of Loin Roast, 10th-Last Rib	Finish	2	0.51	.285	1.47
	Error	72	12.46	.173	
	Total	74	12.97		
% Drip Loss of Boston Butt	Finish	2	.47	.235	1.59
	Error	72	10.57	.147	
	Total	74	11.04		

** Denotes Significance at $P \mp .01$

for loin chops and degrees of finish (Table 9). However, no significant differences were found for the loin roasts or the Boston butts, although the means indicated less drip was obtained as degree of finish increased. The loin chops had more surface area per unit of weight, which would account for considerably more drip than in the case of the other two cuts. Also, the chops from the leaner carcasses had a larger eye muscle than the chops from the higher finished carcasses (Table 2). This would probably result in more surface area for the leaner chops and increase the amount of drip for these chops. The range for the drip loss of the loin chops was from .98 to 6.16 percent. The percent loss for the Boston butts and loin roasts was over one percent in only a very few cases. See Appendix Table F.

Correlations between the amount of fat in each of the three cuts studied as measured by ether extract or specific gravity, and the percent of drip loss were highly significant in all cases. However, the correlations were of low magnitude (Table 10). From the results of this study the degree of finish appeared to affect the amount of drip loss to some extent.

Specific Gravity and Chemical Analysis

When specific gravity and ether extract were grouped according to the three finish groups, there was a tendency for overlapping between groups. This would be expected as backfat thickness is only associated with marbling and not

Table 10. Simple Correlations Between Various Drip Losses and Various Measurement of Fat

Items Studied	"r"
Ether Extract x % Drip of Loin Section - 10th to Last Rib	-.35
Specific Gravity of _Longissimus_ _dorsi_ x % Drip of Loin Section - 10th to Last Rib	.40
Ether Extract x % Drip of Chops - 3rd to 10th loin section	-.53
Specific Gravity x % Drip of Chops - 3rd to 10th loin section	.51
Specific Gravity x % Drip of Boston Butt	.45

"r" needed for P. .01 = .302

a measure of it. Correlation coefficients of -.50 and .41 were obtained between backfat and specific gravity of the _Longissimus_ _dorsi_ and between backfat and ether extract, respectively. However, highly significant differences were found for specific gravity and percent ether extract and a significant difference for percent moisture of the _Longissimus_ _dorsi_ muscle between the different finish groups (Table 11). The ranges of values for the seventy-five samples for specific gravity, percent ether extract and percent moisture were 1.0484 to 1.0832, 0.20 to 16.28 and 64.18 to 75.11, respectively. The rather narrow range between the two extremes of specific gravity, being only .0348, points out the necessity of minimizing the variation due to the experimental procedure and sensitivity of weighing.

The correlation coefficients between specific gravity and percent ether extract of the Longissimus dorsi were -.83 and with moisture .71. Thus, the coefficients of determination would be 69 and 50 percent, respectively. These values were very close to those found by Orme *et al.* (1958), working with beef ribs. The results of this study indicated that specific gravity is a good objective measurement of marbling. For individual values see Appendix Table F.

Extensibility and Shear

Analysis of variance revealed significant differences for muscle fiber extensibility and for shear of the eighth and ninth rib chops. However, no significant differences were found for the shear of the loin chops cut at the second lumbar vertebra (Table 12). Although the correlations between marbling, as measured by ether extract and specific gravity, and shear or extensibility were low, they proved to be highly significant (Table 13). These results indicated that a positive relationship existed between marbling and tenderness of the loin chops.

The correlations between extensibility and shear at both locations of the loin were .59 in each case. This is of particular interest when it is pointed out that all or at least most of the connective tissue was removed from the muscle fiber before stretching it to its breaking point.

Table 11. Analysis of Variance for Specific Gravity, Moisture and Ether Extract of the Longissimus dorsi.

Items Studied	Source	DF	Sum of Squares	Mean Square	"F"
	Finish	2	.0006	.0003	8.00**
Specific Gravity	Error	72	.0027	.0000375	
	Total	74	.0033		
	Finish	2	154.03	77.01	7.51**
% Ether Extract	Error	72	738.54	10.26	
	Total	74	892.57		
	Finish	2	45.13	22.565	4.86*
% Moisture	Error	72	334.00	4.639	
	Total	74	379.13		

* Denotes Significance at P=.05.
** Denotes Significance at P=.01.

Table 12. Analysis of Variance for Extensibility and Shear of Loin Chops

Items Studied	Source	DF	Sum of Squares	Mean Square	"F"
Extensibility	Finish	2	24.81	12.41	4.57*
	Error	72	94.18	2.18	
	Total	74	218.99		
Shear of 8th & 9th Rib Chop	Finish	2	21.88	10.94	4.78*
	Error	72	164.75	2.29	
	Total	74	186.63		
Shear of Loin Chops 2nd Lumbar Vertebra	Finish	2	8.11	4.06	2.20
	Error	72	132.61	1.84	
	Total	74	140.72		

* Denotes Significance at P=.05.

Table 13. Simple Correlation Coefficients Between Shear or Extensibility and Various Measurements of Marbling

	Shear Loin Chops-2nd Lumbar	Shear 8th and 9th Rib Chops	Muscle Fiber Extensibility
Sp. Gravity of *Longissimus dorsi*	.42	.39	.34
Ether Extract	-.48	-.46	.33
Muscle Fiber Extensibility	.59	.59	-

"r" Value of .302 Needed for Significance at P=.01.

These results would tend to substantiate the findings of Cover (1943) that a factor or factors inherent to the muscle fiber *per se* affects the tenderness of meat. For individual values see Appendix Table G.

Cooking Loss

Analysis of variance revealed that differences in total cooking loss were not significant between the different finish groups, regardless of method of cookery or the cut of meat, with the exception of total bacon cooking loss, which was significant at the five percent level (Table 14). These results might be explained by the fact that total cooking loss is not affected by the degree of finish to any great extent, because as the amount of finish increases, the cooking drip loss increases (mostly fat), but the moisture evaporation loss decreases. Thus, these two factors tend to counter balance each other. Bacon is somewhat of a special item as it is a fat cut, the slices are quite thin (approximately three millimeters) and it is cooked to a higher degree. These factors result in a higher total cooking loss as the amount of finish increases.

When chops cut at the last rib from all of the seventy-five carcasses were cooked either by roasting or deep fat frying, the mean values were 20.37 and 29.05 percent total cooking loss, respectively. Thus, an 8.68 percent higher cooking loss was found when chops were cooked in deep fat.

Table 14. Analysis of Variance of Total Cooking Loss of Various Cuts

Items Studied	Source	DF	Sum of Squares	Mean Squares	"F"
8th & 9th Rib Chops Deep Fat Fried	Finish	2	7.90	3.95	.31
	Error	72	930.74	12.93	
	Total	74	938.64		
Loin Chops-2nd lumbar, deep fat fried	Finish	2	19.69	9.85	1.61
	Error	72	439.13	6.10	
	Total	74	458.82		
Loin Chops-2nd Lumbar, Roasted	Finish	2	8.74	4.37	.75
	Error	72	422.27	5.86	
	Total	74	431.02		
Ham - *Semimembranosus* muscle, Roasted	Finish	2	20.27	10.14	1.87
	Error	72	389.73	5.41	
	Total	74	410.00		
Bacon slices Roasted	Finish	2	128.80	64.40	3.76*
	Error	72	1234.33	17.14	
	Total	74	1363.13		

* Denotes Significance at P=.05.

This difference proved to be highly significant. These values for total cooking loss for both roasting and deep fat were similar to those found by Johnston (1957) in his Trial II. For individual cooking data see Appendix H.

Taste Panel

The mean values for the taste panel scores of the loin chops were 6.40, 6.58 and 6.93 from the carcasses which had respectively 1.0 to 1.3, 1.3 to 1.6 and 1.6 to 1.9 inches of average backfat thickness. Although the taste panel results were within a rather narrow range, the differences were great enough to be significant at the one percent level (Table 15). However, the taste panel results for ham and bacons did not approach significance. Perhaps one of the reasons for this fact was the variation which resulted from curing and smoking. It was the observation of the author that the leaner bacons were more salty than the fatter ones even though the same amount of cure per pound of green weight was used. Also, there appeared to be some variation in the saltiness and color of the hams within each group.

Simple correlations were calculated for the loin chops between two mechanical measures of tenderness, two objective measures of marbling and taste panel scores. In addition, a multiple correlation between ether extract, shear and scores of the taste panel was calculated (Table 16). All correlations were relatively low but proved to be highly significant in each case. The results indicated a relationship between both tenderness and marbling with taste panel scores. It should be remembered, however, that the taste panel members only recorded their degree of like or dislike of the product, and did not indicate why they scored as they did, therefore, more conclusive statements could not be made in this respect. For individual values of taste panel scores see Appendix Table G.

Table 15. Analysis of Variance of Taste Panel Results

Items Studied	Source	DF	Sum of Squares	Mean Square	"F"
	Finish	2	3.71	1.855	10.78**
Loin Chops	Error	72	12.40	.172	
	Total	74	16.11		
	Finish	2	.35	.175	.46
Bacon	Error	72	27.52	.382	
	Total	74	27.87		
	Finish	2	.20	0.10	0.45
Ham	Error	72	16.14	0.224	
	Total	74	16.34		

** Denotes Significance at P=.01.

Table 16. Simple and Multiple Correlations Between Taste Panel Results for Loin Chops and Various Measurements of Marbling and Tenderness

Items Studied	Taste Panel Scores
Specific Gravity	-.38
Ether Extract	.31
Shear	-.40
Extensibility	-.48
Ether Extract x Shear	.42

"r" Value of .302 Needed for Significance at P=.01.

SUMMARY AND CONCLUSIONS

This study was designed to observe the effects of different degrees of finish on various processing and palatability characteristics of pork carcasses. The data obtained from the seventy-five hogs used in this project warranted the following conclusions:

1. Backfat thickness could be reduced and percentage of both primal and lean cuts increased by limiting daily gains. The number of days on feed was more than doubled.

2. Loin lean area, carcass length, primal and lean cuts were inversely related to finish.

3. There were differences in color of the <u>Longissimus dorsi</u> between the three finish groups. As the degree of finish increased the hue contained more yellow and was lighter.

4. Highly significant differences were found for cure loss of bacons. Ham cure loss decreased as fatness increased, but the differences were not significant.

5. The difference in defrosting drip loss of the loin chops proved to be highly significant, as finish increased, drip decreased. The mean values of the Boston butts and loin roasts indicated that percentage of defrosting drip loss was inversely related to the degree of finish, but was not statistically significant.

6. High correlation coefficients between specific gravity and both percent fat and percent moisture of the

Longissimus dorsi verified that specific gravity may be used as an objective measurement of marbling.

7. Low but highly significant correlations were found between muscle fiber extensibility and both shear and marbling.

8. No significant differences were found between the degree of finish and total cooking loss except for bacon slices. Deep fat fried loin chops had approximately eight and two thirds percent more cooking loss than roasted loin chops.

9. Highly significant differences were found between degree of finish and taste panel scores of loin chops. No statistical differences were found between taste panel scores of ham or bacon slices. Low but highly significant correlations were found between taste panel scores of the loin chops and the following: specific gravity, ether extract, shear and muscle fiber extensibility.

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A P P E N D I X

APPENDIX A

FEEDING DATA

Hog No.	Initial Wt.	Final Wt.	Total Gain	No. of Days on Feed	Ave. Daily Gain	Feed per 100 lbs. Gain
Lot 1 - Full Fed Group						
5	112	200	88	40	2.23	
9	102	200	98	47	2.09	
11	108	200	92	57	1.61	
12	104	209	105	57	1.84	
13	106	200	94	57	1.65	
15	87	199	112	66	1.70	
16	84	199	115	66	1.74	
17	97	204	107	66	1.62	
18	93	201	108	66	1.64	
21	80	197	117	77	1.52	
Mean	97.3	200.9	103.7	59.9	1.73	454.87
Lot 2 - Limited Fed Group						
14	108	196	88	69	1.28	
22	104	200	96	82	1.17	
35	112	194	82	106	.77	
36	85	198	113	106	1.07	
37	105	200	95	106	.90	
41	94	201	107	125	.86	
45	109	197	88	120	.73	
55	97	196	99	167	.59	
56	73	186	113	174	.65	
57	87	194	107	174	.61	
Mean	97.4	196.2	98.8	122.9	.80	439.47
Lot 3 - Individual Fed Group						
39	101	200	99	122	.81	411.1
40	109	199	90	122	.82	407.0
43	105	195	90	129	.70	491.1
46	96	196	100	136	.74	463.0
50	91	202	111	143	.78	448.6
51	102	201	99	143	.69	510.0
52	101	202	101	143	.71	493.1
53	89	201	112	150	.75	482.1
54	84	201	117	164	.71	492.3
Mean	97.6	199.7	102.1	139.1	.74	466.74

APPENDIX B

SLAUGHTER DATA
1.0 - 1.3 B. F. Carcasses

Hog No.	Feedlot Weight	Slaughter Weight	% Pre-Slaughter Shrinkage	Cold Carcass Weight	% Cooler Shrinkage	Dressing Percentage
2	190.0	188.5	0.79	135.0	4.39	71.62
3	211.0	208.5	1.18	148.0	3.96	70.98
4	196.0	185.0	5.61	133.5	3.96	72.16
6	202.5	185.5	6.90	138.0	2.75	73.21
7	195.0	185.5	4.87	134.0	2.76	72.24
8	194.5	181.0	6.94	131.5	2.88	72.65
10	192.0	183.5	4.43	134.0	3.81	73.02
14	196.0	184.0	6.12	131.0	3.39	71.20
19	216.0	210.0	2.78	153.5	3.15	73.09
28	196.5	185.0	5.85	136.0	3.27	73.51
30	200.0	185.0	7.50	140.0	3.05	75.67
32	194.0	183.5	5.40	136.5	3.33	74.39
33	199.5	185.0	2.25	138.0	3.50	74.59
34	190.6	180.5	5.00	134.0	3.11	74.23
38	190.0	181.5	4.47	134.5	3.38	74.10
39	207.0	192.0	7.25	136.5	3.26	71.09
40	202.0	194.0	3.96	139.0	3.34	71.65
42	185.5	176.0	5.12	132.0	3.65	75.03
44	203.0	193.5	4.68	142.0	3.40	73.39
45	197.0	187.0	5.08	135.0	3.50	72.10
52	195.0	188.0	3.59	134.0	3.04	71.28
54	203.0	193.0	4.93	144.0	3.68	74.61
56	186.0	180.0	3.23	132.0	3.37	73.33
75	212.0	207.5	2.12	154.0	2.72	74.23
76	210.0	210.0	0.00	148.5	2.62	73.88
Mean	198.6	189.3	4.40	138.2	3.33	73.09

APPENDIX B (Continued)

SLAUGHTER DATA
1.3 - 1.6 B. F. Carcasses

Hog No.	Feedlot Weight	Slaughter Weight	% Pre-Slaughter Shrinkage	Cold Carcass Weight	% Cooler Shrinkage	Dressing Percentage
9	200.0	187.0	6.50	140.1	3.04	74.92
11	200.0	190.0	5.00	141.7	3.34	74.58
13	200.0	190.0	5.00	138.8	4.14	73.05
16	199.0	188.0	5.53	137.9	3.50	73.35
17	204.0	197.0	3.43	144.0	4.00	73.35
20	210.5	202.0	4.04	149.5	2.61	74.01
24	198.0	188.0	5.05	138.5	3.62	73.67
25	206.0	194.0	5.83	146.0	4.63	75.26
26	195.0	186.0	4.60	138.0	3.02	74.19
27	194.5	180.5	7.19	130.5	3.22	72.29
29	208.0	197.0	5.29	144.5	3.34	73.35
31	195.5	181.0	7.42	134.5	3.71	74.31
35	194.0	187.0	3.61	138.5	3.15	74.06
41	201.0	192.0	4.48	139.5	2.86	72.66
46	205.0	196.0	4.39	146.0	2.67	71.22
51	195.0	184.5	5.38	138.5	4.34	75.07
53	195.0	188.0	3.59	141.0	3.29	75.00
55	196.0	181.5	7.40	135.0	9.15	74.38
57	194.0	189.0	2.58	138.5	3.85	73.28
66	191.0	186.0	2.62	130.5	2.54	70.16
70	204.0	190.5	6.62	142.5	2.92	74.80
71	204.0	195.0	4.41	139.5	2.86	71.54
72	206.0	194.0	5.82	142.0	2.00	73.20
73	201.0	194.0	3.48	144.0	2.64	74.23
74	205.0	196.5	4.15	147.0	2.32	74.81
Mean	200.1	190.2	4.94	140.3	3.47	73.63

APPENDIX B (Continued)

SLAUGHTER DATA
1.6 - 1.9 B. F. Carcasses

Hog No.	Feedlot Weight	Slaughter Weight	% Pre-Slaughter Shrinkage	Cold Carcass Weight	% Cooler Shrinkage	Dressing Percentage
5	200.0	191.5	4.25	141.3	2.89	73.79
12	209.0	199.0	4.78	147.4	3.53	74.07
15	199.0	189.0	5.03	137.0	2.76	72.49
18	209.0	198.0	5.26	143.6	3.69	72.53
21	202.0	191.0	5.45	143.5	2.84	75.13
22	200.0	192.5	3.75	142.0	3.40	73.76
23	202.0	195.0	3.47	151.0	1.17	74.75
36	198.0	191.0	3.54	143.0	3.31	74.87
37	200.0	193.5	3.25	139.0	2.73	71.83
43	199.0	189.0	5.03	137.0	3.66	72.49
47	196.0	186.0	5.10	138.5	3.28	74.46
48	184.0	174.0	5.43	129.0	3.01	74.14
49	190.0	182.5	3.95	135.0	3.09	73.97
50	204.0	195.5	3.31	146.0	3.31	74.68
58	202.0	195.0	3.47	148.0	2.37	75.90
59	203.0	195.0	3.94	144.5	6.11	74.10
60	205.0	201.0	1.95	149.0	3.25	74.13
61	204.0	194.5	4.66	148.0	2.50	76.09
62	203.0	199.5	1.72	150.0	2.22	75.19
63	203.0	191.5	5.67	136.5	2.57	71.28
64	204.0	196.0	3.96	143.0	2.72	72.96
65	186.0	180.0	3.23	128.5	2.87	71.39
67	216.0	207.0	4.17	147.5	3.02	71.26
68	206.0	198.0	3.88	146.0	2.93	73.74
69	205.0	195.0	4.88	139.0	4.79	71.28
Mean	201.2	192.8	4.13	142.1	3.12	73.61

APPENDIX C

CARCASS MEASUREMENTS and CUT-OUT
1.0 - 1.3 B. F. Carcasses

Hog No.	Ave. Back-fat (In.)	Car-cass Length (In.)	Loin Lean Area 10th Rib (Sq.In.)	Loin Lean Area Last Rib (Sq.In.)	Lean Cuts Yield Live Basis (%)	Lean Cuts Yield Car-cass Basis (%)	Primal Cuts Yield Live Basis (%)	Primal Cuts Yield Car-cass Basis (%)
2	1.09	31.00	4.93	5.51	44.61	62.30	52.89	73.85
3	1.18	29.80	4.55	5.41	43.35	61.35	51.89	73.11
4	1.30	28.90	3.32	4.14	40.05	55.51	50.65	70.19
6	1.30	28.90	4.11	4.11	40.95	55.94	50.66	69.20
7	1.24	30.30	3.70	3.85	40.86	56.57	49.81	68.96
8	1.30	29.37	4.11	3.79	40.28	55.44	49.72	68.44
10	1.30	28.60	4.19	4.57	40.71	55.75	49.48	67.76
14	1.25	28.40	3.54	3.91	39.67	55.73	48.48	68.09
19	1.28	31.60	4.21	4.30	41.05	56.16	50.57	69.18
28	1.06	31.10	4.36	4.20	42.86	58.31	51.56	70.15
30	1.27	29.25	4.55	4.48	44.27	58.30	54.27	71.71
32	1.26	29.80	4.29	4.53	43.22	58.10	52.37	70.40
33	1.25	30.51	3.53	3.41	41.78	56.01	51.19	68.62
34	1.18	29.01	4.58	4.75	46.26	62.31	55.24	74.40
38	1.15	30.31	4.43	4.69	43.75	59.03	52.51	70.86
39	1.30	30.67	4.07	3.85	39.58	55.68	49.17	69.16
40	1.29	29.09	4.09	4.21	39.69	55.39	49.18	68.63
42	1.21	29.17	4.27	4.54	44.43	59.24	53.58	71.44
44	1.30	30.83	4.06	4.25	42.27	57.61	52.20	71.13
45	1.29	28.11	3.14	3.54	37.33	49.89	47.43	63.40
52	1.11	29.53	3.73	3.71	39.63	55.60	49.26	69.10
54	1.30	29.13	4.05	4.48	41.01	54.97	51.01	68.37
56	1.10	28.50	4.22	4.46	42.06	57.35	51.22	69.85
75	1.21	30.91	4.54	4.71	41.30	55.65	51.04	68.77
76	1.26	31.89	3.80	4.41	41.24	55.82	50.65	68.55
Mean	1.23	29.79	4.09	4.31	41.69	56.96	51.04	69.73

APPENDIX C (Continued)

CARCASS MEASUREMENTS and CUT-OUT
1.3 - 1.6 B. F. Carcasses

Hog No.	Ave. Back-fat (In.)	Car-cass Length (In.)	Loin Lean Area 10th Rib (Sq.In.)	Loin Lean Area Last Rib (Sq.In.)	Lean Cuts Yield Live Basis (%)	Lean Cuts Yield Car-cass Basis (%)	Primal Cuts Yield Live Basis (%)	Primal Cuts Yield Car-cass Basis (%)
9	1.55	27.70	3.73	3.96	36.20	48.32	45.29	60.46
11	1.45	28.80	4.05	4.32	40.37	54.13	50.68	67.96
13	1.45	28.20	3.73	3.64	37.58	51.44	46.79	64.05
16	1.58	27.80	3.15	3.46	35.96	49.02	46.22	63.02
17	1.45	29.30	3.94	4.16	39.90	54.58	49.04	67.08
20	1.44	29.40	4.29	4.18	40.69	54.98	50.94	68.83
24	1.47	29.90	4.58	4.68	43.35	58.84	52.45	71.19
25	1.37	30.30	5.28	4.87	44.18	58.70	53.04	70.48
26	1.44	29.90	3.79	3.74	40.54	54.64	50.22	67.68
27	1.43	29.60	4.62	3.83	40.89	56.55	49.64	68.66
29	1.57	30.10	3.41	3.89	38.98	53.15	48.27	65.81
31	1.40	29.70	3.82	3.98	41.33	55.60	51.44	69.22
35	1.50	28.90	3.72	3.30	40.16	54.22	50.05	67.58
41	1.51	28.54	4.00	4.29	38.39	52.83	47.40	65.23
46	1.41	28.98	4.55	4.15	40.56	54.45	50.56	67.88
51	1.54	28.94	3.59	3.48	38.86	51.77	49.16	65.49
53	1.48	29.13	3.78	4.00	39.95	53.26	49.41	65.89
55	1.38	28.82	4.49	4.63	41.26	55.48	51.21	68.85
57	1.43	28.03	4.78	4.98	40.79	55.67	49.79	67.94
66	1.57	28.27	2.94	2.93	35.21	50.19	45.75	65.21
70	1.53	28.82	2.93	3.11	35.23	49.25	45.85	64.09
71	1.53	29.96	3.31	3.56	39.79	53.19	50.24	67.17
72	1.50	29.06	2.89	2.84	37.73	51.55	48.25	65.92
73	1.59	28.58	4.31	4.14	38.45	51.81	49.18	66.25
74	1.57	30.67	3.90	3.97	39.59	52.93	51.04	68.23
Mean	1.49	29.10	3.90	3.92	39.44	53.46	49.28	66.81

APPENDIX C (Continued)

CARCASS MEASUREMENTS and CUT-OUT
1.6 - 1.9 B. F. Carcasses

Hog No.	Ave. Back-fat (In.)	Car-cass Length (In.)	Loin Lean Area (Sq.In.) 10th Rib	Loin Lean Area (Sq.In.) Last Rib	Lean Cuts Yield Live Basis (%)	Lean Cuts Yield Car-cass Basis (%)	Primal Cuts Yield Live Basis (%)	Primal Cuts Yield Car-cass Basis (%)
5	1.82	27.53	3.05	3.32	36.61	49.61	46.11	62.49
12	1.97	28.10	2.92	3.55	34.67	46.81	44.57	60.18
15	1.70	27.70	3.73	4.46	37.20	51.31	46.08	63.58
18	1.77	27.80	3.06	3.14	35.05	48.33	44.49	61.35
21	2.20	26.80	3.23	3.55	34.97	46.55	44.71	59.58
22	1.72	28.03	3.92	3.73	37.50	50.85	48.31	65.49
23	1.63	30.08	4.57	4.42	42.62	55.03	51.95	67.09
36	1.82	28.35	2.98	3.11	37.28	49.79	47.74	63.78
37	1.63	28.03	3.52	2.72	36.64	51.01	47.53	65.90
43	1.77	28.23	3.32	3.64	37.72	52.04	47.09	64.96
47	1.96	27.60	2.97	3.10	33.44	44.71	45.81	61.52
48	1.83	28.10	3.33	3.57	37.82	51.01	47.82	64.50
49	1.82	28.11	2.68	2.54	34.47	46.59	45.86	62.00
50	1.61	28.27	3.25	3.70	39.74	53.22	49.62	64.24
58	1.68	28.78	4.04	4.32	39.85	52.50	50.72	66.82
59	1.98	28.58	3.14	3.83	36.05	48.65	46.36	62.56
60	1.83	28.27	2.82	3.71	37.26	50.27	47.26	64.03
61	1.72	29.06	3.63	3.91	38.30	50.34	49.92	65.61
62	1.84	28.36	3.41	3.32	36.69	48.80	47.82	63.60
63	1.61	28.19	2.61	2.72	35.61	49.96	46.84	65.71
64	1.61	29.06	3.22	3.44	36.48	50.00	47.24	64.76
65	1.69	27.32	3.05	3.15	34.56	48.40	45.50	63.74
67	1.70	29.49	3.32	3.15	34.54	48.47	45.56	63.93
68	1.81	27.83	3.15	3.32	35.56	48.23	46.72	63.36
69	1.70	27.64	3.16	3.59	35.49	49.78	46.82	65.68
Mean	1.78	28.21	3.28	3.48	36.64	49.69	47.14	63.86

APPENDIX D

MUNSELL RENOTATION
1.0 - 1.3 B. F. Carcasses

Hog	Time After Cutting		
No.	2 Hours	24 Hours	48 Hours
2	5.2 YR 5.2/4.7	5.0 YR 5.0/3.0	5.4 YR 4.0/3.9
3	3.5 YR 5.2/3.6	7.4 YR 4.9/3.4	4.9 YR 4.7/5.1
4	3.3 YR 5.2/2.9	4.7 YR 5.1/4.3	6.0 YR 4.3/3.6
6	5.8 YR 6.0/4.1	4.9 YR 5.4/5.1	5.1 YR 5.2/5.6
7	3.3 YR 5.2/4.1	2.5 YR 4.6/5.2	1.3 YR 4.3/5.4
8	5.8 YR 5.9/4.2	4.6 YR 5.0/5.3	3.2 YR 4.5/5.6
10	3.8 YR 5.3/3.5	3.7 YR 4.9/4.6	3.1 YR 4.2/4.7
14	6.4 YR 5.2/3.2	4.3 YR 5.3/3.8	5.0 YR 5.3/3.7
19	3.8 YR 5.0/3.1	4.9 YR 5.2/4.1	3.3 YR 5.1/4.4
28	0.3 YR 5.6/4.1	3.5 YR 5.3/4.5	4.2 YR 5.7/4.3
30	10.0 R 5.5/4.0	3.5 YR 5.5/4.3	3.7 YR 5.8/4.6
32	8.3 R 5.3/4.2	3.7 YR 5.8/3.7	4.3 YR 5.3/2.9
33	10.0 R 5.7/3.5	1.5 YR 6.3/4.2	8.0 YR 5.5/3.3
34	9.8 R 5.0/4.1	9.7 R 5.3/4.9	4.9 YR 4.9/3.7
38	0.5 YR 5.3/4.3	1.6 YR 5.7/5.7	7.9 YR 5.5/4.8
39	1.1 YR 5.8/4.3	1.9 YR 5.9/4.8	6.3 YR 5.9/4.2
40	0.4 YR 5.3/4.2	1.3 YR 5.8/5.2	4.4 YR 5.2/5.1
42	1.6 YR 5.6/3.9	1.4 YR 5.8/4.8	6.2 YR 5.5/4.1
44	4.4 YR 5.8/3.9	7.0 YR 5.7/3.6	6.2 YR 5.8/3.4
45	5.1 YR 5.2/4.2	5.1 YR 5.2/4.2	4.9 YR 5.5/4.0
52	3.3 YR 5.0/4.3	2.9 YR 5.2/4.5	4.1 YR 5.4/4.4
54	3.1 YR 5.3/4.2	4.1 YR 5.2/4.4	4.3 YR 5.1/4.9
56	3.4 YR 5.2/4.7	4.1 YR 5.2/4.6	4.1 YR 5.2/4.6
75	1.5 YR 5.1/3.5	2.9 YR 5.4/3.7	3.4 YR 5.4/3.9
76	10.0 R 5.0/4.4	0.3 YR 5.1/3.9	1.9 YR 5.1/4.2
Mean	2.6 YR 5.4/4.0	3.5 YR 5.4/4.4	4.6 YR 5.1/4.3

APPENDIX D (Continued)

MUNSELL RENOTATION
1.3 - 1.6 B. F. Carcasses

Hog No.	Time After Cutting: 2 Hours	24 Hours	48 Hours
9	4.4 YR 5.9/4.1	7.5 YR 6.5/6.2	1.5 YR 5.2/6.7
11	5.0 YR 5.4/4.3	2.5 YR 5.0/5.6	1.4 YR 4.2/6.3
13	4.2 YR 5.4/4.7	4.2 YR 4.5/4.6	1.1 YR 4.1/6.7
16	0.2 YR 5.3/3.8	3.6 YR 5.3/4.1	4.1 YR 5.2/4.6
17	9.8 R 5.6/4.0	3.2 YR 4.9/4.8	4.0 YR 5.4/4.8
20	4.7 YR 5.1/3.8	2.5 YR 5.4/4.3	4.1 YR 5.4/4.8
24	2.5 YR 5.6/3.8	3.3 YR 5.8/4.4	5.7 YR 5.9/3.8
25	4.7 YR 5.3/5.4	4.9 YR 5.3/4.7	6.8 YR 5.8/4.6
26	2.5 YR 6.0/4.2	4.9 YR 5.3/4.7	4.9 YR 5.8/4.6
27	2.4 YR 5.8/3.8	3.9 YR 5.7/3.8	6.9 YR 6.3/3.3
29	0.4 YR 5.8/3.4	4.3 YR 5.8/3.6	5.5 YR 5.9/3.9
31	8.8 R 5.7/3.8	4.3 YR 6.0/3.3	9.6 YR 5.9/3.3
35	9.0 R 5.5/4.1	9.3 R 6.0/5.1	6.6 YR 5.0/4.4
41	0.4 YR 5.3/4.4	0.9 YR 5.7/5.1	6.0 YR 5.7/4.3
46	3.9 YR 4.9/4.3	4.1 YR 5.1/4.6	2.9 YR 5.1/4.5
51	3.5 YR 5.5/4.6	3.0 YR 5.5/4.8	3.3 YR 5.6/5.1
53	1.4 YR 5.6/4.4	0.2 YR 5.1/4.6	1.5 YR 5.0/5.0
55	3.8 YR 4.6/4.4	4.1 YR 5.2/4.2	5.1 YR 5.6/4.5
57	3.5 YR 5.4/4.4	3.4 YR 5.4/4.7	4.1 YR 5.2/4.3
66	6.6 YR 5.8/3.8	2.0 YR 5.9/4.2	5.1 YR 6.3/4.0
70	5.4 YR 6.0/4.2	1.0 YR 6.2/4.8	7.2 YR 7.3/4.7
71	5.2 YR 6.4/3.6	6.2 YR 6.6/3.9	6.2 YR 6.6/4.0
72	2.4 YR 6.4/4.3	5.1 YR 6.6/4.2	6.0 YR 6.6/4.3
73	0.4 YR 5.6/4.7	4.6 YR 5.9/4.9	4.2 YR 6.0/4.9
74	9.6 R 5.1/4.7	4.0 YR 5.8/4.6	5.0 YR 5.8/4.4
Mean	2.7 YR 5.6/4.2	3.5 YR 5.6/4.6	4.8 YR 5.6/4.6

APPENDIX D (Continued)

MUNSELL RENOTATION
1.6 - 1.9 B. F. Carcasses

Hog No.	Time After Cutting		
	2 Hours	24 Hours	48 Hours
5	6.4 YR 6.6/3.9	6.6 YR 5.2/4.5	6.0 YR 6.1/5.1
12	3.5 YR 5.4/4.9	3.0 YR 5.3/4.4	3.5 YR 4.9/4.4
15	0.6 YR 5.2/4.4	2.9 YR 4.9/4.9	4.1 YR 5.3/5.1
18	0.2 YR 5.4/4.6	3.2 YR 5.7/4.7	4.4 YR 5.3/4.9
21	5.8 YR 5.4/4.1	5.3 YR 5.3/4.4	4.9 YR 5.5/4.6
22	2.6 YR 5.2/4.5	5.1 YR 5.2/4.2	3.5 YR 5.2/4.3
23	3.8 YR 5.6/4.0	5.6 YR 5.3/3.7	6.9 YR 5.3/3.7
36	0.2 YR 5.3/3.8	1.4 YR 6.1/4.5	6.4 YR 5.6/3.3
37	0.5 YR 5.5/3.8	1.3 YR 6.0/4.2	6.5 YR 5.0/4.4
43	4.2 YR 5.5/4.4	5.7 YR 5.5/4.7	5.6 YR 5.5/3.9
47	6.0 YR 5.9/3.9	5.4 YR 5.9/4.1	5.0 YR 5.9/3.9
48	5.0 YR 5.4/3.9	5.0 YR 5.5/4.5	4.8 YR 5.6/4.6
49	5.0 YR 5.6/3.8	5.0 YR 5.7/3.9	6.3 YR 5.7/4.0
50	3.0 YR 5.0/5.3	3.0 YR 5.1/4.9	3.9 YR 5.3/4.9
58	1.2 YR 6.3/4.4	2.8 YR 6.1/3.9	6.1 YR 6.1/4.0
59	0.4 YR 5.6/4.1	6.0 YR 6.1/3.6	6.4 YR 5.5/4.1
60	2.5 YR 5.9/4.4	6.8 YR 6.0/4.9	6.5 YR 5.9/4.5
61	1.7 YR 5.5/4.4	6.7 YR 5.4/4.0	6.2 YR 5.8/4.4
62	1.4 YR 5.6/3.5	5.8 YR 5.8/4.3	5.0 YR 6.0/4.5
63	3.1 YR 6.4/4.1	7.6 YR 7.2/2.2	6.2 YR 7.0/4.4
64	4.6 YR 6.3/4.3	0.8 YR 6.2/4.9	4.9 YR 5.0/3.4
65	5.0 YR 5.9/4.0	1.4 YR 5.6/5.4	4.8 YR 6.1/4.3
67	5.3 YR 5.7/4.1	2.0 YR 5.6/4.5	5.3 YR 6.1/4.2
68	6.4 YR 6.6/4.1	1.5 YR 6.7/3.8	6.2 YR 6.9/4.3
69	5.2 YR 5.6/4.2	3.3 YR 5.6/4.3	5.2 YR 5.5/4.1
Mean	3.3 YR 5.7/4.2	4.1 YR 5.7/4.3	5.4 YR 5.7/4.3

APPENDIX E

PERCENT LOSS IN CURE

1.0 - 1.3 B. F. Carcasses			1.3 - 1.6 B. F. Carcasses			1.6 - 1.9 B. F. Carcasses		
Hog No.	Hams	Bacons	Hog No.	Hams	Bacons	Hog No.	Hams	Bacons
2	-5.75	15.38	9	.00	10.59	5	.00	8.79
3	-3.90	16.64	11	-1.85	10.71	12	+ .83	8.63
4	- .71	9.84	13	-1.59	13.14	15	-1.61	11.90
6	-1.54	12.66	16	-1.81	11.40	18	- .40	13.37
7	-2.25	13.25	17	-2.46	15.56	21	-1.23	11.76
8	-1.93	11.67	20	-1.97	12.08	22	.00	11.06
10	-4.02	14.91	24	-2.75	15.20	23	.00	14.29
14	- .79	14.81	25	-5.68	16.86	36	+ .84	9.00
19	+1.59	12.50	26	+2.52	13.89	37	+2.64	11.11
28	-3.01	12.42	27	+1.88	16.67	43	+1.23	12.99
30	- .34	12.97	29	-2.15	16.94	47	.00	8.70
32	+1.01	12.27	31	+1.46	12.57	48	- .87	11.49
33	+1.82	13.22	35	.00	13.51	49	+ .88	9.13
34	- .32	14.82	41	- .77	12.41	50	-1.09	9.84
38	.00	16.98	46	- .71	13.78	58	- .35	14.62
39	+4.90	14.13	51	- .83	10.53	59	- .39	10.95
40	-1.42	14.13	53	.00	11.24	60	+1.82	9.76
42	-7.80	17.39	55	- .74	13.33	61	+ .72	9.73
44	.00	14.58	57	+1.71	4.12	62	.00	9.91
45	+1.98	12.30	66	- .41	11.73	63	+2.39	10.70
52	.00	13.26	70	+1.57	12.08	64	+2.56	9.48
54	-2.08	13.47	71	- .71	14.07	65	+2.31	10.66
56	+2.21	13.94	72	- .37	11.76	67	+5.15	9.62
75	-1.25	15.42	73	-1.77	13.94	68	+1.93	9.50
76	- .98	14.29	74	- .71	12.89	69	+5.60	9.95
Mean	- .98	13.89	Mean	- .67	12.84	Mean	+ .92	10.68

APPENDIX F

PERCENT DEFROSTING DRIP LOSS, CHEMICAL ANALYSIS and SPECIFIC GRAVITY - 1.0 - 1.3 B. F. Carcasses

	Drip Loss			Specific Gravity		Longissimus dorsi	
Hog No.	Center Loin Roast	Blade Loin Chops-3rd to 10th Rib	Boston Butt	Boston Butt	Longissimus dorsi	Ether Extract (Fat) %	Moisture%
2	1.01	3.11	.77	1.0534	1.0832	.79	74.39
3	1.00	2.74	.37	1.0596	1.0776	.74	74.08
4	.74	2.13	.56	1.0523	1.0748	.90	74.34
6	.14	2.63	.73	1.0656	1.0726	2.36	72.67
7	.19	3.17	.73	1.0516	1.0739	1.54	74.95
8	.45	3.89	.51	1.0520	1.0748	1.48	74.07
10	.36	3.26	.52	1.0551	1.0708	2.41	74.72
14	1.30	3.51	.47	1.0490	1.0762	.60	73.37
19	.43	2.31	.30	1.0439	1.0776	1.84	72.69
28	.66	3.84	.39	1.0535	1.0788	.48	73.26
30	1.88	3.32	.68	1.0485	1.0779	1.27	73.39
32	.75	2.98	.50	1.0583	1.0778	.61	73.56
33	2.01	2.85	.89	1.0474	1.0769	1.24	73.46
34	.60	3.66	1.31	1.0574	1.0765	.77	73.99
38	.22	4.36	.79	1.0524	1.0787	.97	73.18
39	.45	1.77	.40	1.0470	1.0694	8.35	68.81
40	.35	3.06	.50	1.0460	1.0788	.83	72.97
42	1.16	3.61	.86	1.0491	1.0779	1.08	72.82
44	.17	2.51	.78	1.0542	1.0761	.68	73.52
45	.27	1.76	.24	1.0488	1.0722	2.40	73.40
52	.40	2.31	.34	1.0492	1.0754	1.85	72.62
54	.50	1.66	.29	1.0440	1.0763	2.86	72.06
56	1.25	2.06	.70	1.0465	1.0763	2.42	72.33
75	.19	1.53	.41	1.0492	1.0713	2.66	73.84
76	1.05	2.02	.46	1.0527	1.0779	1.08	72.82
Mean	.70	2.80	.58	1.0514	1.0760	1.69	73.25

APPENDIX F (Continued)

PERCENT DEFROSTING DRIP LOSS, CHEMICAL ANALYSIS and SPECIFIC GRAVITY - 1.3 - 1.6 B. F. Carcasses

	Drip Loss			Specific Gravity		Longissimus dorsi	
Hog No.	Center Loin Roast	Blade Loin Chops-3rd to 10th Rib	Boston Butt	Boston Butt	Longissimus dorsi	Ether Extract (Fat) %	Moisture %
9	.28	1.34	.18	1.0407	1.0680	4.35	72.77
11	.73	3.00	.10	1.0494	1.0735	2.98	71.45
13	.95	2.23	.19	1.0430	1.0718	3.23	71.55
16	.24	1.73	.21	1.0392	1.0622	8.27	69.90
17	.57	2.78	.66	1.0472	1.0743	2.21	73.34
20	.63	1.89	.42	1.0540	1.0772	1.60	73.39
24	1.17	6.16	1.05	1.0537	1.0795	1.12	73.03
25	.60	3.25	.52	1.0538	1.0778	.78	73.13
26	1.32	1.88	.20	1.0467	1.0779	.75	73.35
27	.26	3.13	.90	1.0518	1.0767	1.02	74.18
29	.54	2.12	.15	1.0493	1.0765	.20	74.41
31	.29	2.70	.25	1.0489	1.0762	1.22	73.06
35	.25	2.09	.44	1.0570	1.0707	5.78	71.06
41	.36	1.78	.32	1.0410	1.0738	3.66	71.77
46	.52	2.46	.79	1.0510	1.0777	.78	72.68
51	.19	1.22	.22	1.0360	1.0663	11.45	66.15
53	.19	2.44	.32	1.0381	1.0775	1.96	73.02
55	.30	2.07	.54	1.0516	1.0748	4.42	70.95
57	1.33	2.84	1.28	1.0600	1.0768	1.33	73.37
66	.64	1.52	.55	1.0428	1.0739	2.30	74.11
70	.40	1.02	.88	1.0420	1.0575	11.69	67.77
71	1.74	1.64	1.39	1.0392	1.0780	1.05	75.11
72	1.04	1.29	.54	1.0485	1.0762	2.53	73.64
73	1.19	3.44	1.36	1.0441	1.0750	.81	75.09
74	.32	1.33	.19	1.0458	1.0715	2.62	73.87
Mean	.64	2.29	.54	1.0470	1.0737	3.12	72.48

APPENDIX F (Continued)

PERCENT DEFROSTING DRIP LOSS, CHEMICAL ANALYSIS and SPECIFIC GRAVITY - 1.6 - 1.9 B. F. Carcasses

	Drip Loss			Specific Gravity		Longissimus dorsi	
Hog No.	Center Loin Roast	Blade Loin Chops-3rd to 10th Rib	Boston Butt	Boston Butt	Longissimus dorsi	Ether Extract (Fat) %	Moisture %
5	.22	1.13	.00	1.0394	1.0484	16.28	64.18
12	.40	1.47	.09	1.0345	1.0653	7.26	69.28
15	.48	1.98	.47	1.0485	1.0682	4.03	72.32
18	.27	1.79	.14	1.0365	1.0584	8.99	69.38
21	.55	1.21	.22	1.0474	1.0723	5.02	71.16
22	.86	1.45	.24	1.0413	1.0748	2.74	72.48
23	.43	1.77	.72	1.0489	1.0789	1.95	72.06
36	.48	.98	.11	1.0362	1.0565	14.57	64.96
37	.39	1.43	.09	1.0446	1.0592	14.34	65.31
43	.19	1.28	.29	1.0428	1.0707	6.13	70.65
47	.35	1.52	.14	1.0389	1.0492	2.73	73.57
48	.19	1.63	.33	1.0365	1.0759	1.70	73.73
49	.34	1.54	.38	1.0410	1.0747	1.15	73.74
50	.29	1.12	.15	1.0455	1.0717	6.40	70.24
58	.68	1.77	.13	1.0396	1.0746	2.40	72.18
59	.53	2.16	.52	1.0503	1.0745	.69	74.50
60	.29	1.49	.32	1.0412	1.0729	3.99	72.25
61	.73	2.43	1.00	1.0441	1.0726	3.09	73.19
62	.28	1.24	.22	1.0471	1.0664	5.87	71.85
63	.33	1.58	.30	1.0334	1.0638	7.08	71.35
64	.91	1.20	.26	1.0452	1.0748	3.05	72.30
65	.77	2.65	2.38	1.0519	1.0775	.91	74.87
67	.81	1.10	.29	1.0431	1.0730	3.56	72.59
68	1.13	1.48	.76	1.0425	1.0742	3.30	72.18
69	.73	1.93	.39	1.0446	1.0739	2.28	73.42
Mean	.51	1.57	.40	1.0426	1.0689	5.18	71.35

APPENDIX G

TASTE PANEL, SHEAR AND MUSCLE EXTENSIBILITY DATA - 1.0 - 1.3 B. F. Carcasses

Hog No.	Taste Panel: Ham	Taste Panel: Bacon	Taste Panel: Loin	Shear: 10th Rib to 2nd Lumbar	Shear: 3rd to 10th Rib	Extensibility: 3rd to 10th Rib
2	6.83	7.50	5.67	9.82	9.68	7.10
3	7.00	7.17	7.08	9.21	9.86	6.30
4	7.17	7.08	5.92	9.86	9.36	5.75
6	7.08	6.17	6.25	8.50	6.14	5.00
7	6.67	6.33	6.25	8.29	8.82	9.07
8	6.92	6.67	5.92	5.96	4.86	5.35
10	6.67	6.58	6.83	7.79	7.18	7.60
14	6.33	6.92	6.83	5.82	6.75	4.10
19	6.17	7.42	6.33	8.29	10.14	6.05
28	6.17	7.83	6.42	7.81	7.89	7.25
30	6.17	7.33	6.75	8.11	8.05	5.75
32	6.58	6.67	6.75	10.00	9.18	7.45
33	6.75	7.75	6.83	6.69	10.00	5.55
34	5.08	7.42	5.08	7.89	8.07	7.55
38	6.00	7.25	5.58	9.96	8.61	5.60
39	6.33	6.83	6.17	6.36	5.89	4.60
40	6.42	6.83	6.75	7.29	6.96	4.25
42	6.50	6.75	6.17	9.04	9.96	9.75
44	6.16	5.17	6.50	5.71	6.54	2.00
45	6.50	6.42	6.92	5.79	7.46	3.90
52	6.83	5.50	7.00	6.25	8.54	2.35
54	6.75	7.67	6.42	6.54	6.68	4.00
56	6.00	6.00	6.67	6.36	7.50	2.90
75	6.25	6.67	7.08	8.50	8.35	4.25
76	6.92	7.83	5.83	7.29	7.85	4.75
Mean	6.49	6.87	6.40	7.73	8.01	5.53

APPENDIX G (Continued)

TASTE PANEL, SHEAR and MUSCLE
EXTENSIBILITY DATA - 1.3 - 1.6 B. F. Carcasses

	Taste Panel			Shear		Extensibility
Hog No.	Ham	Bacon	Loin	10th Rib to 2nd Lumbar	3rd to 10th Rib	3rd to 10th Rib
9	7.50	6.50	6.75	5.59	5.93	3.70
11	6.67	7.33	7.08	4.89	7.31	4.45
13	6.58	6.17	6.75	5.43	6.64	2.55
16	7.33	5.92	7.17	4.72	5.36	2.55
17	6.17	7.33	6.08	6.68	6.93	4.75
20	6.83	6.58	6.00	7.29	9.04	5.15
24	5.89	6.08	6.17	7.14	9.86	6.70
25	5.92	6.83	6.08	8.82	10.07	6.45
26	6.58	7.50	6.58	7.39	8.75	6.50
27	6.25	6.83	6.08	9.57	10.25	4.85
29	5.89	7.00	6.67	8.71	8.79	6.75
31	6.67	6.83	6.17	8.61	7.71	4.70
35	6.25	7.42	6.83	5.82	4.50	3.05
41	5.25	7.50	7.08	7.25	6.39	4.35
46	6.58	6.17	6.83	6.75	7.78	2.40
51	6.25	6.33	6.42	8.32	7.11	3.65
53	6.83	7.33	6.50	8.36	6.89	5.30
55	6.00	7.58	6.83	6.14	6.89	4.50
57	5.42	6.83	7.33	5.54	6.82	3.60
66	6.58	6.83	6.33	8.89	7.04	4.40
70	6.25	6.67	6.67	6.07	5.57	6.10
71	6.75	6.92	6.50	8.61	8.79	6.95
72	6.50	7.08	7.00	8.11	8.29	5.75
73	6.42	7.00	6.25	6.50	7.36	6.90
74	6.42	7.42	6.25	6.14	9.86	6.30
Mean	6.39	6.88	6.58	7.09	7.60	4.89

APPENDIX G (Continued)

TASTE PANEL, SHEAR and MUSCLE
EXTENSIBILITY DATA - 1.6 - 1.9 B. F. Carcasses

Hog No.	Taste Panel Ham	Taste Panel Bacon	Taste Panel Loin	Shear 10th Rib to 2nd Lumbar	Shear 3rd to 10th Rib	Extensibility 3rd to 10th Rib
5	7.08	6.58	7.17	5.29	2.29	2.30
12	5.89	6.83	7.33	6.36	4.86	2.30
15	6.50	6.83	7.08	7.61	6.00	3.20
18	6.75	6.83	7.00	6.36	5.43	3.00
21	6.58	6.25	6.75	5.96	7.75	4.25
22	6.33	4.75	6.83	5.96	5.32	4.20
23	6.58	6.33	6.58	8.18	9.32	3.95
36	5.58	7.42	6.33	5.79	5.71	3.10
37	5.42	6.92	7.50	3.89	4.29	2.60
43	6.33	7.67	6.83	6.54	5.82	4.20
47	6.25	5.67	7.08	8.04	7.50	6.90
48	6.33	7.25	6.83	7.04	7.39	4.80
49	6.33	6.50	6.67	6.79	7.75	6.75
50	6.25	6.83	6.67	6.96	7.54	3.60
58	6.60	7.67	7.08	6.75	7.04	2.45
59	6.10	7.25	7.00	9.39	7.71	6.65
60	6.00	6.58	7.25	5.86	5.46	3.05
61	6.50	7.00	6.58	6.07	6.75	4.10
62	6.50	7.33	7.22	6.54	6.57	2.00
63	6.42	6.58	6.89	7.79	7.32	4.45
64	7.67	7.33	6.22	9.04	8.43	7.05
65	6.67	7.25	7.22	7.82	8.21	4.50
67	6.25	6.08	7.33	8.43	7.68	4.75
68	6.75	6.17	7.00	8.21	7.36	5.30
69	5.67	6.36	6.92	7.75	8.43	3.60
Mean	6.37	6.73	6.93	6.98	6.72	4.12

APPENDIX H

PERCENT COOKING LOSS
1.0 - 1.3 B. F. Carcasses

	Roasting			Deep Fat	
Hog No.	Ham	Bacon	Loin Chops 10th Rib 2nd Lumbar	Loin Chops 10th Rib 2nd Lumbar	Loin Chops 3rd to 10th Rib
2	20.50	57.87	25.07	32.39	22.28
3	23.27	59.53	22.55	25.61	25.96
4	23.44	59.24	19.27	30.18	21.34
6	25.46	61.26	19.94	29.43	26.18
7	22.60	54.08	19.74	29.37	26.04
8	25.96	61.58	23.74	31.33	26.13
10	22.07	65.75	21.13	29.40	25.22
14	26.48	57.87	26.95	25.44	20.81
19	27.17	59.53	21.79	27.27	32.16
28	22.99	58.49	22.61	31.56	26.10
30	24.18	59.79	20.92	25.44	26.14
32	22.58	53.65	16.27	26.91	26.13
33	23.76	65.33	15.52	28.99	27.41
34	22.03	55.98	23.68	30.42	28.49
38	20.99	49.83	19.90	31.98	28.96
39	28.08	59.99	18.47	26.22	27.05
40	23.00	56.69	20.89	29.74	28.81
42	23.71	67.07	19.65	33.36	23.28
44	21.54	58.19	20.65	27.91	28.90
45	23.02	65.30	19.91	31.52	24.68
52	23.48	48.72	20.90	31.43	25.83
54	22.66	57.97	18.48	32.28	25.51
56	23.37	63.59	19.16	32.74	27.77
75	21.64	65.11	20.82	31.33	26.13
76	19.58	61.25	18.47	31.56	26.30
Mean	23.34	59.35	20.66	29.73	26.14

APPENDIX H (Continued)

PERCENT COOKING LOSS
1.3 - 1.6 B. F. Carcasses

Hog No.	Roasting: Ham	Roasting: Bacon	Roasting: Loin Chops 10th Rib 2nd Lumbar	Deep Fat: Loin Chops 10th Rib 2nd Lumbar	Deep Fat: Loin Chops 3rd to 10th Rib
9	21.97	64.72	20.54	27.27	23.10
11	23.68	57.34	20.51	27.22	20.13
13	28.23	58.05	21.58	32.50	22.96
16	21.52	63.82	20.83	26.93	31.99
17	28.70	60.94	20.87	29.27	27.06
20	23.49	56.80	18.58	27.23	30.11
24	19.30	62.19	27.67	29.87	36.67
25	20.58	53.03	25.41	28.63	33.67
26	26.46	59.53	22.09	31.81	25.03
27	24.54	57.79	21.32	31.81	37.56
29	24.05	65.30	23.03	31.99	25.13
31	23.41	66.08	21.01	28.04	22.16
35	25.02	64.81	21.60	28.46	19.79
41	20.62	63.45	19.04	33.71	19.68
46	21.32	56.44	17.82	27.63	28.61
51	24.04	63.19	17.98	31.03	21.34
53	21.70	62.15	17.99	32.94	25.78
55	22.06	60.02	19.16	27.31	25.00
57	22.74	63.59	17.42	31.09	27.56
66	25.09	59.71	20.54	27.39	26.04
70	21.39	53.51	20.86	25.20	24.39
71	19.95	58.44	20.66	29.50	25.15
72	21.51	64.70	19.90	27.82	26.40
73	22.36	56.90	18.96	25.35	25.07
74	20.42	66.99	18.93	22.34	21.56
Mean	22.97	60.78	20.57	28.89	26.08

APPENDIX H (Continued)

PERCENT COOKING LOSS
1.6 - 1.9 B. F. Carcasses

Hog No.	Roasting: Ham	Roasting: Bacon	Roasting: Loin Chops 10th Rib 2nd Lumbar	Deep Fat: Loin Chops 10th Rib 2nd Lumbar	Deep Fat: Loin Chops 3rd to 10th Rib
5	24.32	63.93	18.28	27.20	29.31
12	29.79	61.15	20.10	25.07	20.14
15	20.78	68.19	23.94	29.61	25.70
18	31.28	61.49	19.98	27.91	30.09
21	22.43	62.33	19.70	27.18	29.69
22	25.36	67.20	23.90	25.80	29.12
23	23.19	63.93	21.60	32.23	29.31
36	26.33	66.86	19.47	28.94	30.72
37	23.73	63.28	19.09	28.42	25.73
43	24.17	54.73	17.57	28.32	26.49
47	24.21	65.47	22.26	27.95	28.99
48	24.20	54.44	22.04	30.22	26.27
49	24.49	60.85	18.99	26.18	27.80
50	24.20	67.88	17.01	28.48	31.00
58	21.23	64.01	17.22	30.43	22.80
59	23.98	64.52	18.28	28.33	23.57
60	21.39	61.64	19.37	28.14	25.59
61	21.12	67.09	17.56	31.47	25.95
62	25.50	58.03	15.65	24.57	23.00
63	25.73	57.17	17.88	27.67	25.39
64	22.39	63.52	22.06	32.18	23.84
65	25.35	58.73	22.37	27.67	32.55
67	22.97	61.68	17.59	27.96	23.93
68	22.89	62.30	24.20	33.50	27.36
69	24.16	63.34	21.26	27.83	25.59
Mean	24.21	62.55	19.89	28.53	26.80