

were calculated and the mean retention time and 50% passage time were determined. The best estimates of total dye recovery were 55 to 95% with a mean \pm standard deviation of 78 ± 14 %. Mean retention times and 50% passage time \pm the standard deviation for alfalfa hay (alfalfa, hay, sun-cured, early blm, cut 2), meadow hay (native plants, Intermountain, hay sun-cured, mature), and beet pulp (beet, sugar, pulp with molasses added, dehy). were 25.8 ± 3.2 , 32.7 ± 3.2 ; 33.4 ± 2.7 , 36.5 ± 4.5 ; and 31.6 ± 8.4 , 36.0 ± 9.2 , respectively.

13. AN APPARATUS FOR TIMED COLLECTION OF SHEEP FECES. J. M. Asplund and L. E. Harris*, *Utah State University, Logan.*

An apparatus was designed to change collection receptacles at given intervals of time. The apparatus was a circular turntable 8 feet in diameter with 24 brackets around the circumference to hold plastic feces containers. Metabolism cages were situated at the periphery so that feces could be collected from one to four sheep at a time; depending on the frequency of resetting desired. Rotational torque was supplied by an elastic cord and the table was allowed to change position at the given time interval by releasing a rotation lock with a timed solenoid. A timer which changed receptacles hourly was used. It was observed that sheep in ordinary metabolism cages could be induced by an attendant to defecate at hourly intervals for at least 60 hr. consecutively merely by disturbing them. Consequently, it was felt that the apparatus would allow more accurate measurement of diurnal defecation patterns because it is unnecessary to have an attendant present for very long periods of time. On the other hand, if hourly defecation should be desired, the apparatus was equipped with electrical connections which were activated at the time of turntable rotation to provide a means for mechanical or electrical stimulation of defecation.

14. GROWTH AND DEVELOPMENT OF SWINE FED SORGHUM GRAIN. Edward J. Braden*, Blaine B. Breidenstein, Robert C. Albin and Dale W. Zinn, *Texas Technological College, Lubbock.*

The effect of sex, final weight and sorghum grain preparation (dry-rolled, finely ground, flaked, and popped) on carcass characteristics of swine and their interrelationships was studied. Sixty-four swine were randomly allotted to four light (32 kg.) and four heavy (68 kg.) weight pens. Sorghum grain preparation did not significantly effect average daily gain or feed utilization. The light weight swine had a lower ($P < .05$) feed utilization than the heavy weight swine. One barrow and one gilt from each weight group and each ration was slaughtered at 77, 91, 104 and 118 kilograms. Subjective and objective carcass characteristics, proximate analysis, cooking yields and Warner-Bratzler shear data were taken and statistically analyzed. Gilts had a higher ($P < .05$) left and right side carcass specific gravity, average backfat thickness and percentage of lean cuts than barrows. Gilts also possessed a higher ($P < .05$) percentage of ash, water and crude protein, but a lower ($P < .05$) percentage of ether extract. With an increase in weight, there was an increase ($P < .05$) in carcass length, average backfat thickness, loin-eye area, percentage of separable fat and lean, and percentage of skin and waste, ash, water and crude

protein. Right side specific gravity was the only variable to be affected ($P < .05$) by sorghum grain preparation. Cooking yields and Warner-Bratzler shear values of the *I. dorsi* were not significantly affected ($P < .05$) by sex, final weight or sorghum grain preparation.

15. CASTOR BEAN BY-PRODUCTS FOR FATTENING CATTLE. E. J. Bris*, J. W. Algeo, A. G. Hibbits and G. R. Wooden, *Santa Ynez Research Farm, Santa Ynez, Calif.*

Ninety Charbray-Hereford cross bred yearling steers with an average initial weight of 299 kg. were used to compare cottonseed meal (CSM), castor bean meal (CBM), coarse ground and fine ground castor bean hulls (coarse and fine hulls), and castor bean oil (CBO). The ration treatments were: (1) 5.00% CSM; (2) 5.71% CBM; (3) 5.71% CBM plus 10.00% coarse hulls; (4) 5.71% CBM plus 10.00% fine hulls; (5) 5.71% CBM plus 0.50% CBO; and (6) 10.00% CBM. The cattle were fed these rations for a 145 day fattening experiment; they were fed in pens of two steers for the final 86 days. The average daily gains of the steers on rations 1 through 6 were: 1.49, 1.45, 1.58, 1.39, 1.47, 1.33 kg.; and the average feed conversions were: 6.52, 6.82, 7.19, 7.20, 6.62, 7.04 kg, respectively. The steers receiving ration 1 gained significantly more ($P < .05$) weight/day than the steers receiving ration 6 but not significantly different ($P > .05$) than the other treatment groups. The feed conversion of the steers appeared depressed by the energy dilution of the castor bean hull ration and by the 10.00% CBM addition. There was no significant difference ($P > .05$) in the average carcass yield of the steers or in their other carcass parameters. Feces samples were collected and composited from the steers for 4 days during the experiment. The digestibilities of organic matter for the rations 1 through 6 were: 70.44, 70.52, 67.42, 68.62, 72.81, 74.33%, respectively. The digestibilities of protein, fat, crude fiber and NFE were consistent with the organic matter. The organic matter digestibility of ration 6 was significantly greater ($P < .01$) than the remaining rations with the exception of ration 5. The digestibility of the organic matter of ration 5 was not significantly different ($P > .01$) than ration 1 or 2 but was significantly greater ($P < .01$) than rations 3 or 4. The use of 10.00% CBM and the lower performance of fattening steers compared to 5.00% CSM did not appear to be due to the digestibility of the corresponding rations. Castor oil at 0.5% of the diet did not cause scouring. CBM appears to be a safe commodity for use at the 5 to 6% level in steer finishing diets.

16. NUTRITIVE VALUE OF SPROUTED WHEAT FOR SWINE AND POULTRY. R. C. Bull* and C. F. Petersen, *University of Idaho, Moscow, Idaho.*

Two trials involving swine and chickens were conducted to determine the nutritive value of Gaines wheat that had sprouted in the head prior to harvesting. Forty weaning pigs were randomly allotted to four different rations containing 50% wheat that was either sprouted or non-sprouted (harvested from the same field prior to the adverse weather conditions) or was a mixture having 66.6 or 33.3% sprouted wheat. The average daily gain was not affected by feeding sprouted grain either as the

sole source of wheat or in various combinations with normal wheat; however, feed efficiency was decreased with increasing amounts of sprouted wheat in the ration (3.68, 3.83, 3.95 and 3.99 kg. of feed/kg. of gain for the groups fed 0, 33.3 and 100% sprouted wheat, respectively.) One hundred and fifty White Leghorn cockerel chicks were allotted to five different rations composed of 61% wheat with the following percentages of sprouted wheat: 0 (Diet 1), 25 (Diet 2), 50 (Diet 3), 75 (Diet 4) and 100 (Diet 5). Neither rate of gain nor feed efficiency were altered by substituting all or part of the normal wheat with the sprouted grain. A significant increase in the metabolizable energy levels ($P < .01$) was noted when the diets contained a combination of both sprouted and normal wheat. Metabolizable energy levels of 2.7207, 2.7443 and 2.7035 kcal./gm. was noted for dietary groups 2, 3 and 4, respectively, as compared to 2.5998 and 2.6155 kcal./gm. for dietary groups 1 and 5.

17. **THE EFFECT OF MOLYBDENUM ON THE MOBILIZATION OF INJECTED COPPER.** W. J. Clawson*, A. L. Lesperance, D. C. Layhee and V. R. Bohman. *University of California, Davis and University of Nevada, Reno.*

The effect of dietary molybdenum on the mobilization of injected copper was investigated with 24 yearling Hereford heifers. All animals received grass hay *ad libitum* plus 500 gm. cottonseed meal daily. This ration contained 4.5 ppm copper and 2.5 ppm molybdenum. Half of the animals received an additional 100 ppm of dietary molybdenum as sodium molybdate. Within each molybdenum group half of the animals were injected with 120 mg. of copper as copper glycinate at the initiation of the trial. Liver biopsies were taken initially and at 1, 2 and 4 months. Liver copper was expressed as total liver storage using body weight $\times 1.067\%$ to predict liver size and averaged initially 4.2 milligrams. After 30 days liver copper storage of injected groups were 30.7 and 25.2 mg. for 0 and 100 ppm molybdenum, respectively. Heifers not receiving copper maintained their liver copper storage throughout the 120 day trial, while injected groups approached the beginning level by the end of the 4 mo. (6.3 and 9.4 mg. for 0 and 100 ppm molybdenum). Plotting liver copper on a logarithmic scale and extrapolating to day zero accounted for all of the injected copper for the animals receiving no molybdenum. However, only 42% of the injected copper could be accounted for in the liver when molybdenum was fed. The half-life of the stored copper was 33 and 54 days for the animals receiving 0 and 100 ppm molybdenum, respectively. A significant ($P < .01$) copper \times molybdenum interaction occurred for daily gains. Supplemental copper had no effect on daily gains without dietary molybdenum (0.53 vs. 0.54 kg. for the animals receiving copper and their controls, respectively) while the daily gains were 0.10 and -42 kg. for the animals receiving copper and their controls when molybdenum was included.

18. **BACKGROUND RATIONS FOR STEERS PRIOR TO NON-ROUGHAGE FATTENING.** J. J. Dahmen* and T. Donald Bell, *University of Idaho, Moscow, Idaho.*

Sixty steers with an average initial weight of 211.6 kg. were group fed in six lots of 10 each for 112

days as follows: Group I (lots 1 and 2), all the roughage they would consume; Group II (lots 3 and 4), 1.36 kg. concentrate mix/steer/day with all the roughage they would consume; Group III (lots 5 and 6), all the concentrate mix and roughage they would consume (free choice basis). Roughage was three parts corn silage (wet basis) and 1 part chopped alfalfa hay for all groups. Three bids were obtained from feeder buyers at the end of the first 112 days to establish market value. Average daily gains for the first 112 days were 0.757, 0.766, 0.933, 0.997, 1.123 and 1.092 kg.; for the entire feeding period 1.092, 1.033, 1.069, 1.069, 1.133 and 1.123 kg. for lots 1, 2, 3, 4, 5 and 6, respectively. If the steers had been sold as feeders at the end of the first 112 days when the average weight was 317.6 kg., the steers in Group III would have made the most money. However, the steers were switched over to a non-roughage ration for the finishing phase and marketed as fat steers when each group of 20 steers averaged between 464.3 and 475.7 kilograms. The steers in Group II made the most money above feed costs per steer after being finished on non-roughage rations.

19. **A COMPARISON OF VARIOUS COMBINATIONS OF TREATED CORN SILAGE FOR STEER CALVES.** J. J. Dahmen, R. C. Bull* and T. Donald Bell, *University of Idaho, Moscow, Idaho.*

Eighty steer calves were randomly allotted to eight different rations to compare the nutritive value of open pit storage with the "Seal-Vac" method of processing corn silage; to determine the contribution of 1% NaHCO_3 at the time of ensiling on the curing process of silage; and to determine the value of urea when added to the grain mixture at the time of feeding. Individual feed consumption and growth rates were measured during the 182-day feeding trial. Steers fed pit silage gained significantly more ($P < .01$) weight per day than did those fed the "Seal-Vac" silage (0.994 kg. and 0.931 kg., respectively). The steers fed pit silage consumed 10.28 kg. per day as compared to 9.67 kg. for those fed "Seal-Vac" silage, although the same amount of feed was required per kg. gain (10.38 kg. and 10.41 kg., respectively). The rate of gain was not altered by the addition of NaHCO_3 to the silage but the steers fed the NaHCO_3 treated silage required significantly less feed ($P < .05$) than those fed untreated silage (10.21 kg. and 10.57 kg./kg. gain). The addition of urea at the time of feeding significantly reduced both ADG (1.02 kg. to 0.91 kg.) and daily feed consumption (10.56 kg. and 9.38 kg.).

20. **EFFECT OF HARVESTING METHOD ON NUTRITIVE VALUE OF ALFALFA.** J. Emmett*, L. H. Paules and C. J. Kercher, *University of Wyoming, Laramie.*

Second-cutting alfalfa was harvested as conventional hay, swather-conditioned hay, high-moisture silage (36% dry matter) and low-moisture silage (50% dry matter). Harvesting method did not significantly influence the yield of dry matter per hectare. The gains and feed efficiency of calves fed either hay or low-moisture silage were not significantly different ($P > .05$). However, calves fed low-moisture silage produced significantly more beef per hectare than calves fed the other forages. Calves