



Research Update

► Summaries of current beef cattle research

Fall research highlights

The following research highlights are presented by Harlan Ritchie, Steven Rust and Daniel Buskirk, beef cattle specialists at Michigan State University, East Lansing. The reviews summarize studies and trends reported at scientific meetings or in scientific and industry publications, which are cited at the end of each item.

Effect of weaning age, creep-feeding and type of creep on steer performance, carcass traits and economics

University of Illinois (U of I) researchers allotted a total of 168 spring-born Angus × Simmental steer calves to four different treatments:

- early wean with program-fed high concentrate (EWP);
- normal wean with creep (NWC);
- normal wean with fiber creep (NWF); and
- normal wean with no creep (control).

Steers were weaned at either 63 or 189 days of age. EWP steers were program-fed a high-concentrate diet to gain the same as steers on the two creep-fed treatments from time of early weaning until normal weaning.

NWC steers had significantly greater ($P < 0.05$) average daily gain (ADG) and gain/feed than NWF steers. The same was true for treatments 1, 2 and 3 vs. the controls. During the combined finishing period (adaptation + finishing), there were no significant differences in ADG, dry-matter (DM) intake or gain/feed between the EWP and the NWC and NWF steers.

For the overall duration of the study, control steers required significantly more ($P < 0.05$) days to harvest than other treatments. EWP steers had significantly greater ($P < 0.05$) marbling scores, percentage of steers grading average Choice or greater, and percentage of steers grading low Prime or greater than either NWC or NWF steers. Control steers had significantly lower ($P < 0.05$) carcass values than the other treatments.

Program-feeding early-weaned steers improved carcass quality traits, but it also increased total costs compared with creep-fed calves. Type of creep did not affect overall performance, carcass quality or carcass value.

(Shike et al. 2007. Prof. Anim. Sci. 23:325)

Effects of DDGs on heifer growth and reproduction

The objective of this two-year University of Nebraska study was to determine if supplementing beef heifers with excess undegradable intake protein (UIP) during development would affect heifer growth or reproduction. A total of 316 weaned crossbred heifer calves were allotted to two different supplemental treatments:

1. Controls, 0.78% of body weight of a supplement consisting of dried corn gluten feed, whole corn germ and urea; and
2. Distillers' dried grains (DDG) fed at 0.59% of body weight.

Supplements were formulated to be equivalent in energy and crude protein (CP) content but different in protein degradability. Control UIP averaged 90 grams (g) daily, whereas DDG UIP averaged 267 g daily. Both groups were fed prairie hay in amounts sufficient for *ad libitum* intake.

Heifers were synchronized with $\text{PGF}_{2\alpha}$ 14 days apart, estrus was detected, and heifers were artificially inseminated (AIed) for five days and turned out with bulls 10 days later. Following is a summary of results.

- ADG, final body weight and final body condition score (BCS) were not affected by supplementation.

- Age and body weight at puberty did not differ between treatments.
 - Proportions of pubertal heifers did not differ at the beginning of the 14-day sampling intervals or before synchronization.
 - However, a greater proportion of DDG than control heifers conceived to AI (75.0% vs. 52.9%), resulting in greater AI pregnancy rates for DDG heifers (57.0% vs. 40.1%).
 - Body weight or BCS at pregnancy diagnosis did not differ between treatments.
- The authors concluded that supplementing beef heifers with DDG during development did not affect age at puberty but improved AI conception and pregnancy rates compared to an isocaloric control supplement.

(Martin et al. 2007. J. Anim. Sci. 85:2298)

Outlook for cow-calf profitability appears positive

Prior to the year 2000, cow-calf profitability was very sporadic. From 1980 to 1999, most cow-calf producers were basically in a break-even business. Some years they endured severe losses, while others were moderately profitable. Over the past seven years, there has been a dramatic difference. Cow-calf producer profitability during this period has been the highest in history, averaging more than \$111 during this time. This compares to an average profitability of only \$9.60 per head during the decade of the 1990s and a \$12.73 per head loss during the decade of the 1980s.

This reversal in profitability can be attributed to several factors, but one of the primary factors is the number of U.S. beef cows. The number of cows hasn't increased at the same rate as it normally does in times of cow-calf profitability, nor has the most recent cattle cycle followed the same pattern that history would suggest it should.

As noted above, losses were most severe during the decade of the 1980s, when the average number of U.S. beef cows was 35.9 million head. With the economic losses

Table 1: Top 10 cow-calf operations in the United States

Rank	Name, head office location	No. of cows
1	Deseret Land & Citrus, Deer Park, Fla.	40,000
2	J.R. Simplot Co., Boise, Idaho	28,000
3	King Ranch Inc., Houston, Texas	25,000
4	Lykes Bros. Inc., Brighton, Fla.	17,285
5	Parker Ranch Inc., Kamuela, Hawaii	16,300
6	Seminole Tribe, Big Cypress, Fla.	14,000
7	Alico Inc., La Belle, Fla.	13,500
8	W.T. Waggoner Estate, Vernon, Texas	11,547
9	Singleton Group, Los Angeles, Calif.	11,500
10	Padlock Ranch Co., Rancho, Wyo.	11,400

Source: National Cattlemen magazine.

producers were incurring, the beef cow herd was projected to decline, which it did — from a high of 39.2 million in 1982 to a low of 32.5 million in 1989. Calf prices recovered rapidly during that liquidation phase and maintained themselves during the early 1990s, but declined thereafter. The largest number of beef cows during that decade occurred in 1996 with 35.3 million, the year of the most severe losses, when calf prices dropped to an average of \$63 per hundredweight (cwt.).

The average number of beef cows in this decade is only 33.1 million, and for 2007 is 32.9 million. In spite of the economic signal (profitability) for expansion, it has not occurred. And with beef cow harvest up 11% and heifer harvest up by 2% during the first eight months of 2007, it doesn't appear that the U.S. cow herd will increase next year either.

(SOURCE: *Cattle-Fax*® Update)

Cattle and calves death loss study

Following are highlights of the U.S. Department of Agriculture's (USDA's) 2007 National Animal Health Monitoring System (NAHMS) *Cattle and Calves Death Loss Report* for the United States. The report covers the calendar year 2005.

- ▶ A total of 1.7 million cattle and 2.3 million calves were lost to all causes (predator and nonpredator) in 2005. These totals represent 2.1% and 6.2% of the cattle inventory and calf crop, respectively.
- ▶ 95.3% of cattle and calf losses were attributed to nonpredator causes. As expected, predators accounted for a higher percentage of calf losses than cattle losses (6.7% and 2.0%, respectively).
- ▶ On beef operations, 4.5% of the calf crop was lost to nonpredator causes, compared to 7.1% for dairy operations.
- ▶ On beef operations, the two most common causes of nonpredator losses were respiratory and calving problems (27.7% and 24.2% of losses, respectively).
- ▶ On dairy operations, digestive and respiratory problems were the most common causes of nonpredator calf losses (35.8% and 33.2% of losses, respectively).

Evaluation of heterosis effects on heifer pregnancy

The objective of this Montana State University study was to estimate breed and heterosis effects on heifer pregnancy. Reproductive records were collected on 651 purebred and crossbred females consisting of three breeds — Hereford, Simmental and Tarentaise. Heifer pregnancy was defined as successful if a female's first calving record was at 2 years of age, but a failure if her first calving record was at 3 years of age.

Results showed that Simmental-sired females were the most likely and Hereford-

Table 2: Top 10 seedstock operations in the United States

Rank	Name, head office location	2006 marketings
1	Stevenson-Basin Angus, Hobson, Mont.	7,320
2	Vermilion Ranches, Billings, Mont.	7,200
3	Express Ranches, Yukon, Okla.	3,580
4	Camp Cooley Ranch Ltd., Franklin, Texas	2,524
5	Leachman Cattle of Colorado, Wellington, Colo.	2,125
6	Sitz Angus Ranch, Dillon & Harrison, Mont.	1,630
7	Nichols Farms Ltd., Bridgewater, Iowa	1,580
8	Gardiner Angus Ranch, Ashland, Kan.	1,514
9	BB Cattle Co., Connell, Wash.	1,025
10	Thomas Angus Ranch Inc., Baker City, Ore.	920

Source: *National Cattlemen* magazine.

sired females the least likely to calve at 2 years of age, with Tarentaise-sired females being intermediate. Comparison of maternal genetic effects revealed that females out of Tarentaise dams were the most likely and those out of Hereford dams were the least likely to calve at 2 years of age, with no estimation on females out of Simmental dams.

Heterosis effects were favorable, indicating that, when considering these three breeds, crossbreeding would increase the percentage of females calving at 2 years of age. No Angus cattle were used in this study.

(McAllister et al. 2007. *Proc., Western Section, ASAS*)

STOCKER/FEEDLOT

Effect of winter stocker growth rate on finishing performance and carcass characteristics

In a collaborative study, West Virginia and Virginia Tech University scientists used a total of 216 Angus-cross steers (595 lb.) over a three-year period to evaluate the effects of winter stocker growth rate on finishing performance and carcass characteristics. During winter months (December to April), steers were allotted to three different stocker growth rates:

- ▶ low (0.5 lb. per day);
- ▶ medium (1.0 lb. per day); and
- ▶ high (1.5 lb. per day).

After the winter phase, steers within each stocker treatment were randomly allotted to either a corn silage-concentrate or a pasture finishing system. All steers were finished to an equal time end point and harvested at approximately 18 months of age. Following is a summary of results:

- ▶ As expected, pasture-finished cattle were significantly lower in ADG, final weight, hot carcass weight (HCW), dressing percent, ribeye area (REA), fat thickness (FT), yield grade (YG) and quality grade (QG).
- ▶ Steers with low stocker gain had greater finishing ADG, but were not able to catch

up with medium and high steers in final body weight or carcass weight.

- ▶ Dressing percent was greater for high than low, and USDA QG was greater for high than low or medium.
- ▶ Carcass REA, FT and USDA YG were not influenced by winter rate of gain.

The authors concluded that cattle performance during the winter stocker period clearly affects finishing performance, carcass quality and beef production in both pasture- and feedlot-finishing when fed to an equal time end point.

(Neel et al. 2007. *J. Anim. Sci.* 85:2012)

Enhancing marketing of feedlot cattle by measuring front-end body weight

Marketing of feedlot cattle could be enhanced if the point of incremental cost of gain could be determined, overweight carcasses prevented and harvest weights forward-projected. The objectives of this University of Missouri study were to evaluate the ability to use front-end weighing platforms at water troughs in a commercial setting to capture daily front-end body weight, to determine the relationship of front-end body weight to total body weight, and to determine the ability to forward-project total body weight at a future point in time based on front-end body weight data. A total of 166 crossbred heifers (1,042 lb.) had front-end body weight measured for 62 days in a commercial feedlot.

Front-end body weight was highly correlated ($r = 0.97$) to body weight measured using conventional chutes equipped with a scale. Body weight was forward-projected using 15, 30, and 45 days of front-end body weight data. Analysis revealed that 30 days of front-end body weight data could be used to predict future body weight. In-pen body weight was uniformly correlated to total body weight and could be used to calculate ADG and forward-project body weight of cattle in the

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feedlot. The authors concluded that the potential to quantify and forward-project animal performance and body weight could enhance cattle management and marketing.

(Kolath et al. 2007. *Prof. Anim. Sci.* 23:295)

Evaluation of DDGs as a supplement for yearling cattle grazing Sandhills range

NU researchers allotted 79 yearling steers and heifers grazing summer Sandhills range to either one of two groups:

- ▶ control, no supplement (n = 39); or
- ▶ treatment (n = 40).

Yearlings in the treatment group were given *ad libitum* access to pelleted DDG in a creep feeder for 54 days of a 63-day grazing period. Following the grazing period, both groups were assigned to a feedlot and fed to a similar finish end point. Forage and DDG estimates and cattle performance and carcass characteristics were used to establish the value of DDG at the end of the grazing period and at harvest.

DDG intake of the treatment cattle averaged 11.0 lb. DM per animal per day.

Summer ADG was significantly greater ($P < 0.01$) for treatment cattle than for control cattle (2.80 lb. vs. 1.94 lb. per day). Treatment-group yearlings gained significantly faster ($P < 0.01$) than controls during the first 30 days in the feedlot (2.91 lb. vs. 2.42 lb. per day). However, overall feedlot gain did not differ.

Treatment group yearlings were harvested 14 days before controls. Carcass characteristics were similar between treatment group and controls. However, there was a tendency for treatment group cattle to have a greater percentage grading USDA Choice (67% vs. 51%). An economic

analysis revealed that the value of DDG to yearlings grazing Sandhills range was greater than the estimated cost at both the grazing and harvest end points.

(Funston et al. 2007. Prof. Anim. Sci. 23:170)

Effects of BRD treatment on feedlot performance and carcass traits

The objective of this Iowa State University study was to examine the effects of bovine respiratory disease (BRD) on economically important performance and carcass traits, and to determine the effect of genetics on susceptibility to BRD. The data

set consisted of performance and health records on 1,714 Angus-sired calves fed at various feedlots over a three-year period (2003-2005).

Sire, percent shrink upon entrance to the feedlot, and disposition score were all shown to have significant effects ($P < 0.05$) on the number of times an animal was treated for BRD. Sex was not a significant predictor of number of BRD treatments. Number of treatments for BRD significantly affected ADG, weight per day of age (WDA), HCW, YG, marbling score and REA. The authors concluded that number of treatments for BRD has significant consequences on

economically important feedlot performance and carcass traits.

(Schneider et al. 2007. Midwest Section ASAS. Abstract 39)

Effect of varying field pea levels on feedlot performance, carcass traits and beef palatability

In recent years, field pea production in the Northern Plains has been increasing at a rapid rate. As field pea production increases, a significant amount is available for livestock consumption. This includes those peas that are unsuitable for human food, such as the

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splits and broken. North Dakota State University (NDSU) scientists used a total of 143 yearling crossbred steers (955 lb.) to evaluate the effect of varying levels of field pea inclusion in a finishing diet on performance, carcass traits and beef palatability. The treatments consisted of field peas replacing 0%, 10%, 20% or 30% of the corn and soybean meal in the basal diet.

Increasing the level of field peas in the diet had no effect on feed intake, ADG, feed conversion ratio, carcass characteristics or beef palatability as measured by sensory evaluation and Warner-Bratzler shear force (WBSF). The authors concluded that field peas present an attractive alternative to corn, as they may be less costly. In addition, the higher protein content of field peas permits the removal of more expensive protein sources from the diet, further reducing feed costs. These results are in general agreement with those reported by NU researchers.

(Larson et al. 2007. NDSU Beef Cattle and Range Research Report)

Effect of starch level during growing phase on performance and carcass traits of steers

U of I scientists allotted 200 crossbred steer calves (342 lb.) to four different growing diets to evaluate the effect of starch level during the growing phase on subsequent performance and carcass traits, especially marbling. Diets were:

- ▶ high-starch (71% corn, 0% soy hulls);
- ▶ intermediate-starch (47% corn, 23% soy hulls);
- ▶ low-starch (23% corn, 47% soy hulls); and
- ▶ no starch (0% corn, 71% soy hulls).

Diets were equivalent in protein, with soybean meal, hay and mineral mix making up the remainder of each diet. Steers were weaned early at an average of 65 days and, after a 57-day adaptation period, assigned to

one of the four growing diets. The growing phase lasted for 105 days, after which steers were placed on a common finishing diet for 172 days. Ultrasonic marbling, backfat and ribeye data were collected after the 105-day growing period. All steers were harvested at 399 days of age.

During the 105-day growing phase, ADG and gain:feed ratio declined linearly as the amount of dietary fiber increased. The same was true for ultrasonic marbling, backfat and REA per cwt. During the finishing phase, ADG and DM intake increased linearly as the amount of fiber increased. The same was true for ultrasonic marbling, backfat and REA per cwt.

During the finishing phase, ADG and DM intake increased linearly as the amount of fiber fed previously increased. For overall performance at harvest, no significant differences were observed. Furthermore, there were no significant differences in carcass traits.

The authors concluded that introducing high levels of starch during the growing phase increased ultrasonic marbling, but differing rates of gain during the finishing phase may have reduced these marbling differences at harvest.

(Bedwell et al. 2007. Midwest Section ASAS. Abstract 81)

More than one-third of cattle feeders are feeding ethanol products

According to a USDA report, 36% of cattle feeders are feeding corn ethanol coproducts, while another 34% are considering it. The survey of 9,400 Midwest livestock operations also revealed that 38% of dairy producers, 13% of cow-calf operators and 12% of hog producers fed the byproducts during 2006.

(Janie Gabbett, Meatingplace.com)

Influence of feeding frequency on feedlot steer performance

Previous research has not been clear on whether feeding frequency has a significant

effect on the performance of feedlot cattle. In this Colorado State University (CSU) study, a total of 270 crossbred steers (702 lb.) were used to evaluate the effect of feeding frequency (once vs. twice vs. three times per day) on performance and carcass characteristics. Steers were fed a high-concentrate steam-flaked corn diet and harvested after 170 days on feed.

ADG and daily feed intake were similar for steers fed once or twice per day. However, ADG and daily feed intake were significantly greater for steers fed three times a day. Feed efficiency was comparable for all three treatments. Hot carcass weight was significantly greater for steers fed three times per day than those fed once or twice. There were no differences between the three treatments for USDA QG or YG.

This study revealed comparable performance between feeding either once or twice a day. However, feeding three times a day increased gain, feed intake and carcass weight.

(Schutz et al. 2007. Proc. Western Section ASAS. 58:387)

Feeding value of "Valier" barley was similar to corn

Previous research has indicated that the "Valier" variety of barley may have starch and nitrogen (N) digestibility that is comparable to corn. Montana State University researchers used 80 crossbred steers (961 lb.) to evaluate the performance, nutrient digestibility and energy content of finishing diets based on corn or Valier barley. Diets were formulated to contain 80% grain, 6% straw and 14% supplement. Steers were harvested when 70% were visually estimated to grade Choice.

There were no differences between grain sources in ADG or feed efficiency. Carcass fat thickness was lower for Valier than for corn (0.43 in. vs. 0.49 in.), but all other carcass characteristics did not differ. DM digestibility was lower ($P < 0.001$) for steers fed Valier, but starch digestibility was greater ($P = 0.005$). Nitrogen digestibility did not differ between

Optimum level of DDGS in finishing diet

In a collaborative study, University of Nebraska and Dakota Gold Research scientists used a total of 240 backgrounded steer calves (676 lb.) to evaluate the effect of increasing levels of dry distillers' grains with solubles (DDGS) in a corn-based diet on feedlot performance and carcass characteristics. Treatments consisted of 0%, 10%, 20%, 30%, 40% and 50% DDGS (DM basis) during days 1-

22, with DDGS replacing dry-rolled corn. After Day 22, the 50% DDGS treatment was removed from the study due to sulfur level. Performance during the subsequent 145-day finishing period is shown in Table 3.

As shown in Table 3, ADG and feed efficiency peaked at 20% DDGS and then declined. DM intake was not affected by DDGS level.

Although not shown here, there were no significant differences in carcass characteristics. These results suggest that a 20% level of inclusion in finishing diets appears to be optimum. This tends to be in agreement with Kansas State University (K-State) research, which revealed that a 15% DDGS inclusion rate was optimum when rates ranged from 0% to 75%.

(Buckner et al. 2007. Midwest Section ASAS. Abstract 88)

Table 3: Finishing performance of steers by varying levels of DDGS

Item	DDGS level, %				
	0%	10%	20%	30%	40%
Avg. daily gain, lb.	3.28	3.55	3.70	3.55	3.55
Final body wt., lb.	1,230	1,266	1,296	1,272	1,259
DM intake, lb./day	20.8	21.8	20.8	21.2	20.7
Gain:feed ratio	0.158	0.163	0.179	0.169	0.173

treatments. Furthermore, there were no differences in net energy for either maintenance or gain. The authors concluded that Valier barley and corn have similar feeding values when used in finishing diets.

(Iverson et al. 2007. *Proc. Western Section ASAS*. 58:372)

CARCASS/MEAT SCIENCE

Comparison of production systems for progeny of sires differing in marbling EPDs

The objective of this Pennsylvania State University (Penn State) study was to evaluate production systems for progeny of Angus sires with higher-marbling expected progeny differences (EPDs). In Trial 1, 40 progeny of sires with either high or low EPDs for marbling were evaluated for feedlot performance, carcass traits and meat palatability. Half of the cattle in each marbling group were harvested at an estimated 0.4 in. FT and half were harvested at 0.6 in. FT. In Trial 2, 20 steers from high-marbling EPD sires were allotted to four different treatments prior to entering the feedlot:

- ▶ weaned at 170 days of age and backgrounded for 40 days;
- ▶ weaned at 170 days of age;
- ▶ weaned at 212 days of age and backgrounded for 4 days; and
- ▶ weaned at 212 days of age.

All steers in Trial 2 were harvested at 0.5 in. FT.

In Trial 1, marbling score and percentage USDA Choice carcasses were significantly greater for progeny of high-marbling sires. Also, percentage of USDA Choice carcasses and numerical yield grades were significantly greater for high-marbling sires and for the higher FT end point cattle. Feedlot performance, WBSF and consumer palatability scores were not affected by sire group or end point.

In Trial 2, weaning early resulted in significantly reduced marbling scores with no difference in other carcass or performance traits. Backgrounding across weaning methods resulted in significantly greater marbling scores with no differences for other carcass or performance traits.

The authors concluded that higher genetic potential for marbling may require a strategic weaning and feeding program to optimize carcass quality and yield.

(Comerford et al. 2007. *Prof. Anim. Sci.* 23:349)

Managing heifers to minimize beef tenderness problems

According to a National Cattlemen's Beef Association (NCBA) checkoff funded project conducted by CSU meat scientists (Tatum et

al.), heifers generally have higher marbling scores and USDA quality grades than steers, but meat tenderness usually favors steers. Among those factors that could account for this disparity are differences between heifers and steers in levels of enzymes that break down muscle proteins; and the effect of the hormone estrogen on heifers, making them generally more excitable and therefore more likely to exhibit stress-related meat quality problems (dark lean color and reduced tenderness).

The authors presented some key points in managing feedlot heifers to minimize beef tenderness problems:

- ▶ When shipping heifers, extra precautions should be taken to avoid aggressive handling, excitement or physical exertion before, during or following transport to the processing plant.
- ▶ Finishing diets that include melengestrol acetate (MGA) can be used to suppress estrus and improve performance of heifers, without negatively affecting beef tenderness.
- ▶ The number and potency of finishing implants can influence beef tenderness and carcass quality grade. For heifers requiring two finishing implants, use of successive "high-potency" implants should be avoided.
- ▶ Heifer beef tenderizes more slowly during storage and requires a longer postmortem aging period than beef from steers to attain a comparable degree of tenderness. Consequently, postmortem aging periods of at least 21 days are recommended for heifer beef.

Effects of heifer finishing implants on carcass traits and meat tenderness

CSU scientists assigned a total of 500 Continental × British heifers to 12 treatments that used zero, one or two finishing implants to deliver cumulative doses of trenbolone acetate (TBA) or estradiol (E_2), or both, ranging from 0 to 400 milligrams (mg) of TBA and 0 to 40 mg of

E_2 during the finishing period. The objective was to evaluate the effects of finishing implants on heifer carcass characteristics and meat tenderness as measured by WBSF.

Carcasses were aged for three, seven, 14, 21 or 28 days.

- ▶ Compared with nonimplanted controls, heifers implanted once increased HCW by 17.4 lb. without affecting marbling score, USDA QG or WBSF.
- ▶ Compared with one implant, two implants resulted in an additional increase in HCW of 13.2 lb.
- ▶ Reimplanting also significantly increased REA; reduced kidney, pelvic and heart (KPH) fat; and improved YG.
- ▶ However, reimplanted heifers had a significantly lower percentage of carcasses grading Choice and Prime, and greater WBSF values (less tender) at all aging times.
- ▶ Among heifers receiving two implants, 14-day WBSF increased linearly as the cumulative, combined dosage of E_2 plus TBA increased.
- ▶ Heifers implanted with the combination of E_2 and TBA had significantly larger REA, lower marbling scores, and greater WBSF values after three, seven, 14 and 21 days of aging than those implanted with TBA alone.
- ▶ Implant treatment effects gradually diminished as length of aging period increased.
- ▶ Heifers implanted twice with the combination of E_2 and TBA required at least 14 days of aging, but were most likely to provide a pleasurable eating experience when aged 21 to 28 days.

The authors concluded that postmortem aging periods of 14 to 28 days were effective for mitigating the detrimental effects of mild or moderately aggressive heifer implant programs on the predicted consumer acceptability of strip loin steaks.

(Schneider et al. 2007. *J. Anim. Sci.* 85:2019)

