fall fern yields may exist under conditions of external stress such as the limiting of the period of fern growth by disease, or frost, or an extension of the harvest season.

The higher nitrogen applications increased the production of both spear and brush yields during the four-year study (tables 2 and 3). The change in yields for weight of spears, number of spears, and the accumulated weight yields for the two nitrogen levels are shown in graph 2.

The weight per spear varied considerably during the harvest period and decreased progressively after mid-season until the harvest was terminated. The high nitrogen treatment produced larger spears than the low nitrogen treatment but the differences became progressively smaller during the final two weeks of the harvest period.

The number of spears harvested in the high nitrogen treatment increased significantly over the low nitrogen treatment as the harvest season progressed, which may account for the increased loss in spear size for the high nitrogen treatment during the latter part of the cutting season. The larger number of spears produced in the high nitrogen treatment suggests that the development of the crown and buds was enhanced by the higher nitrogen treatment.

Since a zero nitrogen treatment was not included in this test the relationship between no fertilization and the 100-lb-per-acre nitrogen application could not be determined. However, a comparison of the yields between the two nitrogen levels indicates that nitrogen fertilization at levels greater than 100 lbs per acre would be useful in the production of asparagus on mineral soils.

The yield by weight of spears for variety 500W was greater than for variety 309 for the four harvest seasons. The difference in yield was significant for the 1966 and 1967 seasons. The total number of spears harvested each year was significantly greater for variety 500W than 309. In a variety study at Riverside, 500W did not outyield 309—suggesting that the production capability of a variety in a particular location is strongly influenced by adaptability. However, trends show that both varieties responded similarly to a given set of treatments.

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W. J. CLAWSON · REUBEN ALBAUGH · DON PETERSEN

BULLS VS.

. . . *conventional and*

and effects of

Two significant findings of this experiment were: (1) Russian castrates were intermediate between steers and bulls in all phases of production (preweaning and postweaning), although these differences were not significant; (2) nursing steer calves implanted with 30 mg stilbestrol, and again as they entered the feedlot for finishing, performed just as well as those that were implanted first upon entering the feedlot—however, the double-implant animals produced carcasses that were 33 lbs heavier (cold weight) than those that were implanted only once (indicating that the cow-calf operator, as well as the cattle feeder, can secure benefits from stilbestrol implantation). Bulls again outperformed steers and Russian castrates (substantiating recent reports by other researchers) in daily gain, carcass index, and cutability as well as feed efficiency.

CASTRATION OF ANIMALS originated with the discovery that male animals with their testicles removed were milder and easier to handle. The practice was increased in comparatively recent years to meet the demand for fatter, more tender carcasses than those produced from aged bulls. The testicles produce sex cells for reproduction, and they also secrete a hormone (testosterone) within the animal that aids and regulates the development of the skeleton, muscles, and organs as well as intensifying the sex drive. Castration affects the parts of the body that develop later—the untrimmed loin, for example, is proportionately heavier in castrates. The proportion of hindquarter to forequarter is also larger in the altered animal though this difference is smaller at younger ages.

Foreign bulls

For many years, foreign countries have been utilizing bulls for beef without discriminating between them and steers in marketing; in fact, bull carcasses often bring a premium. The following research emphasizes the need for some revision of our thinking on this subject. Investigations have been conducted on the use of testosterone to increase meat production. In one experiment, steers treated with testosterone gained about one-half pound more per day than controls, but animals must be given liquid injections three times a week, which is impractical.

A Russian scientist has developed a procedure for castrating to make use of testosterone for increased meat production. The part of the testicles that produces spermatozoa is removed, leaving some of the hormone-producing part intact. To do this, a scalpel is inserted through the scrotum in the middle third of the large curve of the testicle and opposite the epididymis (a coiled tube running up the inner margin of the testicles). The scalpel is rotated 180° and then withdrawn. This loosens the glandular central core of the testicles which then can be pressed out through the puncture wound.

Russian researcher

The Russian researcher reported that the operation could be performed at any time of the year, and postoperative management should be normal. The animals required exercise and the wounds should be protected against flies by a chemical repellent. The cattle were reported to

STEERS

Russian castrates stilbestrol

Typical 15-month-old bull.

grow and develop as well as entire animals and, in some cases, even better. They gained as much as 10 to 20 per cent faster than animals castrated by the usual methods, depending on the species and their age when slaughtered. He also reported that the quality of the meat was improved by this new method, and that the fat content of the carcasses was higher than for entire animals—and considerably less than that for fully castrated animals.

Comparison study

In the fall of 1968, a University of California experiment was established to further study the performance and carcass quality of Russian castrates compared with intact, and conventionally castrated, animals. A total of 124 calves originating from the ranches of Bert Crane, Merced and Jim Sinton, Shandon, were used in the tests. Weaning data on these animals were secured on the ranches and the final performance of the animals was recorded at the Davis station.

The calves were divided into six treatments at an average age of four to six weeks. One-third were left intact as bulls; one-third were castrated by the normal method as steers; and one-third were altered using the Russian system. Half of each sex group received 30 mg of diethylstilbestrol implants at the time of castration.

At weaning time these calves were moved from the ranches to the University feeding facilities at Davis for finishing. At that time the cattle from these two ranches were pooled by treatment and half of each group were re-implanted with 36 mg stilbestrol. This resulted in 12 finishing treatments, involving three sex groups and four implant treatments: a calf implant, a yearling implant, a double implant and controls.

All the cattle were fed the ration listed for 163 days. They were slaughtered at the Alpine Meat Company in Stockton where individual carcass data were secured, including such measurements as hot weight, rib eye area, fat thickness, and percentage of closely trimmed primal cuts. The U. C. ration fed for finishing included the following percentages of ingredients (net energy values [megacalories per hundred weight]: $NE_m = 81$; $NE_p = 54$):

INGREDIENT	PER CENT
Alfalfa hay	8
Sudan hay	4
Beet pulp	4
Cottonseed meal	3
Barley	36
Milo	36
Molasses	5
Fat	2
Urea	1
Trace-mineralized salt	0.4
Dicalcium	0.3
Oyster Shell	0.3
Vitamin A	1200 I.U.

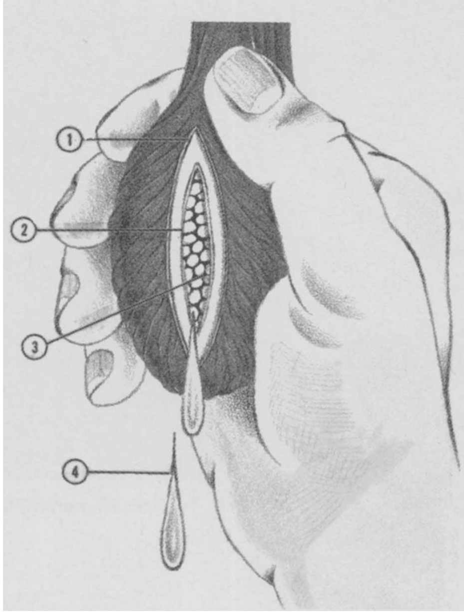
Castration treatments

There were no significant differences in weaning weight comparisons of castration methods. Weaning weights were 578 lbs for steers, and 569 lbs for bulls and Russian castrates. During the 163-day postweaning period, the bulls gained significantly more than the steers, 2.56 lbs compared with 2.35 lbs, while the Russian castrates were intermediate at 2.47 lbs. Feed efficiency was determined by pen lot rather than by individual animal, so could not be analyzed statistically. However, the trend was for the bulls to be more efficient (7.09 lbs of feed per pound

Group of steers castrated by the conventional method, left photo. Two steers castrated by the Russian method, right photo.

of gain), the Russian castrates intermediate (7.24), and the steers less efficient (7.48).

There were no significant differences between test groups in carcass weight, dressing percentage, kidney fat, adjusted carcass index or in estimated retail cuts per-day-of-age, based on carcass index. For example, hot carcass weights were 592 lbs for the steers, 614 lbs for bulls and 605 lbs for Russian castrates. The adjusted carcass index for each of these groups was (same sequence) 51.18, 51.66 and 51.35. Because the steers were fatter, the yield grade was higher and cuttability lower than for the bulls and Russian castrates. However, they all fell within the "2" yield grade. The same statistical picture was true for rib eye area: the bulls had the largest and the steers the smallest. Bulls produced larger and more meaty carcasses and had higher average daily gains. The Russian castrates were intermediate in all measures of production but the differences in comparisons with steer data were seldom significant.



Russian castration method illustrated: 1. Cut scrotum exposing testicle; 2. Cut the membrane which covers testicle; 3. Interstitial tissue (source of androgen for growth); 4. Remove seminiferous tubules (which contain the sperm) by squeezing.

Diethylstilbestrol implants

Nursing calves implanted with 30 mg stilbestrol at an early age (about six weeks) were heavier at weaning time than those receiving no treatment. Treated steers weighed 598 lbs; untreated steers, 564 lbs; treated bulls, 598 lbs; untreated bulls, 533 lbs; Russian castrates, 563 lbs; and untreated Russian castrates, 557 lbs. These differences were only significant, however, in the bull comparison.

In the combined sex groups, final weights showed statistical differences between the double implant and both the calf implant and control, while the yearling implant was intermediate. During the finishing period, the yearling implants had a significantly higher average daily gain than the other treatments, while the calf implant was significantly lower. No differences were shown between the double implant and control groups. The lifetime weight-per-day-of-age evened out to no difference. The feed efficiency could not be statistically analyzed, but (based on pen averages) the yearling implant and control groups were most efficient. Stilbestrol implants had no significant effect on any of the carcass data, such as rib eye area, fat thickness, etc.

Nursing steer calves implanted with 30 mg stilbestrol and re-implanted upon entering the feedlot made an average daily gain of 2.48 lbs. Similar cattle treated only once when entering the feedlot had an average daily gain of 2.49 lbs, while those that were only implanted once as calves had average daily gains of 2.17 lbs and those that received no treatment, 2.29 lbs. Pen averages of feed efficiency favored the yearling implant.

Double-implanted cattle produced the heaviest carcasses; therefore, also the largest weight of retail cuts per-day-of-age. The steers receiving no stilbestrol produced the fattest carcasses, the highest yield grade and the lowest cutability.

Implants in the bulls influenced weaning weights significantly (598 lbs compared with 533). The yearling implants and controls had a higher daily gain during the finishing period than the calf and double implants. Lifetime weight-per-day-of-age figures were the same for all treatments. The yearling implants had a higher quality grade, yield grade, and percentage of kidney fat, plus a larger rib eye, than the calf implants—but these values were not statistically different from those of other treatments. Retail cuts (at 80¢ per pound) were valued at $237.48 for steers, $248.79 for bulls and $244.02 for Russian castrates.

The double-implant treatment on bulls did reduce size of testicles, but did not improve carcass quality. Testicle weights (in grams) were: no treatment, 220.8; double implant, 182.5; single implant, as yearlings, 262.5; and single implant, as calves, 199.1. This would suggest that stilbestrol could be used to decrease libido in bulls. A reduction in sex drive could be useful in altering the behavior of aged bulls to decrease management difficulties.

Weaning weights of implanted Russian castrates were significantly higher than those not implanted. The final weights of the double implants were significantly higher than the non-implanted group with the others in between. The calf implant group had a lower postweaning average daily gain. Implants had little influence on any carcass traits of either castrate group.

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PERFORMANCE COMPARISONS FOR BULLS VS. STEERS (CONVENTIONAL AND RUSSIAN CASTRATES) AND STILBESTROL IMPLANT EFFECTS

	Weaning weight	Finishing weight	Test A.D.G.*	Lifetime W.D.A.†	Hot carcass weight	USDA quality grade‡	USDA yield grade	Rib-eye area	Per cent fat
Steers	578^{a}	952^{a}	2.35^{a}	2.07^{a}	592	16.0^{a}	2.82^{a}	11.39^{a}	30.45^{a}
Russian castrates	569^{a}	$977^{a,b}$	$2.47^{a,b}$	2.13^{a}	605	15.4^{b}	2.55^{b}	12.20^{b}	27.96^{b}
Bulls	569^{a}	992^{b}	2.56^{b}	2.16^{a}	614	15.1^{b}	2.32^{c}	12.70^{c}	26.46^{c}
Calf implant	586^{b}	963^{a}	2.32^{c}	2.09^{a}	596	15.4^{a}	2.48^{a}	12.30^{a}	28.45^{a}
Yearling implant	557^{a}	$981^{a,b}$	2.58^{b}	2.13^{a}	612	15.6^{a}	2.61^{a}	11.99^{a}	26.96^{a}
Double implant	596^{b}	999^{b}	2.48^{a}	2.17^{a}	616	15.4^{a}	2.59^{a}	12.10^{a}	27.96^{a}
No implant	551^{a}	956^{a}	2.47^{a}	2.08^{a}	592	15.6^{a}	2.56^{a}	12.07^{a}	28.45^{a}

^{a,b,c} means with different superscripts are significantly different ($P < .05$).
* A.D.G. = average daily gain.
† W.D.A. = weight per day of age.
‡ 16 = choice–; 15 = good+.