EFFECT OF SYNTHETIC HORMONE IMPLANTS ON GRAZING STEERS IN QUEENSLAND

By W. F. MAWSON, A. W. BEATTIE, and D. N. SUTHERLAND*

SUMMARY

Data are presented on the effect of hormone implants in fattening beef cattle on 10 properties at various centres in Queensland. Sixteen different trials involving observations on 377 treated animals and 295 control animals have been conducted. All but one trial involved grazing animals.

Excluding one trial concerning the effect of implantation on growing animals, a significant response in growth rate was obtained in 12 out of the remaining 15 trials. The overall response to treatment was statistically highly significant and ranged from 0.14 to 0.72 lb per animal daily over the final fattening period.

There were no significant differences in response to levels varying from 15 mg to 60 mg hexoestrol.

A significant positive relationship exists between response of treated animals and growth rate of the controls.

No significant difference was detected between the growth rate of the treated and control animals in the growing state, but the number in each group was small. There is an indication of faster growth by treated animals in the three to four months following implantation.

Condition grade did not appear to be related to magnitude of response.

Conformation defects appeared in treated animals apparently without causing a downgrading of carcasses.

Dressing percentage of treated and control groups did not differ significantly.

Eye muscle depth was significantly greater in the treated animals.

Treated animals had significantly less fat cover over the eye muscle. In one trial a considerable downgrading of carcasses was due mainly to insufficient fat cover in the treated groups at the 30 mg and 60 mg levels.

No significant differences between carcasses were detected by the methods of appraisal which were employed.

I. INTRODUCTION

The administration of synthetic hormones to fattening cattle for purposes of growth stimulation is performed by one of two methods. Oral administration, by admixture of a powder form in the ration daily, is the common method

* Queensland Department of Agriculture and Stock

where practicable and is the method of choice. In the case of grazing animals, subcutaneous implantation is employed, pellets or paste of a known dosage being used.

The first report of the effect of synthetic hormones on fattening beef cattle was made by Sykes *et al.* (1953), who observed that diethylstilboestrol pellets placed as subcutaneous implants in fattening cattle resulted in more rapid and efficient liveweight gains. Additional gains of 0·69 lb daily (30 per cent.) and 0·58 lb daily (46 per cent.) were reported from two experiments using implants of 24 mg stilboestrol in yearling and 2-year-old steers on a pasture of mixed grasses and legumes, mostly oats and alfalfa (O'Mary and Cullison 1956). Clegg and Carroll (1957) indicated that one 15 mg stilboestrol pellet implanted subcutaneously in the ear produced the same response as feeding 10 mg stilboestrol per animal daily during the fattening period.

A significant response to implantation of stilboestrol at the 12, 24, and 36 mg levels or of 20 mg oestradiol plus 1000 mg progesterone was reported by Kercher (1958) in yearling and 2-year-old steers grazing irrigated pasture. A similar gain was recorded from both types of implants and there was no significant difference between implants of stilboestrol at various levels.

Growth responses to hexoestrol implants in steers grazing pasture have been reported by a number of workers, including Chamberlain and McNiel (1958), Smith (1958), Callow and Finney (1959), Everitt (1958), Tulloh (1959) and Burns and Sutherland (1960). Liveweight gain advantages up to 82 lb for treated animals over controls were reported from South Australia by Chamberlain and McNiel (1958), while Tulloh (1959) reported a growth increase of over 50 per cent. in steers grazing pastures in Victoria. Burns and Sutherland (1960) reported the performance of implanted steers grazing native pasture near Gayndah in Queensland. Implanted animals gained at the rate of 0·2 and 0·3 lb daily faster than control animals in two trials lasting 6 months and 4 months respectively.

Using an implant of 1000 mg progesterone and 20 mg oestradiol benzoate, Cerniga (1958) obtained an average gain of 17 per cent. in growth rate in treated animals, the rate of gain of control animals in all tests ranging from 0·63 lb per day to 2·00 lb per day, depending on the plane of nutrition.

Hexoestrol proved superior to progesterone plus oestradiol benzoate when implanted subcutaneously in grazing steers in Jamaica (Nestel and Clay 1961).

The field trials reported here were conducted on private properties, "Brian Pastures" Pasture Research Station, Gayndah, and the Bureau of Tropical Agriculture, South Johnstone, during the four years 1957 to 1960, inclusive. They were concerned primarily with the performance of steers treated by the implant method and under grazing conditions in various types of pasture, crop and climatic conditions.

II. DESCRIPTION OF ENVIRONMENT

The trials were located at centres as shown in Figure 1 between latitudes 17·5°S and 28·2°S, as follows:—

Trials Nos. 1 (*a*) and 1 (*b*).—Yuleba (latitude 26·6°), located approximately 50 miles east of Roma and 280 miles from Brisbane in a north-westerly direction. Implanted animals had access to grazing oats to appetite plus an area of adjacent native pasture.

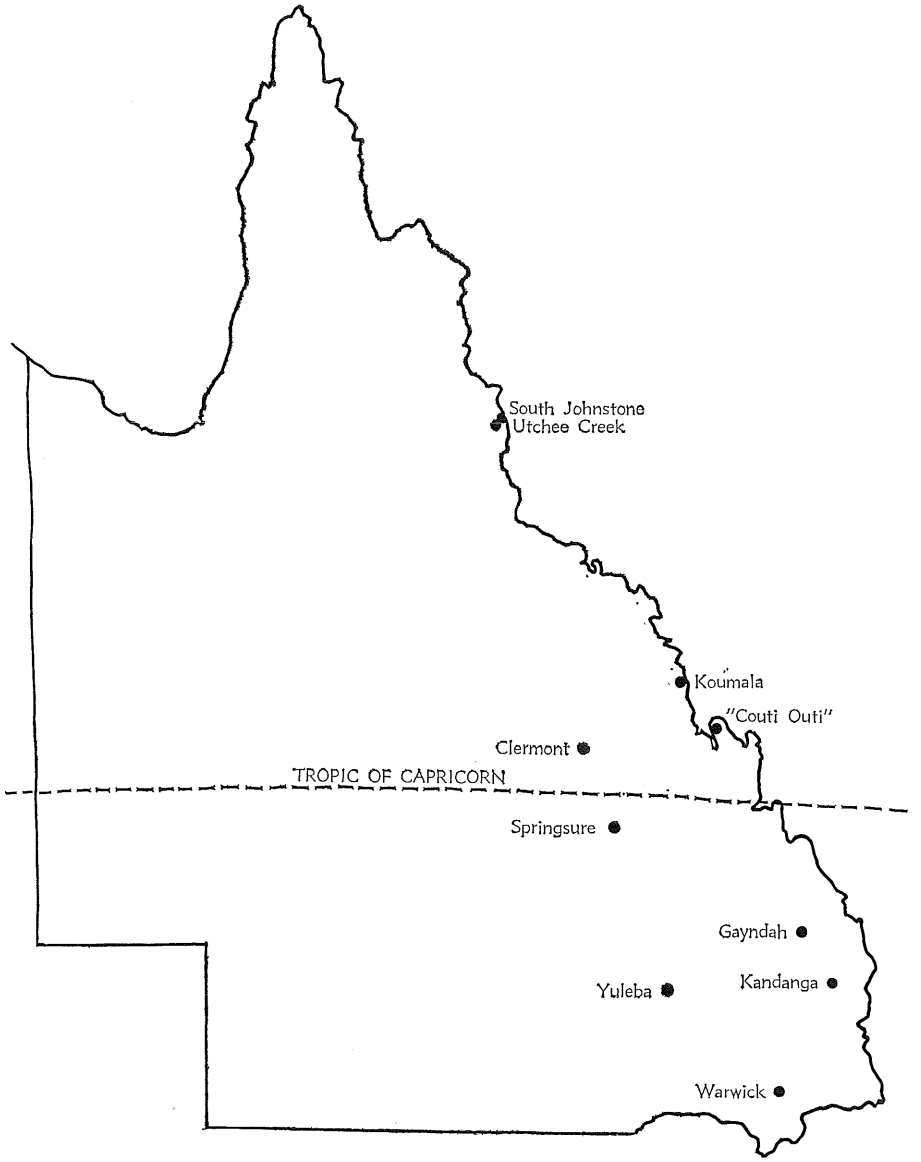

Fig. 1.—Sketch map of Queensland showing location of trial centres.

Trial No. 2.—Koumala (latitude 21·6°), located on the coast approximately 40 miles south of Mackay. The grazing comprised mainly native pastures of kangaroo grass (*Themeda australis*), love grasses (species of *Eragrostis*) and wire grasses (species of *Sporobolus*), plus para grass (*Brachiaria mutica*) in swampy areas.

Trials Nos. 3 *and* 4.—*"Couti-Outi"* (latitude 22·5°), located 60 miles north of Rockhampton. Grazing consisted mainly of para grass and marine couch (*Paspalum vaginatum*) on marine plains and blue grasses (species of *Dichanthium* and *Bothriochloa*) plus Townsville lucerne (*Stylosanthes humilis*) on the foothills.

Trial Nos. 5 *and* 14.—Utchee Creek (latitude 17·5°), located approximately 12 miles south-west of Innisfail on the north-eastern tropical coast. Grazing comprised sown tropical-type pasture consisting principally of molasses grass (*Melinis minutiflora*) but containing small areas of guinea grass (*Panicum maximum* var. *typica*), elephant grass (*Pennisetum purpureum*)and the tropical legumes centro (*Centrosema pubescens*) and calopo (*Calopogonium mucunoides*). In the trial beginning in 1957, pasturage was in short supply until mid-January and stock were moved to a fresh paddock daily. Dry conditions also prevailed for the first six weeks of the 1958 trial and pasturage did not become plentiful until the end of November.

Trial No. 6 (*Growing Animals*).—Bureau of Tropical Agriculture, South Johnstone (latitude 17·5°), located 7 miles south-west of Innisfail on the tropical coast. Stock were grazed on a rotational system in small paddocks consisting mainly of molasses grass with puero (*Pueraria phaseoloides*), guinea grass with centro and with smaller areas of para grass, *Brachiaria decumbens,* calopo and stylo (*Stylosanthes gracilis*).

Trials Nos. 8, 9, *and* 10.—Gayndah (latitude 25·6°), located in the Burnett River Valley approximately 200 miles north of Brisbane. The first series of observations in 1958 was made on steers fattened on a ratoon crop of sweet sorghum. A second series of observations begun late in 1958 was made on steers grazing native pastures, predominantly black spear grass (*Heteropogon contortus*) and blue grasses.

Trials Nos. 7 *and* 11.—Kandanga (latitude 26·3°), located in the coastal range area south of Gympie. Nutrition for both 1958 and 1959 groups was similar and comprised grazing oats during the first four weeks of the observations followed by oats oversown with lucerne and white clover.

Trial No. 12.—Clermont (latitude 22·8°), located on the Central Highlands, 180 miles south-west of Mackay. The grazing consisted of an ample supply of grazing oats plus wheat which was affected severely by frost and rendered unsuitable for grain production.

Trial No. 13.—Warwick (latitude 28·2°), located on the Darling Downs, approximately 90 miles south-west of Brisbane. Stock had access to grazing oats but owing to dry conditions insufficient oats was available and a supplement of fair-quality lucerne hay was fed in the paddock at the rate of 4 lb per animal daily.

Trial No. 15.—Springsure (latitude 24·1°), located 60 miles south of Emerald on the Central Highlands. Of the trials reported, this is the only one involving other than grazing animals. The ration in this case consisted of a mixture of milled grain sorghum and milled sudan grass hay *ad lib.*, plus urea and ground limestone.

Trial No. 16.—Fitzroy Vale (latitude 23·6°), situated approximately 40 miles south-east of Rockhampton. The experimental animals were reared in the Northern Territory. Available grazing consisted of blue grasses on the drier parts of the coastal plain and various couch grasses (species of *Cynodon*) on the wet flats.

III. MATERIALS AND METHODS

(i) *Animals.*—The animals used varied from junior yearling to 5-6-year-old bullocks. Details are given in Table 1.

(ii) *Management.*—Environmental conditions were identical for groups of animals within each trial. All were depastured or fed as one mob. Parasite control was adequate and water and shade available as required.

(iii) *Hormone.*—In all but Trials 1(*a*) and 1(*b*), the hormone used was hexoestrol, which is a form of synthetic oestrogen. This was in the form of 15-mg tablets. An implant of 200 mg. progesterone and 25 mg oestradiol benzoate was used in Trials 1(*a*) and 1(*b*).

(iv) *Method of Implantation.*—In all cases, implantation was effected in the subcutaneous tissue at the back of the ear. The full dosage was implanted with one injection. Where necessary, the required dosage was obtained by using multiples of 15-mg tablets.

(v) *Weighing Techniques.*—Initial weights, coinciding with the day of implantation, were obtained in all cases. Final weights are weights on the property

prior to turn-off, which usually occurred within one or two days of final weighing. In cases where slaughter data are given, the animals were slaughtered within four days of the final paddock weighing.

Intermediate weights at intervals of 28 days were made in Trials 8, 9, 10 and 15. In Trials 1(*a*), 1(*b*), 7, 11, 12, 13, 14 and 15, interim weights were obtained. Both fixed and mobile weighbridges were employed. Normal procedure was to yard the stock and commence weighing within 2 hr.

(vi) *Grading.*—Where condition grades were allotted, animals were classified as Grade 1, 2 or 3 according to the degree of visually observed muscle development and fatness of each animal at the beginning of the trial. The best conditioned animals were classified as Grade 1. Carcass grading was done on a commercial basis as for the export chilled beef trade.

(vii) *Carcass Measurements.*—The methods of Kneebone, Marks, McMeekan, and Walker (1950) were used to measure eye muscle depth (measurement of a transverse section of the longissimus dorsi muscle between the 10th and 11th ribs at the site) and fat cover over the eye muscle at the cut surface between the 10th and 11th ribs, and for appraising carcasses.

IV. RESULTS

(a) Liveweight Performance

(i) *Weight Gains.*—A summary of weight gains appears as Table 1. The comparison tested is the difference between controls and pooled treated groups where more than one level of hormone was used.

In trials involving a total of 367 treated animals and 285 controls, a significant response was obtained in 12 cases out of 15. In the remaining three trials a response was obtained but failed to reach the level of statistical significance. The feedlot trial (No. 15) was the only one in which the control group had other than the lowest mean gain of any of the groups in the trial. In none of the trials where different levels of hormone treatment were applied was there any significant difference in response to levels varying from 15 to 60 mg.

The overall response to hormone treatment is very highly ($P < 0{\cdot}001$) significant. The magnitude of the response varies significantly ($P < 0{\cdot}01$) among trials.

If Trials 1 (hormone other than hexoestrol) and 16 (growth data unavailable) are omitted, 13 sets of results remain. These are arranged in descending order

TABLE 1

SUMMARY OF EXPERIMENTAL DATA

Trial No.	Location	Type of Animal	Feed Supply	Date of Implant	Treatment†	No. in Group	Duration of Trial (days)	Initial Weight (lb)	Daily Gain (lb)
1(*a*)	Yuleba	Hereford and Hereford x Shorthorn	Crop and native pasture	22.viii.57	Treated Control	20 20	56	890	3·15 ± 0·14* 2·71 ± 0·14
1(*b*)	Yuleba	Zebu X	Crop and native pasture	22.viii.57	Treated Control	4 7	56	640	3·08 ± 0·17** 2·24 ± 0·13
2	Koumala	3-year-old bullocks	Native and improved pasture	31.vii.57	45 mg 30 mg 15 mg Control	14 11 12 13	107	890	0·84 ± 0·09 1·07 ± 0·11 1·09 ± 0·10 0·78 ± 0·10
3	" Couti-Outi " ..	2-year-old steers ..	Native and improved pasture	4.ix.57	30 mg 15 mg Control	8 7 9	96	730	1·82 ± 0·08* 1·69 ± 0·08* 1·55 ± 0·07
4	" Couti-Outi " ..	3-year-old bullocks	Native and improved pasture	4.ix.57	30 mg 15 mg Control	5 6 6	96	980	1·36 ± 0·15 1·58 ± 0·14 1·32 ± 0·14
5	Utchee Creek ..	2–4-year-old bullocks	Improved tropical pastures	27.xi.57	60 mg Control	80 71	102	820	2·01 ± 0·08*** 1·67 ± 0·08
7	Kandanga ..	5–6-year-old bullocks	Crop and improved pastures	29.vii.58	60 mg Control	13 13	76	970	2·51 ± 0·10* 2·18 ± 0·10
8	Gayndah	3–4-year-old bullocks	Native pasture ..	22.xi.57	60 mg 30 mg Control	23 23 23	155	750	1·74 ± 0·05* 1·79 ± 0·05 1·59 ± 0·05

† Treatments in Trials 1(*a*) and 1(*b*) were 200 mg progesterone plus 25 mg oestradiol benzoate; all other treatments were with hexoestrol at the levels shown

* Significant at 5 per cent. level

** Significant at 1 per cent. level

*** Significant at 0·1 per cent. level

TABLE 1—continued

SUMMARY OF EXPERIMENTAL DATA

Trial No.	Location	Type of Animal	Feed Supply	Date of Implant	Treatment†	No. in Group	Duration of Trial (days)	Initial Weight (lb)	Daily Gain (lb)
9	Gayndah	3–4-year-old bullocks	Crop ratoon ..	30.ix.58	30 mg Control	13 13	53	840	3·45 ± 0·20* 2·82 ± 0·20
10	Gayndah	3-year-old steers ..	Native pasture ..	19.xii.58	30 mg Control	21 21	105	860	1·88 ± 0·06* 1·65 ± 0·06
11	Kandanga ..	Senior yearling steers	Oats and improved pasture	29.vii.59	30 mg Control	16 14	96	850	1·38 ± 0·06* 1·15 ± 0·06
12	Clermont ..	3-year-old bullocks	Oats and frosted wheat	20.vi.59	30 mg Control	20 20	72	890	3·27 ± 0·12*** 2·55 ± 0·12
13	Warwick	2-year-old steers ..	Oats and hay ..	19.v.60	30 mg Control	9 9	102	820	2·09 ± 0·07* 1·86 ± 0·07
14	Utchee Creek ..	2–4-year-old bullocks	Improved tropical pasture	15.x.60	4 x 15 mg 50 mg 2 x 15 mg Control	14 15 13 36	127	730	1·57 ± 0·07* 1·43 ± 0·07* 1·48 ± 0·08* 1·80 ± 0·05
15	Springsure ..	Junior yearlings ..	Feed-lot	4.iii.60	30 mg 15 mg Control	10 10 10	83	610	2·04 ± 0·18 1·73 ± 0·18 1·80 ± 0·18
16	Fitzroy Vale ..	4-year-old Shorthorn bullocks	Native pasture ..	16.i.59	50 mg 45 mg 30 mg 15 mg Control	14 32 32 32 110	96	N.A.	N.A.

N.A. = Not available

† Treatments in Trials 1(*a*) and 1(*b*) were 200 mg progesterone plus 25 mg oestradiol benzoate; all other treatments were with hexoestrol at the levels shown

* Significant at 5 per cent. level

*** Significant at 0·1 per cent. level

of response in Table 2, which also lists the daily gains of the control animals and the mean initial weight of all the animals in each trial. Taking these results as they stand (without weighting) there is only a slight suggestion of increased response related to higher initial weight. There is, however, a significant ($P < 0{\cdot}01$) positive relationship (accounting for about 60 per cent. of the variation in response from trial to trial) between response and growth rate of the controls. Reflecting this relationship there is a general tendency for response to be related to the overall level of nutrition although there are one or two exceptions.

TABLE 2

DAILY GAIN IN RELATION TO INITIAL WEIGHT AND GROWTH OF CONTROLS

Trial No.	Response to Hormone* (lb per day)	Daily Weight Gain of Controls (lb)	Initial Weight (lb)
12	0·72	2·55	890
9	0·63	2·82	840
5	0·34	1·67	820
7	0·34	2·18	970
10	0·24	1·65	860
11	0·24	1·15	850
13	0·23	1·86	820
2	0·22	0·78	890
3	0·20	1·55	730
8	0·17	1·59	750
14	0·16	1·34	730
4	0·14	1·32	980
15	0·07	1·80	610

* Response measured as difference between daily gains of treated and control animals

(ii) *Response of Growing Animals (Trial 6).*—A trial which has not been included in Tables 1 and 2 was conducted with Devon/Shorthorn cross steers, 16 months old when treated on March 14, 1957, and weighed at approximately monthly intervals until March 8, 1958. They were grazed on improved tropical pasture at the Bureau of Tropical Agriculture. Two groups of 10 animals were used. Four growth periods were considered approximating to autumn, winter, spring and summer. No significant difference (Table 3) was detected in any period. Examining the trend of the results, it appears that if there was any response at all it took the form of faster growth over the first three or four months of the trial. The weight advantage gained was held through the winter but then largely lost. Comparative growth rates are shown in Figure 2.

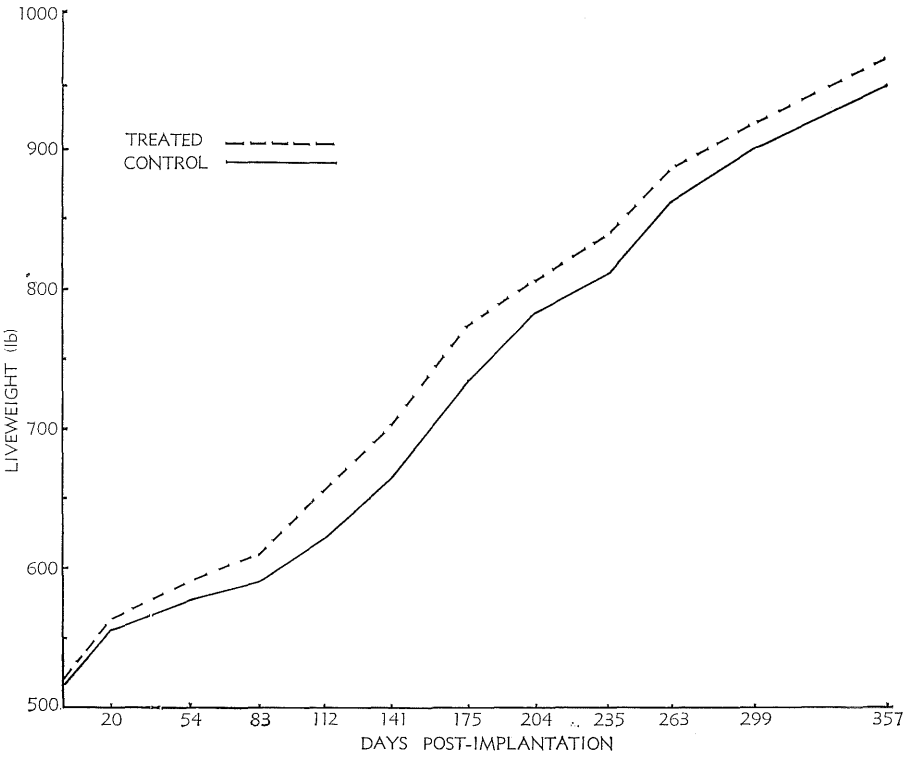

Fig. 2.—Growth rates of treated and untreated young cattle on tropical pasture.

TABLE 3

WEIGHT GAINS IN YOUNG CATTLE ON TROPICAL PASTURE

Period	Days	Daily Gain (lb)	
		Treated†	Controls†
14.iii.57 to 5.vi.57 ..	83	1·04 ± 0·08	0·86 ± 0·08
5.vi.57 to 5.ix.57 ..	92	1·80 ± 0·08	1·71 ± 0·08
5.ix.57 to 2.xii.58 ..	88	1·30 ± 0·12	1·46 ± 0·12
2.xii.58 to 8.iii.58 ..	96	0·82 ± 0·10	0·96 ± 0·04
Initial Weights ..	..	518	515

† 10 animals per group

Differences between treated and control not significant for any period

(iii) *Influence of Condition of Animals at Start of Trial.*—In Trial 5 condition grades were allotted (Table 4). It is not clear whether the liveweight differences initially present among the three condition grades are due to the observer's use of visually assessed liveweight as one of his criteria in allotting grades or reflect a real tendency for better conditioned animals to be heavier. In any case there is no suggestion from the results that condition grade is related to magnitude of response.

TABLE 4

CONDITION GRADE AND RESPONSE, TRIAL 5

—	No. of Animals	Initial Weight (lb)	Daily Gain (lb)	Response to Hormone (lb)
Grade 1:				
Treated ..	5	939	1·85	0·37 ± 0·22
Control ..	9	977	1·48	..
Grade 2:				
Treated ..	57	824	1·98	0·30 ± 0·08
Control ..	44	824	1·68	..
Grade 3:				
Treated ..	18	743	2·13	0·37 ± 0·13
Control ..	18	751	1·75	..

(iv) *Carcass Weight.*—As it will be shown that dressing percentage varies only negligibly (Table 5), there does not seem to be any point in considering carcass weight *per se*. Any difference in carcass weights is only a growth difference expressed in different units.

TABLE 5

DRESSING PERCENTAGE

(Chilled Carcass Weight as a Percentage of Paddock Weight Prior to Transport to Abattoirs)

Trial No.	60 mg	30 mg	Control
8	(23) 51·8 ± 0·5	(23) 51·3 ± 0·5	(23) 51·1 ± 0·5
9		(13) 51·8 ± 0·5	(13) 52·2 ± 0·5
10		(21) 51·4 ± 0·3	(21) 51·9 ± 0·3
11		(16) 53·1 ± 0·3	(14) 53·2 ± 0·4
13		(9) 54·5 ± 0·8	(9) 54·9 ± 0·8
1a†	(20) 52·1 ± 0·4		(20) 52·3 ± 0·4
1b	(4) 52·6 ± 1·5		(7) 50·8 ± 1·1

† Progesterone 200 mg plus oestradiol benzoate 25 mg

Number of carcasses in parentheses

Differences between treated and control not significant in any trial

(b) Effect on Conformation of Live Animal

(i) *Defects.*—In Trials 2, 3, 4 and 8, changes in the conformation of treated animals were observed. The most obvious of these defects were (*a*) a slackening of the ligaments at the base of the tail, which appeared to be associated with an elevation of the tail "head"; (*b*) a depression in the back-line, leading to a condition popularly referred to as "sway-back," and (*c*) a lateral sloping effect of the rump. In these and other trials there was evidence of abnormal mammary development together with the secretion of a small amount of opaque fluid in the rudimentary mammary glands. So far as could be ascertained these abnormalities did not affect the carcasses to the extent of being the cause of downgrading.

A scoring system ranging from 1 (completely normal) to 4 (serious deformity) was employed in Trials 2, 3 and 4. Results are shown in Table 6. In Trial 2 a significantly ($P < 0{\cdot}01$) higher tail score was given to the treated animals. The difference was $1{\cdot}2 \pm 0{\cdot}3$ units. No significant difference was detected among levels of hormones although there is a suggestion of increased deformity with increased dose in Trials 2 and 3.

TABLE 6

TAIL DEFORMITY SCORE

Trial No.	45 mg	30 mg	15 mg	Control	Significance
2	(14) $2{\cdot}6 \pm 0{\cdot}3$	(11) $2{\cdot}5 \pm 0{\cdot}3$	(11) $2{\cdot}3 \pm 0{\cdot}3$	(13) $1{\cdot}3 \pm 0{\cdot}3$	**
3	..	(8) $2{\cdot}0 \pm 0{\cdot}3$	(7) $1{\cdot}1 \pm 0{\cdot}3$	(9) $1{\cdot}2 \pm 0{\cdot}3$	N.S.
4	..	(5) $1{\cdot}0 \pm 0{\cdot}2$	(6) $1{\cdot}0 \pm 0{\cdot}1$	(6) $1{\cdot}2 \pm 0{\cdot}1$	N.S.

Number of animals in parentheses

** Significant at 1 per cent. level

N.S. Not significant

(ii) *Grading of Carcasses.*—Grading of carcasses for the export trade was done on a commercial basis in respect of animals in Trials No. 8 and 16. Grading standards may vary through time according to market requirements. Since it is a subjective appreciation no comparisons should be made between groups slaughtered at different times and at different centres. According to the standards observed at the time, the allocation of carcasses into grades is shown in Table 7.

TABLE 7

CARCASS GRADING

Trial No.	Treatment	Grades (%)				
		Chiller		First		Second
8	60 mg	43·5		43·5		13
	30 mg	39·1		52·2		8·7
	Control	78·2		17·4		4·4
		First Quality	Second Quality	Third Quality	Boneless Beef	Reject
16	Pooled Treated	0·23	32·36	0·91	41·5	25
	Control	Nil	59·18	Nil	11·92	25·23

In the control group of Trial 16, four carcasses were condemned for reasons not associated with the trial. Rejection in both groups was due to bruising.

The main reasons for downgrading in both trials was the lack of sufficient fat cover or "finish" and this was most marked in the case of treated animals. Animals in Trial 8 suffered a nutritional setback within a few weeks of implantation, a factor which appears to have affected the ability of implanted stock to reach the required degree of fatness under the prevailing conditions of time and nutritional plane.

In the case of Trial 16, conditions necessitated the slaughter of stock at a stage when visual appraisal on the hoof indicated that they were apparently "unfinished". This was subsequently borne out at slaughter, when it was again evident that treated animals carried less fat cover.

(c) Effects on Carcass

(i) *Dressing Percentage.*—Information on dressing percentage is available for Trials 1(*a*), 1(*b*), 8, 9, 10, 11, 13. The percentage expressed is the relationship of chilled carcass weight to paddock liveweight prior to transport to an abattoir. This particular dressing percentage relationship gives a lower figure than the methods which use hot carcass weights and/or fasted live animals' weights as the basis for calculation.

Data on the dressing percentage on a chilled basis are given in Table 5. The difference is not significant for any trial separately or for the pooled data.

(ii) *Eye Muscle Depth.*—Information on eye muscle depth is available for Trials 8, 9, 10, 11, 13 and 16. The data are presented in Table 8.

TABLE 8

EYE MUSCLE DEPTH (mm)

Trial No.	60 mg	50 mg	45 mg	30 mg	15 mg	Control
8 ..	(23) 50 ± 0·8			(23) 49·5 ± 0·8		(23) 48·4 ± 0·8
9 ..				(13) 58·2 ± 1·8		(12) 59·0 ± 1·9
10 ..				(21) 50·1 ± 0·8		(21) 48·3 ± 0·8
11 ..				(12) 48·4 ± 1·6		(13) 45·6 ± 1·6
13 ..				(9) 59·0 ± 1·7		(9) 58·7 ± 1·7
16† ..		(11) 47·7 ± 1·5	(13) 48·6 ± 1·4	(16) 47·6 ± 1·3	(25) 48·2 ± 1·0	

† In this trial a further 39 animals are known to have been treated but level of implant is unknown. The mean of all 104 treated cattle in this trial is 48·3 ± 0·5 mm

Number of carcasses in parentheses

Differences between treated and control not significant in any trial

TABLE 9

FAT COVER (mm)

Trial No.	60 mg	50 mg	45 mg	30 mg	15 mg	Control	Significance
8 ..	(23) 17·9 ± 1·2			(23) 18·2 ± 1·2		(23) 21·5 ± 1·2	*
9 ..				(13) 19·8 ± 3·1		(12) 23·0 ± 3·2	N.S.
10 ..				(21) 16·9 ± 0·8		(21) 18·4 ± 0·8	N.S.
11 ..				(15) 17·2 ± 1·7		(14) 18·5 ± 1·7	N.S.
13 ..				(9) 18·1 ± 1·8		(9) 18·2 ± 1·8	N.S.
16† ..		(11) 15·5 ± 1·8	(13) 18·2 ± 1·6	(16) 17·8 ± 1·5	(25) 16·6 ± 1·2	(104) 19·2 ± 0·6	N.S.

† See footnote to Table 8. The mean of the 104 treated animals in this trial is 18·5 ± 0·6

Number of carcasses in parentheses

* Significant at 5 per cent. level

N.S. Not significant

Although the effect of hormone treatment is not significant in any of the six trials considered separately, a pooled analysis indicates that eye muscle depth is significantly ($P < 0{\cdot}01$) greater (by $1{\cdot}3 \pm 0{\cdot}5$ mm) in the treated animals. No difference among hormone levels was detected.

(iii) *Fat Cover Over Eye Muscle.*—Data on measurement of fat cover over the eye muscle at the cut surface between the 10th and 11th ribs are presented in Table 9 for Trials 8, 9, 10, 11, 13 and 16. In Trial 8 the average of the two treated groups is significantly ($P < 0{\cdot}05$) less than the controls. The difference is in the same direction in the other 5 trials, and pooling the data from all 6 trials the treated groups have significantly ($P < 0{\cdot}001$) less ($1{\cdot}4 \pm 0{\cdot}4$ mm) fat cover than the controls.

A feature of these results, for which an explanation is not readily forthcoming, is the average of 39 treated animals in Trial 16. The individual identification of these animals was lost so the level of dosage is unknown. The mean figure for these 39 head was 20·9 mm, a value considerably higher than the controls or any of the other treated groups. In fact, if these 39 animals are omitted the mean of the remaining 65 treated animals in Trial 16 is significantly ($P < 0{\cdot}05$) lower than that of the controls.

(iv) *Carcass Appraisal.*—In Trials 9 and 10 carcass measurement scores were allotted according to the following scoring system (Kneebone *et al.* 1950):

Eye muscle depth	20 points
Fat cover over eye muscle	15 points
Blockiness	20 points
Balance	10 points
Weight suitability	5 points
	70 points

The carcasses in Trial 13 were not scored for weight suitability, and their scores are therefore out of a possible 65. No significant difference was detected in any trial separately or the three taken together (Table 10).

TABLE 10

TOTAL POINTS BY APPRAISAL MEASUREMENTS
(Maximum 70 points)

Trial No.	30 mg	Control
9	(11) 36·6 ± 1·5	(8) 39·6 ± 1·7
10	(21) 31·9 ± 1·0	(21) 32·7 ± 1·0
13	(9) 28·7 ± 2·3	(9) 23·9 ± 2·3

Number of carcasses in parentheses

Differences between treated and control not significant in any trial

In Trials 9 and 13 points for visual appraisal were added according to the system described by Kneebone *et al.* Points in this regard total 30, made up as follows:—

Rib cover	15 points
Colour and texture of muscle	5 points
Colour and texture of fat	5 points
Marbling	5 points

Points were not allotted for marbling in the case of Trial 13 and total points possible were 90 for Trial 13 and 100 for Trial 9. These appear in Table 11 and indicate no significant difference between the control and treated groups.

TABLE 11

TOTAL POINTS

(Including Eye Judgement)

Trial No.	Maximum Score	30 mg	Control
9	100	(11) 54·4 ± 1·7	(8) 57·1 ± 2·0
13	90	(9) 52·2 ± 2·4	(9) 46·6 ± 2·4

Number of carcasses in parentheses

Differences between treated and control not significant in either trial

V. DISCUSSION

Discussion is focussed on the effect of implants on the performance of steers fattening on pasture or crop. The only trial (No. 15) involving animals in a feedlot revealed no advantage to the treated animals. This result is in conflict with many overseas reports and also with recent work in Queensland (Pryor and Hart 1961) from which significant liveweight and chilled carcass gains were obtained in a study on the effect of implants in feedlot steers.

The range of response to implantation ranges from 0·14 lb liveweight to 0·72 lb liveweight daily, or 14-72 lb liveweight over a 100-day fattening period. Since no significant differences were detected in dressing percentages in all trials for which the relevant data were available, it is evident that a proportionate carcass weight response has been obtained.

Comparable bone, muscle and fat weights of treated and control carcasses were not obtainable. Where measurements of the eye muscle and fat cover over this muscle were made, the eye muscle depth was greater in treated animals. This supports the results of Everitt (1959), which differed from those reported by Callow and Finney (1959).

Fat cover was significantly reduced in the case of treated animals, thus indicating that implantation induced muscle development at the expense of fat. In the light of current demand for leaner beef this is a desirable characteristic but its implication should be understood by producers.

These observations agree with those recorded by Nestel and Clay (1961) for European-type stock in trials in Jamaica, Davenport and Neil (1959) and other Australian reports where animals have been slaughtered before reaching a high degree of fatness. As the dressing percentages indicate, stock were not forced to a high degree of fatness before slaughter. However, carcasses were deemed generally to be quite suited to the local trade requirements.

In one trial (No. 8) downgrading of carcasses of the treated group occurred primarily because of insufficient "finish". These animals had experienced a low plane of nutrition for a few weeks soon after implantation and thereafter failed to reach the required level of carcass fatness. The monetary loss incurred through downgrading outweighed the advantage of the additional weight gain. Commercially, it is essential that animals be in a fattening state and on an assured plane of nutrition for the fattening period if advantage is to be gained from implantation.

Conformation defects in the live animal became more pronounced with increased dosage, and although such defects did not cause downgrading it is desirable that they be kept at a minimum. Since no significantly increased responses were obtained to dosages exceeding 30 mg, it is suggested that this level of implantation be not exceeded*.

VI. ACKNOWLEDGEMENTS

Thanks are due to several officers of Cattle Husbandry Branch, Department of Agriculture and Stock, for field work in connection with the trials and to the co-operating graziers concerned. Acknowledgement is also made to various meatworks for facilities made available for carcass appraisal and measurement.

REFERENCES

BURNS, M. A., and SUTHERLAND, D. N. (1960).—Use of synthetic oestrogens for promoting weight gains in beef steers grazing on native pastures. *Qd J. Agric. Sci.* 17:39-42.

* It should be noted that the sale of hormone preparations for use on meat animals is not now permitted in Queensland.—Editor.

BURROUGHS, W., CULBERTSON, C. C., KASTELLI, J., CHENG, E., and HALE, H. W. (1954).—The effects of trace amounts of diethylstilboestrol in ration of fattening steers. *Science* 120:66.

CALLOW, E. H., and FINNEY, D. J. (1959).—Some effects of implanted hexoestrol on the growth of steers. *J. Agric. Sci.* 53:404-9.

CERNIGA, R. M. (1958).—Hormone implants in pasture cattle. *Vet. Med.* 53:134.

CHAMBERLAIN, A. V., and MCNEIL, R. W. (1958).—Hormones in beef cattle. *J. Agric. S. Aust.* 61:561-4.

CLEGG, M. T., and CARROLL, F. D. (1957).—A comparison of the method of administration of stilboestrol on growth and carcass characteristics of beef steers. *J. Anim. Sci.* 16:662-9.

DAVENPORT, N., and NEIL, G. H. (1959).—Hexoestrol implants with yearling steers. *J. Agric. W. Aust.* 2:211-4.

EVERITT, G. C. (1959).—Trials with hexoestrol for beef production. *N.Z.J. Agric.* 99:360-8.

KERCHER, C. J. (1958).—The use of hormone implants for beef cattle on pasture. Proc. West. Section Amer. Soc. Anim. Prod. 9:38.

KNEEBONE, H., MARKS, T., MCMEEKAN, C. P., and WALKER, D. E. (1950).—Evaluation of the chiller beef carcass. *N.Z. J. Sci. Tech.* A31:3-14.

O'MARY, C. C., and CULLISON, A. E. (1956).—Effect of low level implantation of stilboestrol in steers on pasture. *J. Anim. Sci.* 15:48-51.

NESTEL, B. L., and CLAY, D. (1961).—The effects of hormone implantations on the growth rates of European, Zebu and hybrid steers grazing in Jamaica. *Brit. Vet. J.* 117:455-65.

PRYOR, W. J., and HART, B. (1961).—Observations on the effects of implantation of progesterone—oestradiol benzoate on cattle fattening under Queensland feedlot conditions. *Aust. Vet. J.* 37:342-5.

SMITH, R. G. C. (1958).—Hexoestrol—grazing cattle. *Agric. Rev.* 3:29-34.

SYKES, J. F., ANDREWS, F. N., HILL, F. W., LORENZ, F. W., THOMAS, J. W., and WINCHESTER, C. F. (1953).—Hormonal relationships and applications in the production of meats, milk and eggs. National Research Council Publ. No. 266.

(Received for publication April 29, 1962)