EFFECT OF HORMONE IMPLANTATION ON GROWTH RATE AND CARCASS COMPOSITION OF CATTLE GRAZING PASPALUM-DOMINANT PASTURE

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SUMMARY

Twelve 4-year-old steers and 12 3-year-old steers were divided into four comparable groups. One group was slaughtered at the commencement of the experiment; the other three groups were placed on good quality paspalum pasture. Of these three groups on pasture one was implanted with 200 mg progesterone and 20 mg oestradiol benzoate, another received an implant which contained in addition to the above 25 mg cholesterol and 4.9 mg hydrocortisone acetate and the third was an untreated control.

Body-weight gains over the 103 days of the experiment were 2.8 lb per head per day for the group receiving progesterone plus oestradiol, and 2.7 lb per head per day for the group receiving in addition cholesterol and hydrocortisone. There was no significant difference between these two rates of gain but both were significantly greater ($P < 0.01$) than the 2.2 lb recorded for the non-treated group on pasture. The mean carcass weights of the progesterone plus oestradiol group, the progesterone plus oestradiol plus cholesterol plus hydrocortisone group and the control group on pasture were 114, 121 and 85 lb greater respectively than that of the group slaughtered initially. As determined from chemical analysis of the 9th, 10th and 11th rib cut, the weight of protein in the carcass of both implanted groups was significantly greater than that of the control group slaughtered at the same time.

I. INTRODUCTION

It is now well known that an increased rate of body-weight gain can be obtained in cattle in feedlot by the administration of sex hormones either orally (Burroughs *et al.* 1955; Perry *et al.* 1955; Kastelic, Homeyer, and Kline 1956; Klosterman *et al.* 1958) or by subcutaneous implantation (Andrews, Beeson, and Johnson 1954; O'Mary and Cullison 1956). Responses have also been obtained in cattle grazing good quality pasture (Smith 1958; Nestel and Clay 1961). Where the quality of grazing is poor, little or no response is obtained (Burns and Sutherland 1960), but as pasture improves, response from hormones shows a positive correlation with body-weight gains (Mawson, Beattie, and Sutherland 1962).

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Most experiments on the use of hormones for promoting growth in cattle involve diethylstilboestrol and hexoestrol. The use of the naturally occurring progesterone and oestradiol has received less attention. Deans *et al.* (1956) with yearling Hereford steers in feedlot obtained better growth with an implant of 1·5 g progesterone and 50 mg oestradiol than by feeding 10 mg diethylstilboestrol daily. In another experiment (Nestel and Clay 1961), a progesterone-oestradiol implant proved inferior to a hexoestrol implant when used on cattle on pasture.

In the experiment described below cattle were implanted with two types of hormone pellets, one containing progesterone and oestradiol benzoate and the other containing in addition cholesterol and hydrocortisone acetate. The effect on growth rate and carcass composition was studied.

II. MATERIALS AND METHODS

The experimental animals consisted of 12 3-year-old and 12 4-year-old Hereford steers in store condition.

No botanical analyses were made of the pasture but line transect samples obtained from an adjacent paddock at the same time of year showed the predominant species to be *Paspalum dilatatum* (66 per cent.) and *Cynodon dactylon* (15 per cent.). As the experiment extended over a late summer/autumn period of adequate rainfall, the pasture was of high quality and at all times in plentiful supply.

Hormone implants used in this experiment were of two compositions: (1)* containing 200 mg progesterone, 20 mg oestradiol benzoate and (2)** containing 200 mg progesterone, 20 mg oestradiol benzoate, 25 mg cholesterol and 4·9 mg hydrocortisone acetate.

The implants were given at the base of the ear with a syringe-type instrument.

At slaughter the fresh hide was weighed. The weight of the gastro-intestinal tract after removal of the contents of the rumen, reticulum and omasum was also obtained. The spleen was included in this weight.

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* Synovex-S and ** modification supplied by E. R. Squibb and Sons Pty. Ltd., 126 Franklin St., Melbourne

Carcass composition was calculated from analysis of the 9th, 10th and 11th rib cut according to the procedure of Hankins and Howe (1946). Of the several equations which they derived, the ones given by Beames (1961) were used for these calculations.

Carcass and organ weights were obtained on scales accurate to ± 1 lb. Body-weight was obtained on cattle-weighing scales accurate to ± 1 lb.

III. EXPERIMENTAL

Twelve 4-year-old steers and 12 3-year-old steers were divided into four comparable groups by stratified random sampling on a body-weight basis and placed on the following treatments—

Group I: Each animal given one progesterone/oestradiol benzoate implant.

Group II: Each animal given one progesterone/oestradiol benzoate/cholesterol/hydrocortisone acetate implant.

Group III: No hormone treatment.

Group IV: No hormone treatment; slaughtered at the commencement of the experiment.

Groups I, II and III grazed a predominantly *Paspalum dilatatum* pasture for the duration of the experiment, from January 20 to May 5, 1961, a period of 103 days. At the end of this period these groups were slaughtered.

The animals were weighed at the beginning and the end of the experiment on both a shrunk (after 18 hr with neither feed nor water) and non-shrunk basis. Non-shrunk body-weight was obtained at fortnightly intervals.

Teat development was measured on the 83rd day of the experiment.

IV. RESULTS

(i) *Body-weight and Dressing Percentage.*—Body-weight changes, dressing percentages, hide and gastro-intestinal weights are given in Table 1. Mean non-shrunk body-weight gains on pasture in Groups I and II of 2·7 and 2·8 lb per head per day respectively were significantly ($P < 0·01$) greater than that in Group III (2·2 lb). There was no significant difference between Groups I and II. Similar results were obtained with the shrunk weight data. All groups gained

weight rapidly throughout the experiment, with the differences in rate of gain being apparent over the whole period. The mean non-shrunk body-weight gains in Groups I, II and III of 280, 285 and 224 lb respectively resulted in carcass weights which were 114, 121 and 85 lb greater respectively than the mean of Group IV slaughtered initially (Table 1). The mean of the hot dressed weights of Groups I and II was significantly greater than that of Group III ($P < 0.05$).

TABLE 1

MEAN BODY-WEIGHT CHANGES, DRESSING PERCENTAGES AND HIDE AND GASTRO-INTESTINAL WEIGHTS

—	Group I	Group II	Group III	Group IV	Standard Error	Significant Differences
Non-shrunk body-weight (lb)—						
Initial	862	856	846	853	..	N.A.
Final	1,142	1,141	1,070	..	..	N.A.
Total gain	280	285	224	..	..	N.A.
Mean gain/day	2·7	2·8	2·2	..	0·14	I, II > III**
Shrunk body-weight (lb)—						
Initial	798	789	784	800	..	N.A.
Final	1,079	1,068	1,009	..	..	N.A.
Total gain	281	279	225	..	..	N.A.
Mean gain/day	2·8	2·8	2·3	..	0·10	I, II > III**
Hot dressed weight (lb) ..	544	551	515	430	12·0	I, II, III > IV***, I, II > III*
Dressing percentage—						
(a) hot dressed; non-shrunk	47·7	48·3	48·1	50·4	0·72	I, II, III < IV*
(b) hot dressed; shrunk ..	50·4	51·6	51·0	53·7	0·69	I, II, III < IV**
Hide weight (lb)†	72·2	72·3	71·3	56·3	1·8	I, II, III > IV***
Gastro-intestinal tract weight (lb)†	90·8	90·8	82·7	75·9	3·9	N.S.

* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$ N.A. Not analysed

† Clean fresh non-dried weights N.S. No differences significant ($P > 0.05$)

There were no significant differences in dressing percentage among Groups I, II and III but all were significantly less than that in the group slaughtered initially (Group IV). No significant difference was obtained in the weight of either the fresh hide or the gastro-intestinal tract among the three groups on pasture, although in both hormone-implanted groups the mean weight of gastro-intestinal tract was 8·1 lb greater than that of Group III.

(ii) *Carcass Analysis.*—The carcass composition calculated as ether extract, protein, water and separable bone is given in Table 2. The differences in carcass weight between Group IV and Groups I, II and III of 114, 121 and 85 respectively resulted from increases in weight of ether extract, protein and water but not separable bone. Weight of protein and water was greater in Group I and II carcasses than in Group III carcasses although only the differences in level of protein were statistically significant ($P < 0.01$).

TABLE 2

PERCENTAGES AND TOTAL WEIGHTS OF CARCASS COMPONENTS AT SLAUGHTER CALCULATED FROM PERCENTAGES IN THE 9TH, 10TH AND 11TH RIB CUTS

Carcass Component	Group Means				Standard Error	Significant Differences
	I	II	III	IV		
Percentage in separable portion–						
Ether extract	22·8	25·7	27·9	13·7	..	N.A.
Protein	18·0	16·4	15·9	17·7	..	N.A.
Water	58·0	57·2	55·2	67·4	..	N.A.
Total	98·8	99·3	99·0	98·8	..	N.A.
Percentage in whole carcass—						
Ether extract	17·3	19·1	20·5	11·0	0·96	I, II, III > IV***
Protein	15·1	14·2	13·9	14·6	0·47	N.S.
Water	51·0	50·3	48·9	55·6	0·58	I, II, III < IV*** I, II > III*
Separable bone	15·8	15·5	15·7	17·9	0·46	I, II, III < IV***
Weight in whole carcass (lb)—						
Total	544·3	551·5	515·1	430·3	12·0	I, II, III > IV*** I, II > III*
Ether extract	94·8	105·0	105·3	47·8	6·1	I, II, III > IV***
Protein	81·8	78·3	71·9	62·7	2·1	I, II, III > IV*** I, II > III**
Water	277·4	277·9	252·4	239·1	6·9	I, II, III > IV** I, II > III**
Separable bone	85·4	85·4	80·7	77·0	2·4	N.S.

* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$ N.A. Not analysed

N.S. No differences significant

(iii) *Teat Development.*—The measurement of teat length on the 83rd day of the experiment gave a mean length of 0·7 in. and a maximum of 1·3 in. in both hormone-treated groups compared with a maximum length of 0·2 in. in the control group.

V. DISCUSSION

Both types of hormone implants resulted in an increased rate of body-weight gain and an increased carcass yield. However, the addition of cholesterol and hydrocortisone to the implants made no significant difference to the effect achieved by oestradiol and progesterone alone. The rationale for the inclusion of cholesterol by the manufacturers could be either because it is involved in fat metabolism or because of its close chemical resemblance to the oestrogens. The larger weight of ether extract in the carcasses of the animals which received cholesterol and hydrocortisone than in those of the animals which received oestradiol and progesterone only, even though not significantly larger, would indicate that cholesterol may have exerted an effect on fat metabolism and deposition. If this were

so, the use of cholesterol might be of importance in minimizing the downgrading of carcasses of hormone-treated animals reported by Andrews, Beeson, and Johnson (1954). According to Long (1942), the inclusion of hydrocortisone could be contra-indicated because of a possible increase in protein deamination and urinary nitrogen excretion. The trend towards a lower weight of protein in the carcass in the group receiving hydrocortisone could be a result of this effect.

All three groups on pasture had a significantly smaller dressing percentage than the animals slaughtered initially. In view of the findings of O'Mary *et al.* (1952) and Means, Andrews, and Beeson (1953), who obtained a lowered dressing percentage in lambs by the use of stilboestrol, the weights of gastro-intestinal tract and hide were obtained. Neither dressing percentage nor hide weight was affected by hormone treatment although there was a marked but non-significant effect on the weight of the gastro-intestinal tract.

From the analysis of the carcass, the major effect of the hormones appears as an increase in the production of protein together with approximately three times its weight of associated water. Separable bone accounted for only 4·7 lb of the mean 32·8 lb advantage in the carcass weight of the hormone-treated animals. The ratio of protein to moisture in the edible portion was not significantly affected by the hormone treatment. This is in contrast to the observations of Smith (1958), who obtained an increase in the moisture content of selected muscles from 66·6 to 71 per cent. by hormone implantation of steers, but supports the data of MacDonald and Slen (1959), who were unable to demonstrate any effect of hormones on muscle dry-matter.

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