EFFECTS OF YARD WEANING AND PRE-FEEDLOT VACCINATION ON FEEDLOT PERFORMANCE OF *BOS TAURUS* STEERS

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SUMMARY

It was hypothesised that better weaning management, together with pre-feedlot vaccination, could reduce the incidence of Bovine Respiratory Disease (BRD) and improve feedlot performance.

Some 200 male beef calves (Angus x Hereford, and Hereford) were separated from their mothers at seven to nine months of age and allocated to one of three weaning treatment groups. The groups were matched for liveweight and any negative disease history. The treatments were (1) yard weaning with hay or silage; (2) yard weaning with hay or silage plus a novel handling procedure to train the animals to be able to find a grain ration in a trough; (3) paddock weaning without supplement or handling, according to common industry practice. Experimental vaccines against the major BRD pathogens were given to half of each group one to two months prior to entry into a large commercial feedlot. Performance in the feedlot was monitored up to slaughter after approximately 90 days on feed, with extensive serology to monitor disease transmission and detailed clinical and postmortem examination. This experiment was repeated over three production cycles.

The yard-weaned and yard-trained cattle had a significantly higher weight gain in the first month and over the 90 day feeding period than the paddock-weaned control groups. There was no difference between the groups in pre-feedlot weight gain. The yard-trained groups were not significantly different from yard-weaned. The vaccination treatment also significantly improved the weight gain in the first month and over 90 days. The combination of yard weaning and vaccination produced the highest weight gains overall. There was consistently lower morbidity in the yard-weaned groups compared to paddock-weaned controls. The morbidity in yard-trained groups was more variable, but overall it was intermediate compared with these two. The treatments did not, however, prevent losses due to a 'late' outbreak of BRD after 80 days on feed.

This method of weaning in small yards, coupled with the appropriate use of effective BRD vaccines one to two months before feedlot entry was shown to minimise sickness due to early respiratory disease and to improve productivity in the feedlot. Associated benefits are reduced risks of antibiotic residues and of animal welfare problems. This procedure was clearly cost-effective there being an increase in gross margin of up to $33 per head while costs increased by $5 to 15 per head. Benefits to the beef industry were estimated to be $8 million by 2001.

Keywords: feedlot cattle, weaning, vaccination, respiratory disease

INTRODUCTION

Bovine Respiratory Disease (BRD) has been shown to cause production losses and increased costs in Australian feedlots when feeder steers adapt poorly to their new conditions on arrival at the feedlot. This previous research (Dunn *et al.* 1993) showed that most respiratory disease occurred in the first four to six weeks after arrival at the feedlot and there was huge variation between pens in morbidity and mortality. It was hypothesised that better weaning management, together with pre-feedlot vaccination, could contribute to solving this problem and improve performance in the feedlot.

MATERIALS AND METHODS

Each year, during the autumn of 1993, 1994 and 1995, some 200 male beef calves were separated from their mothers at seven to nine months of age and subjected to various weaning treatments at the Elizabeth Macarthur Agricultural Institute (EMAI), Camden, NSW. After a further grow-out period of six to nine months on pasture at EMAI, these steers were transferred to a large commercial feedlot near Quirindi, NSW, where they were fed for about 90 days before slaughter. One to two months before entering the feedlot, selected animals were given specific vaccination treatments.

The experimental animals came from two main sources. About 60% were bred at EMAI while the remainder came mostly from one commercial property in the southern highlands of NSW. The majority were Angus x Hereford calves, but there was a significant number of Herefords also and a small number of other crosses. In the feedlot they were placed in a single pen, together with a similar number of comparable commercial-in-contact cattle, which were provided by the feedlot to ensure that a typical behavioural and infectious challenge occurred.

Prior to feedlot entry, measurements were made of the disease status, weight gain, responses to stress and the behaviour of these cattle. Health, weight gain and behaviour were closely monitored during the feedlot phase in order to determine the treatment effects and gain an understanding of the causal mechanisms involved. Offal and carcases were examined immediately after slaughter for effects of disease, and for meat quality attributes.

The experiment was repeated over three production cycles in order to refine the treatments. Ultimately, two types of yard weaning treatment were thoroughly tested, with and without the experimental vaccines, so that the most cost-effective combination could be determined. These experimental yard weaning procedures were compared with a control group which was paddock-weaned according to the common industry practice for *Bos taurus* cattle at the present time. The yards used for weaning were 14x14 m, each holding 50 calves of 180 to 260 kg liveweight ($4m^2$/head).

The two types of weaning treatment were: (1) yard weaning for 10 days with good quality hay or silage, but no handling of the cattle during this time; and (2) the same yard weaning plus a novel handling procedure to train the animals to be able to find a grain ration in a trough (see Fell *et al.* 1997). The groups were known as *yard-weaned*, *yard-trained* and *paddock-weaned* controls.

The vaccination treatments, which were administered at times ranging between 77 and 13 days prior to feedlot entry, consisted of experimental vaccines against Pestivirus, Infectious Bovine Rhinotracheitis virus (IBR), Parainfluenza 3 virus (PI_3) and Pasteurelleae (*P. haemolytica* and *P. multocida*). These were experimental vaccines, not yet commercially available, but they were prototypes of vaccines which are now in an advanced stage of commercial development.

For the first two to three weeks in the feedlot detailed measurements of behaviour were made by direct observation and time-lapse video recording with infra-red lighting to enable surveillance of feeding behaviour during the night.

RESULTS

A more detailed account of all the results from this large study can be found in the official report to the funding body (Fell *et al.* 1997).

The production and health measurements summarised in Table 1 show that both the yard-weaned groups had significantly better feedlot performance than the paddock-weaned control group, but there was no significant difference between yard weaning and yard training. There was no significant difference between the groups in pre-feedlot weight gain.

The results presented here are from 1995 only. Results from the previous development phases generally supported these conclusions. In 1993 the trends were the same as 1993 for production and health measures, but the differences were smaller and not significant over 90 days, except for the beneficial effect of vaccination. Liveweight gain in the first month was significantly better for the yard weaning treatments than for paddock weaning. In 1994 there was a 'late' respiratory disease outbreak (after 80 days on feed) with associated mortalities in all groups, but morbidity was again lowest in yard weaned animals. Treatment

Table 1. Average daily liveweight gain (ADG) (kg/head/day) in the first month and after 90 days on feed, and morbidity (% of animals removed from the pen) for *Bos taurus* steers that had been either yard weaned, yard weaned with training, or paddock weaned six months prior to feedlot entry

Treatment Group	ADG (first month)	ADG (90 days on feed)	Morbidity
Yard Weaned	1.54 [a]	1.45 [a]	5.9 [a]
Yard Trained	1.46 [a]	1.39 [a]	17.3 [a b]
Paddock Weaned	1.22 [b]	1.20 [a]	22.2 [b]

Values in the same column with different superscripts are significantly different ($P < 0.05$)

effects on liveweight gain were not significant. There were no deaths in vaccinated cattle from the EMAI source, but the vaccines did not prevent deaths at this stage in cattle from the other source.

The measured feeding activity during the adaptation period (ie time spent at the feedbunk for individual animals) was greatest for yard-trained animals and significantly less for the paddock-weaned groups, but this difference did not persist beyond two weeks in the feedlot.

In the yard-trained groups it was possible to measure animal temperament by means of a confidence test (see Fell *et al*. 1997) and it is of interest to note that, if six animals with particularly bad temperament had been excluded from that feedlot group, its morbidity would have been 10.2% rather than 17.3% (see Table 1). The liveweight gain of a group of 18 animals classified as 'shy' by this test in Phase 3 was 1.22 kg/head/day compared to 1.43 kg/head/day for the remainder of the group.

Table 2 shows (Phase 3 data) that the combination of yard weaning and pre-feedlot vaccination produced the best feedlot performance and the paddock-weaned, unvaccinated (control) group was significantly worse than any other group in terms of liveweight gain.

The vaccination treatment also had a significant beneficial effect on liveweight gain. The overall comparison between vaccinated and unvaccinated animals was 1.43 vs. 1.35 kg/head/day ($P < 0.05$). Over all three years there was a consistent difference of 8% in favour of vaccinated animals. However, there was also significantly higher morbidity (as measured by % removals from pens) in the vaccinated groups, particularly in 1995 (see Table 2).

The liveweight gain of animals that were found to be sick during the trial was significantly less than that of healthy animals. This difference was less after 90 days on feed than it was in the first month, but it was still a significant difference (1.56 vs. 1.43, $P < 0.05$) when averaged over all three phases.

The treatments had no effect on fat depth or dressing percentage of the carcases.

Table 2. Average daily liveweight gain (ADG) (kg/head/day) in the first month and after 90 days on feed and morbidity (% of animals removed from the pen) for *Bos taurus* steers that had been either yard weaned, yard weaned with training, or paddock weaned six months prior to feedlot entry and treated or not treated with experimental vaccines against respiratory disease one month prior to feedlot entry

Treatment Group	ADG (first month)	ADG (90 days on feed)	Morbidity
Yard Weaned, Vaccinated	1.62 [a]	1.46 [a]	12.0 [a]
Yard Weaned, Unvaccinated	1.46 [b]	1.43 [a]	0.0 [a]
Yard Trained, Vaccinated	1.48 [b]	1.44 [a]	21.2 [b]
Yard Trained, Unvaccinated	1.44 [b]	1.35 [b]	13.5 [a]
Paddock Weaned, Vaccinated	1.45 [b]	1.27 [b]	25.9 [b]
Paddock Weaned, Unvaccinated	0.99 [c]	1.13 [c]	18.5 [b]

Values in the same column with different superscripts are significantly different ($P < 0.05$)

Economic analysis

This showed that all treatments improved the gross margin for feedlot finishing compared to the control (paddock weaning) treatment. The highest improvement in gross margin was in the yard-weaned group and the yard-weaned, vaccinated group where, using projected income levels and price levels, an improvement of $33 per head was achieved in the feedlot. On-farm costs of $5.50 per head for yard weaning alone or, perhaps, $15 with vaccination (the price of future vaccines was not known), must be deducted from this benefit giving an added value of $18 to $27.50 for feeder steers that are prepared in this way.

DISCUSSION

It is clear that weaning in yards had a beneficial effect on the feedlot performance of short-fed *Bos taurus* steers in these experiments. Possible reasons for this effect could be (1) the learned feeding behaviour resulting from yard weaning and training, (2) taming and quietening of temperamental animals during the yard treatments, (3) strengthening of social bonds between animals during the yard weaning and (4) greater familiarity with yards, troughs and human activity in yard treated groups. While each of these probably played some part, the results indicated that (1) and (2) were not major factors because additional training to find grain in a trough gave no extra advantage, vaccinated animals did not have greater feeding activity in the first two weeks and there were still temperamental animals in every group at the conclusion of the treatments.

The most likely explanation (based on observations of pair-bond formation and social behaviour in the feedlot pen) seems to be that stronger social bonds which developed between individual animals during yard weaning helped to protect these animals against the stress of adapting to the feedlot. It is planned to test this hypothesis in future experiments.

Although the vaccination against respiratory disease improved weight gain, presumably due to a reduction in subclinical and clinical disease, this was not reflected in the morbidity data based on the numbers of animals removed from the pen by the feedlot stockmen. However, some of the vaccinated animals identified for removal from pens were not clinically sick so it is possible they were exhibiting some side-effect of a successful immunological defence against infection. Further work is needed.

The suggestion of a relationship between animal temperament (measured at weaning) and both liveweight gain and morbidity in the feedlot agrees with and adds to Voisinet *et al.* (1997) and Burrow and Dillon (1997) and is certainly worthy of further investigation.

The economic advantage of yard weaning as carried out in this study and the use of vaccines against BRD that will be commercially available in the near future warrants consideration by beef producers who currently wean their calves by turning them out into a paddock with no further supplement or handling. However, additional training during yard weaning to find grain in a trough did not appear to be cost-effective.

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