A PRACTICAL METHOD OF SELECTING BULLS FOR TICK RESISTANCE

P.J. ROUND*, K.S. WATERS** and J.C. MULDER*

SUMMARY

This project evaluated an effective practical system of bull selection based on high resistance to cattle tick (Boophilus microplus) and high liveweight gain, in a five year study with a Droughtmaster herd of 2,000 cows. Growth rate and tick resistance were unrelated (r range=-.27 to .24). There was a high correlation of tick counts over two successive days following earlier artificial infestation. Our study shows that bulls with a high tick resistance can be reliably identified.

(Keywords: ticks, tick resistance, growth, selection, bulls).

INTRODUCTION

The cattle tick is a major ectoparasite of the cattle industry in Queensland. This industry can no longer afford to rely solely on chemicals to control ticks which rapidly develop resistance to specific tickicides. Research shows that Bos indicus crossbred cattle have a high tick resistance (>95%), that there is a wide variation within crosses and the characteristic is highly heritable (Seifert 1971; Utech et al. 1978). Many Bos indicus x Bos taurus cattle (approx. 50% indicus content) have a high level of resistance, but others have only low resistance (Seifert 1971). Selection of bulls for high resistance offers an alternative method of control to tickicides.

For selection programmes to be accepted by the industry they must be as simple as possible, but give reliable and accurate results. Our paper describes a simple method of using a single tick infestation together with growth performance for selection of bulls. This method is suitable for immediate use by those producers in the tick infested areas wishing to use crossbred cattle and increase the tick resistance of their bull replacements.

MATERIALS AND METHODS

The bulls involved originated from two properties, Valley of Lagoons and Mungalla northwest of Townsville. Valley of Lagoons is an inland property basically open eucalypt forest grassed mainly with Heteropogon and Bothriochloa species on 42,000 ha. Mungalla is in a wet coastal area with alluvial soils grassed mainly with Pangola (Digitaria decumbens) and Para (Brachiaria mutica) grasses on 1,586 ha. There are 2,000 commercial Droughtmaster breeders with an approximate Bos indicus content of 50-60%.

Over a five year period, 1979-83, five groups each of approximately 150 of the heaviest weight for age bulls were left entire. Breeding records indicated that when branded in April/May they had an age range of 90 days. At weaning about 20% of the slowest growing bulls were culled. The selected bulls from Valley of Lagoons were then transported to Mungalla and all bulls run in a common paddock. Data were collected separately from each group.

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Evaluation for tick resistance can be carried out at 10-12 months of age (Hewetson and Utech 1979). In this study bulls were assessed for tick resistance at 18-21 months for managerial reasons. As growth rate in this environment is slow (approx. 0.4 kg/day) growth evaluations were carried out when bulls were approaching physical maturity (30-33 months).

Tick resistance was determined using a system whereby animals were artificially infested with 20,000 larvae, applied with special collars (Hewetson and Utech 1979). Engorging female ticks on one side 4.5-8 mm in diameter (Wharton and Utech 1970) were counted 20 and 21 days later for the first three groups and thereafter on day 21 only. The bulls were restrained for counting in a modified squeeze crush.

Bulls were given a tick resistance rating calculated using the formula:-

\[
\text{Tick rating} = \left(1 - \frac{C_i}{\bar{C}}\right) \times 100
\]

where \(C_i\) = tick count of the \(i\)th animal
\(\bar{C}\) = mean tick count of the group (Seifert pers. comm.)

Tick ratings are scaled between 0, highly susceptible and 100 highly resistant.

Bulls were weighed each year at approximate age 30-33 months when final selection was made. Correlations between growth rate and tick resistance were calculated using \(\log(x+1)\) transformation of the tick count \(x\).

For simplicity in selection bulls are divided into four groups:-

1. Growth rate - mean and higher; tick rating - 80 and higher.
2. Growth rate - below mean; tick rating - 80 and higher.
3. Growth rate - mean and higher; tick rating - below 80.
4. Growth rate - below mean; tick rating - below 80.

Normal tick control on Mungalla was 2-4 short interval dippings (<21 days) during July-September period, with occasional dippings if tick population was sufficiently high. Bulls were allowed a minimum period of 7 months without dipping to assist the development of immunity. Assessment was done in July because the heavy wet season delays the natural rise of tick population until March/April and bulls need time to be challenged and develop immunity. This was the time when nutrition was best so there was no confounding effect of nutritional stress with tick infestation.

Each year bulls were chosen for use in the breeding herd. Rejections are made for: - physical defects 1-2%; pendulous sheaths 10-15%; presence of horns 30-35%; poor temperament 2-3%. Of the remaining 80 bulls, 20 with the highest growth performance and tick ratings were retained. Bulls not used in the Valley of Lagoons herd were offered for sale. Information on growth performance and tick rating was available to intending buyers.

RESULTS AND DISCUSSION

The project demonstrated that the technique of single artificial infestation after a period of natural exposure to ticks, combined with one count of engorging female ticks 21 days after infestation appeared to provide a reliable indication of tick resistance among bulls, allowing accurate selection for this trait.
On subsequent days of counting (days 20 and 21) we found few differences in ranking. Of the 25% of bulls with the lowest tick counts 81-94% maintained their ranking over six assessments (Table 1). This percentage is high enough to eliminate the second count and avoid yarding cattle for two nights. As resistant bulls remained in their tick resistance categories this was sufficiently accurate in practice.

Table 1. Percentage of the 25% most resistant bulls remaining in the same tick category for counts on day 20 and 21, number of animals and correlation between first and second day tick count (tick counts were (log count +1) transformed)

<table>
<thead>
<tr>
<th>Period</th>
<th>% bull remaining in group</th>
<th>No. of Animals</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 1978</td>
<td>93.8</td>
<td>62</td>
<td>0.88</td>
</tr>
<tr>
<td>December 1978</td>
<td>81.3</td>
<td>65</td>
<td>0.86</td>
</tr>
<tr>
<td>September 1980</td>
<td>87.9</td>
<td>176</td>
<td>0.95</td>
</tr>
<tr>
<td>July 1981</td>
<td>91.6</td>
<td>95</td>
<td>0.92</td>
</tr>
</tbody>
</table>

The correlations between tick resistance and liveweight gain were poor (Table 2). This lack of relationship has implications in management as it doubles the number of animals which must be tested. Our findings agree with O’Rourke (1981) and substantially agree with information cited by him, derived from research herds.

Table 2. Correlation between growth rate and tick count

<table>
<thead>
<tr>
<th>Period</th>
<th>Tick Assessment date</th>
<th>Mungalla bulls Correlation</th>
<th>Valley of Lagoons bulls Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>17.2.81-30.7.82</td>
<td>-0.19 (10)</td>
<td>-0.27 (59)</td>
</tr>
<tr>
<td>Group 2</td>
<td>22.12.81-9.8.83</td>
<td>0.10 (15)</td>
<td>-0.14 (92)</td>
</tr>
<tr>
<td>Group 3</td>
<td>22.83-23.8.84</td>
<td>0.05 (11)</td>
<td>0.24 (49)</td>
</tr>
<tr>
<td>Group 4</td>
<td>31.1.80-5.9.81</td>
<td>0.04 (34)</td>
<td>0.06 (49)</td>
</tr>
</tbody>
</table>

Numbers in brackets indicate the number of animals.

Animals with tick ratings of 80 and higher are above average resistance. We have found that the selection method used simplifies the mechanics of selection and allows quick comparisons of all animals. The majority of bulls selected come from group 1, above mean growth and above 80 tick rating.

Later it is hoped to monitor the changes in tick numbers of distribution of resistant and susceptible animals. No selection has been carried out on females and we are only now reaching the stage where progeny of selected bulls are being evaluated (Round, Waters, unpublished data).

Selection procedures must be simple and reliable. Our method is suitable for immediate use by those producers in the tick infested areas wishing to use cross-bred cattle and increase the tick resistance of their bull replacements.
ACKNOWLEDGEMENTS

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REFERENCES