An Overview of the Incorporation of Management Systems for Red and Rusa Deer in Queensland within a Decision Support System

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ABSTRACT: Decision support systems (DSS) provide for effective transfer of new information and technology in addition to evaluating management scenarios to aid in end-user decision making. The latest FEEDMAN (Version 3) software package has been developed to provide a deer module, in addition to an existing beef management DSS template, applicable for use in pastoral-based animal production systems in southern Queensland. FEEDMAN incorporates results from research on grazing systems for both beef cattle and deer, and has been released commercially to aid in decision making and strategic planning for farmers and agricultural consultants. The package considers input data and parameters for a specific farm and essentially evaluates feeding management strategies for both beef cattle and deer in sub-tropical Queensland. Since it is a repository of past research it is an aid to information transfer and to the adoption of sustainable pastoral animal production based on deer and or cattle. While existing and potential deer farmers will benefit from use of this package, an ultimate goal is to encourage more commercial size deer enterprises seen as essential for a sustainable and viable deer farm industry in Queensland.

Key Words: Farmed Deer, Decision Support Systems, Model Development

INTRODUCTION

The farmed deer industry in Queensland is currently considered an emergent animal industry within a consolidation/commercialisation phase. The industry is based on two major species, namely temperate adapted red deer (Cervus elaphus) and tropically adapted rusa deer (C. timorensis). Recent survey data (Sinclair, 1997) elucidates an industry of some 20,000 head in total from approximately 100 farmers, however only 20% of farms account for more than 75% of the total deer, with 77% of farms having deer fence areas < 40 ha and deer numbers < 200 head. The inability of the industry to attract commercial operations with economies of scale for management, product processing and marketing has been a recognised major impediment to industry growth and development (Woodford, 1997). This poses the question of how new participants can be encouraged into the industry and existing larger farmers encouraged to expand activities.

We hold the view that in spite of the uniqueness and infancy of deer farming in Queensland, diversification by say existing commercial beef producers into deer production would be encouraged by an interactive computer-based decision support systems (DSS). It would aid in information transfer, farm scenario evaluation and decision making. In recent years a range of DSS have been compiled for Queensland beef producers (eg. Gillard and Monypenny, 1988; Rickert et al., 1996). This paper provides an overview of how farm management options and technical knowledge for deer farming can be incorporated into an existing beef cattle DSS to provide a cost-effective decision support tool for both beef and deer production systems in southern Queensland. The benefits of including a novel component of animal production in DSS (as most beef producers in southeast Queensland would regard deer farming) are also described.

MATERIALS AND METHODS

Selection of existing beef cattle DSS for deer model development

In view of limited resources available to the deer industry for research and development (a function of low product volume and levy revenue) it seemed appropriate to adapt an existing beef cattle management DSS to encompass deer management scenarios.

FEEDMAN Version 2 is a computer based DSS for pastoral-based beef cattle production in southeast Queensland. It is user-friendly software that compares feeding management scenarios for growing cattle in terms of forage utilisation (including supplementation), animal performance, market options and economics (Rickert et al., 1996). In view of the similarities of soil types, vegetative zones and pasture species specified for FEEDMAN with those evident in both intensive and semi-intensive deer production systems in southern Queensland (Sinclair, 1997; 1999), it was logical to adapt FEEDMAN to simulate deer production from pastures in south eastern Queensland.

Model development

The development of FEEDMAN V2.0, used as a template for development of the deer model, has been described previously by Rickert (1998). While the basic structure, and in particular data input and forage production/utilisation rules and calculation remain the same, the animal production module had to be modified for deer. While the original FEEDMAN calculated animal production based on a user-specified potential liveweight gain (Plwg) for a standard steer for a given forage (Rickert et al., 1996), insufficient field and research observations on animal growth precluded this approach for deer. Rather, using the Plwg specified for steers for a forage, a 'steer bio-assay', was regressed to determine the ME of a selected forage.

On this basis, and using the principles of growth prediction from ME intake as determined in
accepted ruminant feeding standards (SCA 1990), ME intake and ultimately animal production (growth) was calculated using algorithms derived from both published and non-published datasets and information pertaining to red and rusa deer in Queensland (Woodford, 1997; Sinclair, 1999). Further modifications to both potential DM intake and growth prediction were also required, to account for the complex interactions of breed, genotype, seasonality and breeding (rut) effects evident in deer biology and production in Queensland as described by Woodford (1997). Velvet production for stags can be derived from default values, user input values, or by calculation based on liveweight.

Deer production algorithms and assumptions were incorporated into the existing DSS template based on Microsoft® Access 97 (© 1996 Microsoft Corp.) using Access Basic™ program code. The algorithms were first developed and tested in a spreadsheet.

**Input data**

Users of the software are required to input information on the farm and forages monthly rainfall, mob management, market specifications and variable costs as per FEEDMAN V2 (Rickert et al., 1996). Default values are also available. The deer module requires further specification of the deer farm area and an option harvesting velvet from entire mature males (ie. stags). Only growing deer can be specified (ie. stags, castrates and non-pregnant, non-lactating hinds), although FEEDMAN v 3.0 has been expanded to include breeding cows as well as growing cattle. It should be noted that with regards to mob management, deer and cattle can not graze together in the same paddock.

**RESULTS**

The compiled new version of FEEDMAN, encompassing both deer and beef cattle production systems, exists as IBM-compatible CD-ROM software marketed by Queensland Department of Primary Industries as FEEDMAN v 3.0.

**USER INTERFACE**

Data are entered via forms with user-friendly dialogue boxes, option and data selection buttons, help notes and error traps (Figure 1).

Figure 1. Example of a screen interface for FEEDMAN v. 3.0 DSS.

The interface has been designed to allow ease of data entry and selection of farm management options. All key parameters have default values, which can be changed to reflect local conditions.

**PROGRAM FEATURES**

Input data is compiled and calculated to generate results provided in the form of reports, detailing forage supply/utilisation, mob management and animal production, performance summaries, economics and market options. These reports are supplemented by summary graphics regarding performance and mob value, costs and profit as per original FEEDMAN (Rickert et al. 1996). The deer module also generates, where appropriate, velvet production and value reports. In fact deer production and economics, market options etc. have been largely incorporated into existing DSS template report and graphic formats. Sustainable stocking rates are also assessed from estimates of forage growth and safe levels of forage utilization.

FEEDMAN produces a wealth of information (Gaffney, 1997) that is presented in 10 separate reports. Table 1 is an example of one report called a performance summary. It displays monthly rainfall, paddock ID (denoting area and soil type, fertility) and forage type (including supplementation), forage yield and utilisation, and animal performance. Note that both cattle and deer can be accommodated on the same property. Monthly liveweight performance is recorded for both species, with stags in this example also selected for velvet production, which is duly recorded. Monthly liveweight gain is provided as a graphic option for individual mobs.
Table 1. Example of a performance summary report from a hypothetical beef and deer property in southern Queensland as generated by FEEDMAN v 3.0.

<table>
<thead>
<tr>
<th>Item of Performance</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
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<th>Nov</th>
<th>Dec</th>
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<tbody>
<tr>
<td>Rainfall mm/month</td>
<td>102</td>
<td>62</td>
<td>54</td>
<td>30</td>
<td>33</td>
<td>40</td>
<td>27</td>
<td>29</td>
<td>61</td>
<td>71</td>
<td>89</td>
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<tr>
<td>Mob: 110 Weaner steers; XBS class ID2: 16 Supplementation: Grain at 2 kg/hd/d from May to Aug</td>
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<td>Paddock: SP/Road LW(kg/head), start: 180 max:282</td>
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<td>Forage: TropGnolegumeOld Velvet kg 0</td>
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<tr>
<td>AvLiveWeight kg/head</td>
<td>0 0 0 189 203 215 225 236 243 252 266 282</td>
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<td>AvForageYield kg/ha</td>
<td>1747 2056 2224 2048 1790 1530 1289 1180 1153 1611 2269 3143</td>
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<td>AvForageUtilisation %</td>
<td>27 26 26 31 34 36 37 38 39 36 32 27</td>
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<tr>
<td>Mob: 90 2 yr-old stags; ARS class ID2: 17 Supplementation: none</td>
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<td>Paddock: SP/Deer LW(kg/head), start: 140 max:151</td>
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<tr>
<td>Forage: TropGnolegumeNew Velvet kg 2.27</td>
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<tr>
<td>AvLiveWeight kg/head</td>
<td>144 147 148 148 147 146 144 142 144 146 148 151</td>
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<tr>
<td>AvForageYield kg/ha</td>
<td>1532 1806 1968 1889 1724 1438 1179 1048 1011 1389 1944 2649</td>
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<td>AvForageUtilisation %</td>
<td>26 25 26 28 30 32 35 37 38 35 32 28</td>
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</table>

XBS X-bred steer ARS Australian Red Stag

VALIDATION AND EVALUATION

The FEEDMAN package has been satisfactorily validated and evaluated for both forage production and cattle liveweight gain by comparison of experimental and field observations against the models predictions (Rickert, 1998). Deer production has to date been validated against a very limited dataset of research observations, due to the scarcity of data on performance for farmed deer in Queensland, especially across a range of forage types. Nevertheless FEEDMAN-generated deer performance was similar to the data from a research farm and appears to agree with deer farmer observations, due to the scarcity of data on experimental and field observations against the models predictions (Rickert, 1998). Indeed, the addition of a deer module has effectively provided a conduit for existing deer farming technical and management knowledge (both research and field data) to be passed on to both existing and potential deer farmers in southern Queensland. In view of the limited knowledge of farming both sub-tropical (ie. rusa) and temperate (ie. red) deer species in the sub-tropical

DISCUSSION

FEEDMAN v 3.0 is a new computer DSS that has modified V2.0 to enhance the existing beef production component, but more importantly to include a component for farmed deer in Queensland, not previously available to the pastoral industry.

FEEDMAN is a technically complex package in that a range of soil, rainfall, vegetation and forage, animal, market and economic variables must be integrated, assessed and reported. Nevertheless the package is presented in a user-friendly format and application as acknowledged by peer review (Gaffney, 1997). FEEDMAN is an ‘expert system’ that allows beef cattle producers and deer farmers to evaluate numerous feeding and mob management scenarios in order to evaluate on-farm strategies, particularly cost-effective feeding management to meet specific market requirements (Rickert, 1998). Estimates of farm forage and animal production are complemented by market options and economics as an important aid to both tactical and strategic decision-making. While FEEDMAN is designed to be interactive and user-friendly, the degree of technical inputs and interpretation required for effective use of this package suggests a target user group of competent farmers, agricultural professionals and farming systems proponents (Gaffney, 1997). Whilst the software package is used to evaluate alternative management scenarios it is the end-user who is responsible for decision making (Gillard and Monypenny, 1988).

Essentially the design of the new FEEDMAN software consists of interrelationships between inherent biological models (both deer and cattle) and the overall DSS framework, as exemplified in recent DSS packages for the temperate Australian cattle and sheep grazing industries (Donnelly et al., 1997). The importance of a computer DSS to aid in effective transfer of new information and technology to pastoral animal industries is widely recognised (Donnelly et al. 1997; Gaffney, 1997) and the FEEDMAN package is no exception (Rickert, 1998). Indeed, the addition of a deer module has effectively provided a conduit for existing deer farming technical and management knowledge (both research and field data) to be passed on to both existing and potential deer farmers in southern Queensland. In view of the limited knowledge of farming both sub-tropical (ie. rusa) and temperate (ie. red) deer species in the sub-tropical

environment of southern Queensland, such information transfer can be seen as critical in aiding industry development (Woodford, 1997).

Whether or not FEEDMAN V3 helps to establish the deer industry in south east Queensland by increasing the number and size of commercial farms remains to be seen. Successful integration of pastoral deer and cattle farming systems exists in New Zealand (Cowie, 1991), and is a valid management option for southern Queensland which can be evaluated as ‘what if’ scenarios by FEEDMAN. Certainly the addition of the deer module to the package may stimulate the wider adoption of the FEEDMAN. However, the eventual impact of FEEDMAN on industry depends on how well it is accepted. An essential ingredient to this end is a ‘product champion’ who enthusiastically uses, evaluates and promotes the package (Rickert, 1998).

ACKNOWLEDGMENTS

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REFERENCES


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