

## Impact of weeds on animal productivity

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### Summary

Weeds can impact significantly on animal productivity. In some cases they provide an inadequate diet for stock or are unpalatable. This causes reduced weight gains and deficiency diseases, which can lead to reproductive inefficiencies and affect the quality of animal products. Sharp seeds and thorns can cause physical damage to the feet, eyes and other tissues, facilitating bacterial infections and reducing the quality of animal products. Poisonous weeds can cause significant increases in livestock deaths, as well as reducing the productive life of animals and the quality of animal products. Poisonous residues from weeds can be retained in animal products. These, and other weed chemicals, can taint products such as meat and milk, and thus reduce their marketability. The costs involved in managing livestock exposed to weeds with undesirable characteristics can be substantial, and add significantly to the cost of livestock production.

### Introduction

Weeds impact on animal production in a number of ways, many of which are difficult to quantify in monetary terms. This paper considers some of the issues involved, with particular reference to two poisonous weeds affecting livestock production in Australia.

### When are weeds not a problem for animal productivity?

While loss of animal productivity can be a significant factor in the overall cost of a weed problem, in some cases it is not a major consideration. Indeed, some weeds may have little or no effect on animal production and are, in some cases, or at certain times, not a problem but a blessing. Capeweed (*Arctotheca*

*calendula*), for example, is valued by Australian farmers as a source of feed for livestock, especially during periods when no other feed is available. Barley Grass (*Hordeum* spp.) also can be a useful forage in winter and early spring. In these circumstances, livestock may be effectively used to control the weeds concerned. However, caution is necessary when making an assessment that livestock are unaffected by a particular weed, because the adverse effects of some weeds are not immediately obvious. Some deleterious substances, e.g., pyrrolizidine alkaloids, present in weeds such as Paterson's Curse/Salvation Jane (*Echium plantagineum*), are characterized by a delayed effect on animal health and production (14,17). Some other toxic components may be retained by animals without apparently affecting them (e.g., the non-protein amino acid indospicine from *Indigofera* spp.) (9). They, and other undesirable components, such as substances contributing off-flavours, e.g., from *Brassica* spp., *Arctotheca calendula*, *Allium* spp., can reduce the quality and safety of animal products such as milk, eggs and meat.

Relatively small production losses associated with some weed species, which may have been acceptable in the past, and contamination of animal products not previously recognized nor considered of significance, may be less acceptable in an era where production-efficiency and product-quality are becoming increasingly important to survival in the market-place, and ultimately to the survival of livestock industries.

### When are weeds a problem for animal production?

Weeds are a problem for animal production when they:

- provide an inadequate or unbalanced diet
- contain factors which make them unpalatable
- reduce the quality of animal products
- affect reproductive performance
- cause stock losses

### Weeds which provide poor quality forage

Where a weed provides an inadequate or unbalanced diet or is unpalatable or repellent, animal production losses are akin to a shortage of feed. Weeds such as *Erodium* spp. and thistles, have an effect on animal production by reducing the stocking rate which would otherwise be expected on improved pasture. They compete with, and prevent, more valuable species from growing. As well as reduced weight gains associated with stock feeding on poor quality pastures, adverse effects on animal reproduction can be expected as a consequence of inanition or a lack of essential nutrients. Feed supplying inadequate carbohydrate and protein, for example, can result in pregnancy toxemia in which ewes metabolize fat reserves leading to excess production of fatty acids and ketones and ultimately death (11). Undernutrition of ewes, particularly from mid pregnancy, results in the birth of underweight lambs of low viability. The quality of animal products can also be adversely affected by inadequate nutrition.

### Weeds causing physical damage to stock

Weeds producing sharp seeds, burrs or thorns, e.g., Spiny Burrgrass, *Cenchrus pauciflorus*, can affect animal health and productivity by causing physical damage to the feet and mouth-parts which prevents animals from feeding effectively. Physical damage e.g., to the eyes and feet, also exposes animals to infection e.g. pinkeye, footrot and peritonitis. Contamination of wool by weed seeds such as those of *Aristida*, *Erodium* and *Stipa* spp. lowers the quality of the product and if seeds penetrate the skin of livestock, they can also have an adverse effect on skins and carcass quality. Trimming of carcasses affected by seeds can mean a significant loss of weight of the product.

### Poisonous weeds

Weeds which are poisonous probably have the greatest impact on livestock production and provide perhaps the strongest animal production-based arguments for the development and implementation of weed control measures. The most obvious effect of poisonous weeds is the death of stock, but they also have many other important effects which increase the cost of animal production and reduce the marketability of animal products.

Exposure of livestock to weeds can lead to unpalatable, unwanted and sometimes toxic weed constituents entering the human food chain (e.g., 4,9,12,21). The result is then to reduce the quality and "saleability" of animal products. This is an area of growing importance as markets, driven by public health legislation and consumer awareness, focus on chemical residues in food. The current concerns in this area are mainly on synthetic agrochemical residues, but natural toxins associated with the ingestion of poisonous plants are likely to become increasingly important in the future, with recognition that they are likely to present the greater hazard to human health (1).

Poisonous weeds growing at high density in pastures are the major source of exposure of livestock but feed-lot and intensively reared animals are also exposed when toxic weed components contaminate hay, grain and other items of feed.

### Specific examples of the impact of poisonous weeds on animal production

Two Australian poisonous "weed" problems illustrate a number of issues involved when considering the impact of poisonous weeds on animal production. The direct and indirect impacts of these weeds on animal production have been among issues considered by government-sponsored investigations conducted in Australia in the last decade (2, 3). The data reported in these investigations give some insight into the impact of poisonous weeds on animal production and the nature of the costs incurred in managing animal poisoning diseases caused by weeds. Both examples illustrate some of the dilemmas which arise in assessing both the costs and benefits associated with weeds and balancing competing interests.

#### Annual ryegrass (*Lolium rigidum*)

Annual ryegrass, while valued as a high-quality pasture for grazing livestock in the 350-500mm average rainfall (sheep/wheat) zone of southern Australia, is also considered to be an important weed of cereal crops (7). Its weed status in Australia is at present being exacerbated by its increasing resistance to herbicides (18). It can also, under certain circumstances, become a poisonous plant/weed (5) and it is in that capacity in particular that it is considered here.

The seedheads of annual ryegrass can be colonized by the nematode *Anguina toxicus* which acts as a vector for a toxin-producing bacterium, *Clavibacter toxicus*. The toxins (corynetoxins) (6) produced by *C. toxicus* within the seedhead gall induced by the nematode vector, are potent inhibitors of protein glycosylation (10). They cause annual ryegrass toxicity in sheep, cattle and other livestock. This disease, which was first recorded in South Australia in 1956 (13), appeared in Western Australia in 1968 (8) and has continued to spread throughout the annual ryegrass pastures of both states (3). The direct effects on sheep production include breaks in wool fibres, reduced lambing rates, as well as loss of stock. The deaths of 147,000 sheep and 567 cattle, valued at \$6 million, were recorded in W.A. to 1988, representing about \$7,000 for each of the 866 W.A. farms which had experienced livestock deaths from annual ryegrass toxicity to that time. In 1988, 493 Western Australian properties recorded outbreaks of annual ryegrass toxicity and the disease killed 11,600 sheep and 31 cattle (3). It was estimated in 1984, when the disease had been recorded on 281 Western Australian farms, that losses from annual ryegrass toxicity amounted to \$9.3 million per annum in that state alone. The greatest costs, however, are associated with the management of properties in affected areas aimed at limiting the incidence of the disease (3). The management costs include:

- Cost of spraying to remove annual ryegrass or to reduce seed-set and prevent toxicity developing.
- Loss of pasture productivity from spraying.
- Farmer time in examining paddocks for evidence of poisonous grass.
- Inspection of stock, up to twice daily, for signs of toxicity in paddocks suspected of toxicity.
- Reduce carrying capacity of farms due to the closure of affected paddocks.
- Cost of supplying alternative feed.

Destocking of farms in Western Australia and concentration on grain production has occurred in some instances as a result of annual ryegrass toxicity, illustrating the significant changes in farm management and animal production that a poisonous weed can induce. Land may not be used to the best

economic advantage under these circumstances and flexibility is greatly reduced.

#### **Weeds containing pyrrolizidine alkaloids**

Plants containing hepatotoxic pyrrolizidine alkaloids occur world-wide and are among the worst weeds known for adversely affecting livestock production. Pyrrolizidine alkaloids occur in species of the family Boraginaceae (*Heliotropium*, *Amsinkia*, *Echium*) as well as in *Senecio* and *Crotalaria* species (19).

Two introduced species containing pyrrolizidine alkaloids, heliotrope (*Heliotropium europeum*) and Paterson's Curse (*Echium plantagineum*) form dense infestations over large areas of Australia.

Hepatotoxic pyrrolizidine alkaloids may not, under normal grazing conditions, cause acute toxicity in livestock, although some examples of acute toxicity resulting in deaths do occur (17). However, over several seasons of exposure these alkaloids can cause chronic liver damage (17). Some mono-gastric species are particularly susceptible to pyrrolizidine alkaloids, e.g., horses, pigs and chickens, and they show signs of toxicity in the first year of exposure. Other species, e.g., cattle and especially merino sheep, may not show signs of toxicity for some time but they eventually succumb, with deaths sometimes occurring many months after exposure has ceased, often when liver-damaged animals are subsequently exposed to lush green feed (17).

The direct, adverse effect of *E. plantagineum* on animal production relate in particular to the chronic liver damaged produced by the pyrrolizidine alkaloids and the reduced digestibility of the plant compared to other pasture species. This leads to reduced productivity in terms of lower liveweights and wool production in fewer sheep, and shortened productive life of stock. These factors influence animal production to a relatively greater extent in higher rainfall areas where improved pastures would otherwise provide forage (2). In drier areas, where, in general, poorer quality alternative feed is available, the production losses are, in relative terms, thought to be less and some even consider the weed to be useful as fodder, at least prior to the reproductive phase of growth when it becomes prickly and unattractive to stock (2).

Indirectly, *E. plantagineum* also reduces animal productivity by preventing more

productive pastures from growing by, for example, displacing nitrogen-fixing legumes and using up essential nutrients. Estimates have suggested that *Echium* can reduce grazing capacity by 50 to 70% (2).

The seeds of pyrrolizidine alkaloid-containing plants can contaminate grain, and there have been large-scale outbreaks of toxicity in humans in some third-world countries (20). While such grain is unlikely to be used in human food in developed countries, contaminated grain can be fed to livestock and cause production losses and, occasionally, produce outbreaks of toxicity in intensively raised animals. Chickens are particularly susceptible to these toxins and marked effects on weight gain and egg production have been demonstrated (15,16).

This brief outline of the impact of weeds on animal productivity has indicated some of the issues involved. The effects of weeds on animal production are not widely appreciated, probably because of a lack of hard data to demonstrate the magnitude of the problem. Apathy of stockowners, based on a feeling that little can be done to prevent losses from this cause, may be another important factor.

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