

INTRODUCTION OF GRASSES INTO TUSSOCKGRASSLANDS

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Abstract

This paper reviews the problem of introducing grasses into tussock grassland. The remarks will be of value to those who are contemplating oversowing grasses into tussock grassland.

Where an extended grazing season, improved pasture quality or increased total yield of tussock grassland is required, cocksfoot and ryegrass is recommended to provide higher spring and autumn yields. However, this intended advantage is often reduced by poor establishment and/or survival (often less than 1%) particularly if attention is not paid to correct establishment techniques. The contribution of the **oversown** and resident grasses to total yields will vary, largely due to management practices. In addition on sites where adventive grasses like **browntop** are already present, there is little evidence to suggest that oversowing grasses will improve total yields or seasonal pasture productivity.

This review illustrates that the introduction of grasses into tussock grasslands may not always give the benefits sought.

Keywords: Oversowing, establishment, survival.

INTRODUCTION

While undeveloped tussock grasslands are low producing, oversowing with legumes and raising the soil phosphorus and/or sulphur status increases herbage yields. Barratt and Brash (1965) recorded 7600 kg DM/ha/annum from a tussock grassland at 460 m on the Otago Plateau and Cossens' (1982) formula predicts the potential for tussock grasslands at 1000 m in Otago and Southland to be 3200 kg DM/ha/annum.

Production in **oversown** tussock grasslands tends to be restricted to late spring and summer and therefore to extend the production into early spring and autumn, grasses have to be introduced which are higher yielding at these times (Douglas 1967, Vartha & Clifford 1971). The introduction of grasses into tall tussock vegetation on **YBE** soils, where adventive species such as **browntop** have come to occupy much of the inter-tussock vegetation, has generally been poor. Established plants as a percentage of seed sown may be as low as 0.4% after 2 years (Figure 1). In contrast, introducing more desirable grasses into tussock grassland on **BGE** and **YGE** soils in Canterbury and Otago can be successful (Vartha & Clifford 1973a). These grasses can then make a major contribution to total yield if the pasture is managed so that the sward is opened up and soil fertility improved. But even in these areas there are instances of poor grass establishment or survival (Vartha & Clifford 1973b).

WHY SOW GRASSES

The value of routine grass oversowing must be regarded as questionable. Tussock grassland containing **browntop** and sweet vernal and **oversown** with legumes produced as much feed during late spring and summer as areas **oversown** with both legumes and new grasses (Hall & Scott 1985). The newly introduced grasses merely replaced about half of the existing exotic grasses (Figure 2). However, grass species vary in ability to grow in harsh environments (Ritchie 1974). More importantly some, such as cocksfoot and ryegrass, are suitable for the production of high quality autumn-saved-pasture particularly on summer dry faces (Scott et al. 1985). Here introducing grasses is justifiable.

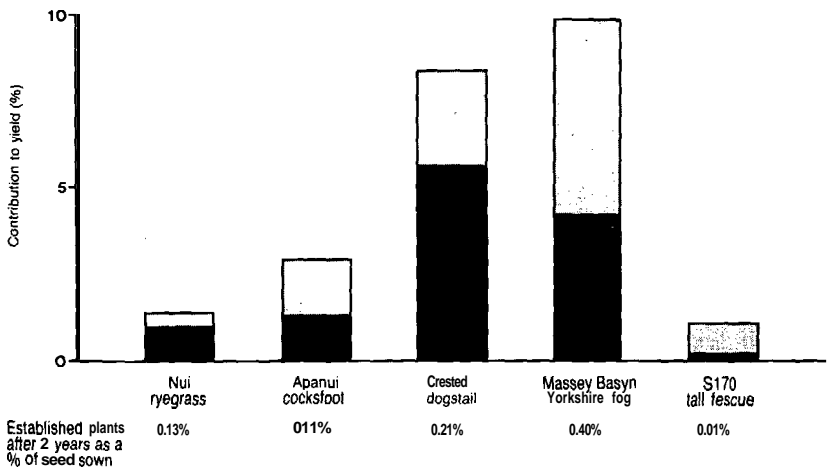


Figure 1: Contribution five sown grasses made to yields of **OVERSOWN** tussock grassland at 450 m on Invermay's Waiora Research Farm (Spring, seven weeks after nitrogen treatments applied — Hall and Scott 1985) ■ No N applied, □ N applied.

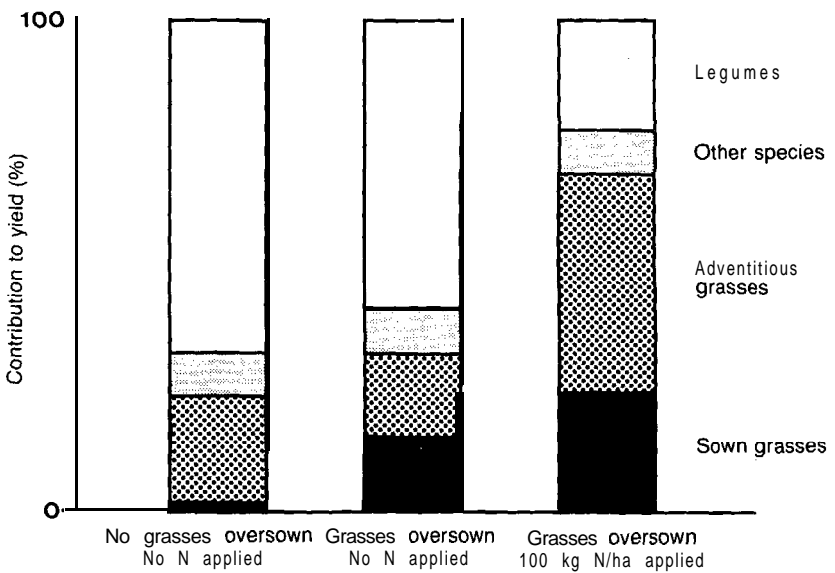


Figure 2: Intertussock pasture composition of grass and/or legume **OVERSOWN** tussock grassland pasture at 450 m on Invermay's Waiora Research Farm (Spring, seven weeks after nitrogen treatments applied — Hall and Scott 1985).

HOW TO ESTABLISH GRASSES

In the drier tussock grasslands and on denuded slopes, grass establishment rates of 14% to 33% have been achieved for uncoated surface sown seed (Scott et al. 1975, Vartha & Clifford 1973a). Establishment was further improved if the seed was raked into the soil surface and/or pelleted. On these sites, low soil moisture levels

can cause problems particularly during establishment. In contrast on hygrous tussock grassland sites, the poor establishment of grasses appears to be related to the presence of a dense resident vegetation.

Modifying or removing resident vegetation prior to sowing can dramatically improve grass establishment (Cullen 1971). For example, when cocksfoot was **oversown** into intact tussock grassland near Lake Mahinerangi, Otago, less than 1% of the seed established regardless of whether N, P, insecticide or fungicide was applied and even though water was not limiting and the resident vegetation had been trimmed to only 20 mm high. In contrast, if the vegetation was removed at ground level prior to sowing 54% established.

Fire can be used to open up a sward but on its own fire is undesirable as the **oversown** seed is often left exposed. For example, on Invermay's Waiora Research Farm where the vegetation was burnt ten weeks prior to oversowing, less than 1% of grass seed produced established plants (Figure 1). Where a limited cover occurs or has been brought about by management, improved grass establishment can then be obtained by using mob stocking to open up the sward further and tread the grass seed into the soil surface (Sithamparanathan et al. 1986). In an experiment at 900 m on a NW facing slope at Tara Hills where this technique was used, 10% of Nui ryegrass, Apanui cocksfoot and Massey **Basyn** Yorkshire fog seed established (Hall unpublished data).

It has been shown that grass establishment in native grasslands can also be assisted by the application of nitrogen, phosphorus, **sulphur**, and lime (Douglas 1967, Cullen 1972). While it is questionable whether the direct application of nitrogen to tussock grassland is an economic proposition, the use of adequate amounts of Pand **S** fertilisers should ensure that there is sufficient nitrogen available for the grasses through N fixation by the legumes. There may also be justification **for** incorporating P, S and N in seed coating materials (Vartha & Clifford 1973a).

Vartha and Clifford (1973a) did not detect any beneficial effects of incorporating fungicide into seed coating materials. However, dressing seed with fungicides (Falloon 1982) and controlling pathogenic fungi by drenching soil with fungicides (Hall et al. unpublished data) can have marked beneficial effects on grass establishment. In view of the very small additional cost of fungicide seed dressings their use might therefore be a worthwhile precaution.

Although insects can have marked detrimental effects on grass establishment, survival and yields, their long term control may be uneconomic. Unfortunately the data on whether insecticide seed dressings can assist seedling establishment in tussock grassland is inconclusive. More research is required on this topic.

WHEN TO SOW GRASSES

The problem is how long after the legumes and at what time of year should grasses be oversown. In extreme sites, seedlings from seed sown in autumn may fail to survive winter frost heave. This may explain Vartha and Clifford's (1971) result that when resowing **ryegrass** 2½ to 3 years after the legumes, sowing in early **autumn** was inferior to sowing in late winter.

In some circumstances grasses can be sown with the legumes. Despite **low** fertility and very low nitrogen levels Cullen (1971) concluded that the grasses would survive and ultimately thrive after the nitrogen status improves. Similarly on north facing slopes with sparse vegetation, White et al. (1973) concluded there was no difference from oversowing grasses with the legumes or sowing them later. In contrast on a south facing slope with a dense vegetation they obtained **Only** 0.1% grass establishment when grasses were sown with the legumes. When grass oversowing was delayed for 3 years after the legumes, **ryegrass** establishment

improved to approximately 7%. This was attributed to elevated soil N levels. However, in some areas the soil N status may be so low that even though there may be bare ground and high initial establishment, the grasses may fail to survive (Vartha & Clifford 1971).

The above conclusions are generally based on experiments with very low rates of establishment or survival. What is needed are a series of **oversown** trials on a range of sites where grasses are sown with the legumes or in subsequent springs and autumns thereafter, and with precautions taken to ensure that germinating grasses have every chance of survival.

WHAT SPECIES OF GRASSES SHOULD BE SOWN

Although cocksfoot and perennial **ryegrass** are commonly **oversown** into hill and high country, it is important to sow the grass most suited to the temperature, fertility and moisture status of an area. Species vary markedly in their ability to establish in different environments. Also attention will have to be paid to their potential productivity once established. Figure 1 suggests that Massey Basyn Yorkshire fog and crested **dogstail** were superior to the other sown grasses. However, this may have merely reflected **the slightly** better establishment by these two grasses. Further information on the best species to sow into tussock grasslands will come from further research.

REQUIRED CONDITIONS FOR GOOD GRASS GROWTH

From a survey Hall & Scott (1985) concluded that N **insufficiency** was widespread in exotic grasses from tussock grassland environments and suggested that this was a prime cause of the poor grass productivity observed in these areas. Subsequently they showed that N applications greatly stimulated total yields (**36-40 kg DM/kg N/annum**) and productivity of the **oversown** and adventitious grasses (Figure 1 and 2). In a legume based pasture, nitrogen insufficiency limits the productivity of the grass component and in many tussock grassland areas the application of additional P and/or S will stimulate legume growth and hence the amount of N fixed and available to the grasses. But greater input of P and/or S to responsive soils would largely be wasted if the nitrogen, phosphorus and sulphur rich dung and urine derived from the **clovers** were deposited in stock camps and not returned evenly to the pastures where they would have the required beneficial effects on the grasses. Subdivision and the controlled grazing of smaller blocks is therefore essential to ensure maximum fertiliser efficiency and productivity. Similarly the application of extra P **and/or** S fertilisers would be of no value in areas where legume N fixation is limited **not** by nutritional factors but by, for example, moisture stress or low temperatures. In these areas the build up of soil N might always be restricted and hence the productivity of the grasses too will be limited.

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