The persistence of introduced pasture species through severe drought on the northern tablelands of New South Wales.

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This paper reports on the longevity of four legume cultivars cvv. Haifa, Grasslands Huia, Grasslands Tahora white clover (*Trifolium repens*) and cv. Grasslands Maku lotus (*Lotus pedunculatus*) with the same companion grasses (phalaris/tall fescue) over five years on the northern tablelands of New South Wales. The study period included a two year drought event that was the most severe recorded this century. All pasture systems suffered major demise of legume cultivars. The only sown species to maintain a substantial presence was phalaris. The drought effects were attributed to plant death from moisture stress rather than overgrazing. Results reinforce the need for drought tolerance characteristics in new pasture cultivars and improved management techniques to rehabilitate degraded pasture.

The pasture environment of the northern tablelands of New South Wales is characterised by high rainfall (750 - 1000 mm AAR) with summer dominance, a 200 day frosting interval with cold conditions in July/August, and acid infertile soils (Hartridge and Parker, 1979). The major stresses for pasture plants are summer/autumn moisture deficit, close grazing during the winter feed-gap, and periodic drought. The main introduced grass species are phalaris (*Phalaris aquatica*), tall fescue (*Festuca arundinacea*), cocksfoot (*Dactylis glomerata*) and perennial ryegrass (*Lolium perenne*). The main pasture legume is white clover (*Trifolium repens*). Red clover (*Trifolium pratense*) may be included in the

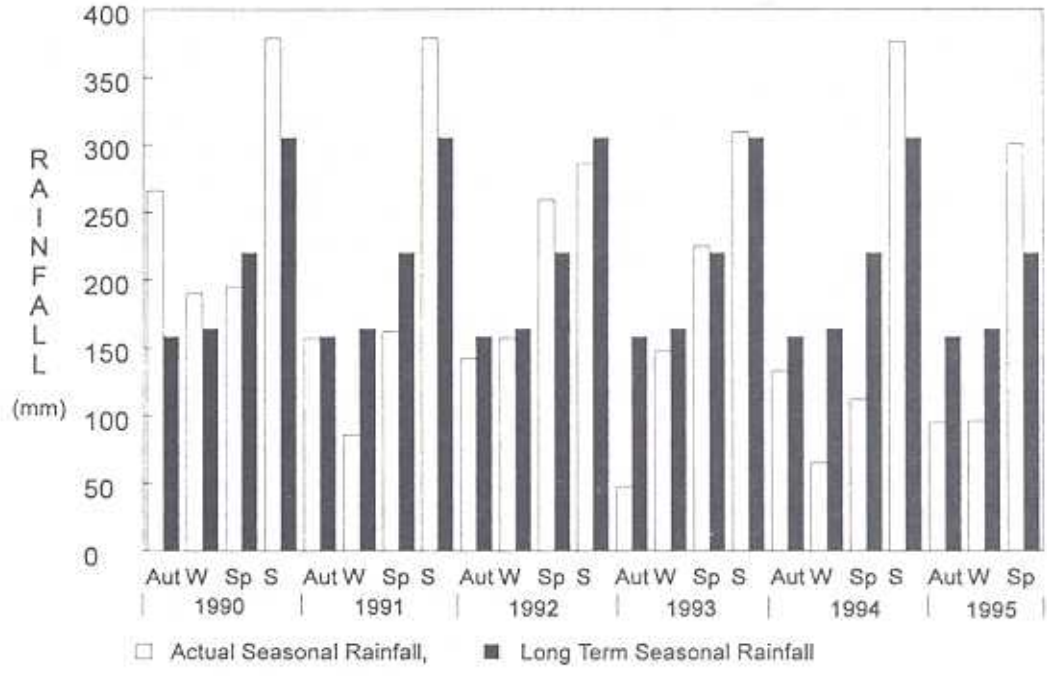

Figure 1. Seasonal rainfall conditions at Glen Innes during 1990-1995

pasture mix to provide an early flush of leguminous forage but is shortlived.

Four white clover cultivars are on the recommended list for dryland conditions; cvv. Grasslands Huia, Grasslands Tahora and Grasslands Kopu for high rainfall districts and Haifa for low rainfall districts. A wide range of alternative perennial legumes has been evaluated for adaptation to the northern tablelands (Ayres unpublished data) and the most successful were Greater lotus (*Lotus pedunculatus*) and Caucasian clover (*Trifolium ambiguum*). *L. pedunculatus* cv. Grasslands Maku is the only Greater lotus cultivar available. Commercial seedstocks of Caucasian clover are not available.

This paper reports on the longevity of cvv. Haifa, Grasslands Huia, Grasslands Tahora white clover and Grasslands Maku lotus with the same suite of companion grasses through a severe drought event.

Methods

***Location*:** The site was located at the Agricultural Research & Advisory Station, Glen Innes (latitude 29^{O} 42' S, longitude 151 ^{O} 42' E, altitude 1057 m) on the northern tablelands of New South Wales. Average annual rainfall is 853 mm with summer dominance (36 per cent incidence between December and February inclusive). The annual temperature range is ca. 25^{O}C; the mean maximum and minimum temperatures in the warmest month (January) are 25.8 and 13.1^{O}C, respectively; the mean maximum and minimum temperatures in the coldest month (July) are 12.3 and 0.2^{O}C. The soil type is a self mulching dark brown clay Ug 5.15 (Northcote 1974).

Pasture Establishment: Pastures were established on four adjacent unreplicated blocks in autumn 1990; block size was four hectares. Each pasture comprised the same suite of companion grasses (tall fescue/phalaris mixture) but differed in the legume component being either cv. Grasslands Huia white clover, cv. Grasslands Tahora white clover, cv. Haifa white clover or cv. Grasslands Maku lotus. Seeding rates were 6, 1.5 and 0.75 kg seed/ha for cvv. Au Triumph fescue, Uneta phalaris and Sirosa phalaris respectively, and 2 and 1 kg seed ha^{-1} for white clover cultivars and lotus respectively (Lowien *et al*, 1991). Planting was undertaken with a conventional disc seeder into a cultivated seed bed. The fertiliser program included 125 kg ha^{-1} SF15 (*compound N/ P/S fertiliser*) at planting and 250 kg/ha single superphosphate as an annual topdressing.

Grazing management: Each block was independently grazed by sheep or cattle to maintain a "yield window" of 2500/1500 kg DMA/ha; *i.e.* grazing was imposed when DMA increased above 2500 kg/ha and grazing ceased when DMA fall below 1500 kg/ha.

Measurements

Plant frequency for the legume component in each pasture system was assessed in November each year by recording the presence or absence of the notional legume in a 1 x 1 m^2 quadrat, expressed as a percentage from 100 estimations obtained randomly along four predetermined transects.

Botanical composition in each pasture system was assessed in November 1995 using Botanal procedures (Hargreaves and Kerr 1978). Data are presented for species aggregated into the following categories; sown perennial grasses, sown perennial legumes (white clover or lotus), native grasses, annual grasses, broadleaf weeds, and other (invading perennials, medics).

Results

Rainfall conditions during 1990, 1991 and 1992 were favourable. However, prolonged and severe drought prevailed during 1993 - 1995 due to low autumn rainfall in 1993, low winter and spring rainfall in 1994, and low autumn and winter rainfall in 1995 (Figure 1).

After five years, pasture systems were in decline as evidenced by demise of all legume cultivars and ingress of broadleaf weeds and annual grasses (Table 1). Clover presence was 22, 9 and 17% of pasture biomass in spring 1993 and 5, 1, and 5% in spring 1995 for cvv. Grasslands Huia, Grasslands Tahora and Haifa respectively. Lotus presence expanded from a low base of 7% frequency presence in spring 1991 to 70% in spring 1992 but thereafter progressively declined with onset of drought conditions (46, 28, and 18% biomass presence in 1993, 1994 and 1995 respectively). A substantial sown grass content persisted in all pasture systems and this was mainly phalaris. Tall fescue declined to only trace presence by 1995.

Conclusions

1. These results derive from unreplicated but adjacent pasture blocks set up to demonstrate temperate perennial pasture systems based on alternative legume cultivars cvv. Grasslands Huia, Grasslands Tahora and Haifa white clover and cv. Grasslands Maku lotus. The pasture blocks were established using the same cultural practices, block size was large and grazing management protocols were identical.

2. The pasture systems were fully established by 1992, however, drought intervened in winter 1993 and continued until spring 1995. Anecdotally, this was considered to be the worst drought on the northern tablelands this century. Under these conditions, the only sown species that retained substantial biotic presence was phalaris. Tall fescue, white clover and lotus declined to remnant levels. The interrow niche sites vacated by legumes became occupied by winter annual grasses (*Vulpia* and *Bromus* spps.), summer annual grasses (*Digitaria* and *Setaria* spps.), broadleaf weeds (*Hypochoeris* and *Gnaphalium* spp.) and invading perennials (*Dactylis glomerata*, *Paspalum dilatatum*).

Table 1. The botanical composition of temperate perennial pastures based on the alternative legume cultivars Grasslands Huia white clover, Grasslands Tahora white clover, Haifa white clover and Grasslands Maku lotus following severe drought.

	Huia	Tahora	Haifa	Maku
Sown Perennial Grasses	44	54	61	49
White clover	5	1	5	6*
Lotus	-	-	-	1
Native grasses	2	-	-	1
Annual grasses	22	19	19	14
Broadleaf weeds	19	11	11	3
Other	7	4	4	26

*indigenous white clover

3. Because the grazing protocols rigorously precluded grazing when pasture yield was less than 1500 kg DM/ha, loss of tall fescue, white clover and lotus is attributed to plant death from moisture stress rather than overgrazing. Accordingly, there are two broad requirements indicated to obviate long term adverse effects from severe drought on introduced pastures in this environment; i) drought tolerance characteristics in new cultivars, and ii) management procedures that multiply up desirable species from remnant population levels.

References

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