

# Future Forage Systems Project

## New Annual Clovers – A brief review

### Introduction

These clover species Arrowleaf (*Trifolium versiculosum*), Balansa (*T. michelianum*), gland (*T. glanduliferum*) and Persian (*T. resupinatum*) are relatively new to New Zealand and are currently being used in a limited way. They appear to be promising in summer dry areas where white clover does not persist. There are many questions about these clovers that we do not yet have the answers for, these include:

- Regional, site and soil suitability
- How best to establish these clovers in direct drilling, cultivation and oversowing situations
- Herbicide and insecticide recommendations
- How to best integrate into farming systems
- Should they be treated as a annual with regular re-sowing or can reestablishment from reseeding be successful

Initial observations of strengths and limitations in New Zealand are shown in Table 1.

**Table 1. Current state of knowledge of annual clovers under New Zealand conditions**

	Strengths	Limitations
<b>Arrowleaf clover</b>	<ul style="list-style-type: none"> <li>• Long growing season, extending into summer.</li> <li>• Can be grazed then shut for hay.</li> <li>• Provides valuable feed over late spring/summer.</li> <li>• Responds well to summer rain.</li> <li>• Ability to suppress summer weed species.</li> <li>• Deep taproot and able to exploit water at depth</li> <li>• Highly palatable, bloat safe legume.</li> </ul>	<ul style="list-style-type: none"> <li>• Intolerant of poorly drained soils.</li> <li>• Poor winter dry matter production.</li> <li>• Requires moderate to high fertility for maximum yields</li> <li>• Requires annual sowing</li> <li>• Weakly crowning</li> </ul>
<b>Balansa clover</b>	<ul style="list-style-type: none"> <li>• Excellent waterlogging tolerance</li> <li>• Adapted to a wide range of soil types and pH ranges.</li> <li>• Sets large amounts of hard seed if allowed to flower.</li> <li>• Can be grazed or used for hay.</li> </ul>	<ul style="list-style-type: none"> <li>• Not suited to infertile soils.</li> <li>• Slow establishment if sown under cold conditions.</li> <li>• Best suited to areas receiving more than 600 mm rainfall.</li> </ul>

	Strengths	Limitations
<b>Gland clover</b>	<ul style="list-style-type: none"> <li>• Moderate tolerance of waterlogging.</li> <li>• Suited for hay production.</li> <li>• Compatible with other annual legumes in mixtures.</li> </ul>	<ul style="list-style-type: none"> <li>• Very early flowering</li> <li>• Short growing season compared to other annual legumes.</li> <li>• Susceptible to competition from more vigorous species during establishment</li> </ul>
<b>Persian clover</b>	<ul style="list-style-type: none"> <li>• Most tolerant of all to waterlogging.</li> <li>• High nutritive value.</li> <li>• Extremely high production potential.</li> <li>• Multi cut forage crop.</li> <li>• Free of oestrogen risks</li> </ul>	<ul style="list-style-type: none"> <li>• Sets little or no hard seed depending upon cultivar</li> </ul>

### *Establishment*

**Rainfall** – Generally adapted to temperate climates with annual rainfall of 350 - 800 mm. Early flowering varieties are suited to lower rainfall zone, and later flowering varieties to higher rainfall areas. It can be grown successfully under irrigation. Tolerance to winter water logging varies considerably with species.

**Sowing** – These clovers may be established by oversowing, by direct drilling or by drilling following cultivation. If drilling, seed depth is critical. Seeds should not be sown deeper than 4-5 mm. Where a well cultivated seed bed and sufficient moisture exists oversowing followed by rolling is the preferred method used in Australia and the USA. Where direct drilling or limited or no cultivation is carried out two sprays appear better than one and the addition of an insecticide in the final spray just before seed sowing may be beneficial (see below).

**Inoculation** – All these clovers require a different strain of rhizobia than white or red clover. Arrowleaf, gland and Balansa clovers use the same inoculant type as subterranean clover (group C), while Persian uses a different type (Group O). Inoculation of arrowleaf, gland and balansa clovers is therefore essential where they have not been grown before. Seed can be ordered coated and inoculated by a range of methods or you may order the inoculant and do it yourself – a cement mixer is ideal. It is important to keep coated and inoculated seed cool and to sow within 10-14 days of it being inoculated. If inoculating yourself, this should be done the day of sowing or the night before and seed must be kept cool.

**Competition** – All these clovers have seeds smaller than white clover. This means that they are slow to establish compared to other legumes and can suffer more from completion from weeds and grasses than other clovers. Seed bed preparation to remove existing vegetation and weed seeds is very important. Post emergence spraying may be required to reduce completion from annual grasses and weeds. Care needs to be taken in selecting appropriate sprays. The following has been successfully used post emergence for the control of grasses and broadleaved weeds in arrowleaf and Persian clover stands in Hawke’s Bay.

250 ml/ha Crest (Galant) plus litre/ha Bonza plus plus 3 litres/ha Troy (Basagran) in 125 litres water /ha). **Note** - clovers must be at 5 trifoliolate leaves or more before application

**Insect attacks** – Severe insect attacks on establishing seedlings has been seen in several instances. The application of a broad-spectrum insecticide at or near sowing may be advantageous. This could be coupled with a final spray of vegetation in a direct drilled situation

or oversowing situation. 1 litre/ha Lorsban (all in 125 litres water /ha). Note - Ensure that any withholding periods are met if treading and grazing after oversowing.

**Hardseed** – Most annual legumes produce quantities of hard seed as a insurance against false strikes from summer rains or early autumn rains. Typically earlier flowering or maturing species and cultivars will produce more hard seed than later maturing ones. Climate during the period when seed is maturing also affects the level of hard seed set. The amount of hard seed produced in New Zealand situations by these new clovers is not yet known.

**Winter activity** – A characteristic of these annual clovers is that they tend to establish relatively quickly in the autumn but then appear to go dormant for much of the winter. Growth begins in late winter early spring. The timing of spring growth is dependant upon both species and cultivar.

**Post Sowing Monitoring** – Stands should be closely monitored for 6-8 weeks after sowing to ensure that any issues, particularly insect or slug damage, are reorganised early and can be managed appropriately.

### *Management*

These clovers can be sown as annuals in intensive situations or can be managed to produce high levels of reseeding in their first year to build a s seed bank for use in following years. Very little seed will be produced if mature flowering stands are hard-grazed. These clovers will generally not recover well from a late cut or grazing when stems are large and the plants tall and flowering.

Management policies required to allow annual regeneration from seed are not yet know for all New Zealand conditions. Until this is known it may be prudent to expect stands to require annual replanting.

It is necessary to ensure that seed has matured before grazing as standing hay. It has been suggested that making hay of a mature stand of annual clovers will case seed drop that will enable a stand to re-establish itself in following years. This has not yet been successfully demonstrated.

### *Feed Value*

These legumes produce high quality feed in terms of crude protein, dry matter digestibility, and metabolisable energy. All decline as they commence flowering as is generally the case with annual pasture legumes. Crude protein levels at 50% flowering may be over 20% and digestibility about 75%. Within 4 weeks, these values may drop to about 14% and 65% respectively. In the same period, metabolisable energy may drop from around 10.5 to 9 MJ/kg DM.

**Yields in New Zealand** – Growth rates can be very large in the spring and early summer which makes these clovers attractive when compared to grass clover swards under dryland conditions.

**Hawke's Bay** - At Poukawa the growth rates of of Persian and Balansa clovers was large through August 2012. On the 24<sup>th</sup> August, Persian clover produced 1542 kg DM/ha (2817 kg DM/ha from a 10 kg/ha sowing) and Balansa clover produced 1561 kg DM/ha – almost all during August. By the 25<sup>th</sup> September, Balansa had produced 5014 kg DM/ha whereas the Persian clover had produced 3358 kg DM/ha. However, after the 25<sup>th</sup> September cut, Balansa failed to re-grow whereas Persian grew at 73 kg DM/ha for October and 40 kg DM/ha for November. In total,

Persian produced 8381 kg DM/ha whereas Balansa produced 5014 kg DM/ha.

**Marlborough** - At Clarence Bridge, Marlborough, dry matter yield of the green clover component of eight clovers on 31 August 2011 (158 days after sowing), and on 14 December 2011 (85 days regrowth after grazing) all exceeded 10 t DM/ha (Table 2). Grey shading indicates perennial clovers, and annual clovers are listed from earliest to latest flowering date.

**Table 2. Growth of a selection of clovers over 158 days**

Clover	t DM/ha		
	31-Aug-11	14-Dec-11	Total
Nomad white clover	4.0	7.3	11.3
Hamua red clover	4.9	7.5	12.4
Prima gland clover	6.8	3.3	10.1
Woogenellup subterranean	6.4	9.6	16.0
Bolta balansa clover	7.2	7.3	14.5
Lightning Persian clover	8.3	11.2	19.5
Cefalu arrowleaf clover	6.9	8.2	15.1
Arrotas arrowleaf clover	5.9	9.6	15.5

## Summary

These relatively new clover species to New Zealand have shown promise in some parts of New Zealand. It is clear they require management and several other factors will influence the choice of species and cultivar. If large areas are to be grown, farming practices may need to change to take into account a reduction in area available for grazing during the establishment of the annual clover (autumn through until late winter).

## References

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