

## EVALUATION OF TRIFOLIUM SUBTERRANEUM SSP. BRACHYCALYGINUM IN SOUTH AUSTRALIA, NEW SOUTH WALES AND QUEENSLAND.

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### Abstract

In a series of trials conducted in South Australia, New South Wales and Queensland 12 ssp. brachycalycinum accessions were tested over 3 years to identify more productive and persistent types for low or erratic rainfall environments with slightly acid to alkaline soils. Seedling recruitment, dry matter production and seed reserves were measured over this period. The results were compared to the control cultivar Rosedale and suggest that large adaptation advantage exist for accession BE011 which was consistently superior across different state environments. BE011 produced on average 34% more dry matter and 27% higher seedling populations than the existing cultivar Rosedale.

**Keywords: *Trifolium subterraneum* ssp. *brachycalycinum*, Rosedale, Clare, subclover.**

*Trifolium subterraneum* ssp. *brachycalycinum* is a relatively under-developed subspecies of subterranean clover (1, 2, 3, 4, 5). There are only two commercial cultivars which have been developed in Australia (Clare and Rosedale) and a further two have been developed overseas (eg. Nuba and Antas). Clare does not persist well under frequent cropping and/or where the growing season is short. Clare is also soft seeded and can also lose substantial amounts of seed through false starts to the growing season. Rosedale was selected to extend subterranean clover into drier cropping - livestock regions (ie. 400 – 480 mm) which have slightly acid to alkaline pH soils. However, since the release of Rose-dale, it has been inconsistent in its performance and has lost favour with some farmers. Therefore, the aim of this study was to find new ssp. *brachycalycinum* cultivars with similar or earlier maturity to Rosedale that would provide more dry matter through a succession of ?seasons. The cohort established comprised of overseas introductions with early to mid-season maturity and hard seed levels higher than Clare, with some lines having similar levels of hard seed to that of Rosedale. The potential area in South Australia, New South Wales and Queensland for this ideotype is 1.8 million hectares. ?This paper will report on the progress and success of this cohort.

### **Materials and methods**

A cohort consisting of 12 (BE001 - BE012) overseas ssp. *brachycalycinum* introductions was selected based on maturity and hard seededness. During 1995 this cohort entered the final field testing stage in South Australia (3 sites), southern New South Wales (2 sites), northern New South Wales (2 sites) and southern Queensland (1 site). Enough seed was provided to sow plots at 8 kg/ha. The Queensland site was re-sown in 1996 due to poor seasonal conditions in 1995. Trials were managed by the state collaborators. Trials in South Australia and southern NSW were not fenced so they were treated like the remainder of the farmer's paddock.

Measurements were made on seedling numbers in the establishment year and subsequent regeneration years, dry matter yields in winter/spring and seed reserves. ??Additional measurements were made, however, these will not be reported in this paper. The data is presented as mean values across all sites and then expressed as a percentage of Rosedale (Rosedale set at 100%). All of the data will be analysed in 1998 using spatial and multi-environment analyses.

Trials are nearing completion and promising lines will be recommended for registration during 1998.

## **Results**

### **Seedling density**

Seedling establishment numbers from the first and regeneration years for 1996 and 1997 are shown in Table 1. The ssp. *brachycalycinum* accessions BE010 and BE011 (126% and 127%, respectively, compared to Rosedale) had the highest recruitment numbers of all the BE accessions. The commercial cultivars Seaton Park and Dalkeith had higher plant numbers (152% and 151% respectively), which may be explained by their lower levels of hard seed (Tables 1 and 3). The poor recruitment observed in BE003 and BE004 was largely explained by poor seed reserves.

### **Dry matter production**

Five of the twelve BE accessions had higher dry matter production than Rosedale when averaged across all sites. The lines BE001, BE009 and BE011 had the greatest production (147%, 129% and 134%, respectively). Lines BE002 and BE010 were marginally better than Rosedale (106% and 104%, respectively). The commercial cultivar Clare had greater dry matter production than Rosedale, the cultivar Seaton Park was only marginally better than Rosedale.

### **Seed production**

Rosedale was the highest seed producer meaned over all sites. In southern New South Wales trials the line BE002 (108%) and Dalkeith (122%) were the only two genotypes to out produce Rosedale.

### **Performance by region**

The overall comparison takes into account seedling density, dry matter production and seed yield. This comparison shows that the accessions BE001, BE009, BE010 and BE011 were ranked the overall best performers (Table 1). The cohort's performance across environments is generally consistent when the top BE accessions from each state are examined (Table 2).

Table 1: Seedling density, dry matter yield, seed yield and overall performance of *ssp. brachycalyximum* accessions compared to Rosedale (=100%) meaned across all trial sites and years.

Line/ cultivar	Seedling count		Dry matter		Seed yield		Overall	
	Mean Plant no./m <sup>2</sup>	% of Rosedale	Mean kg DM/ha	% of Rosedale	Mean kg/ha	% of Rosedale	Mean	% of Rosedale
BE001	670	102	1420	147	236	67	776	118
BE002	476	73	1021	106	257	73	584	89
BE003	391	60	776	81	157	44	442	67
BE004	405	62	700	73	148	42	418	64
BE005	462	71	677	70	175	50	438	67
BE006	456	70	779	81	192	54	475	72
BE007	454	69	874	97	186	53	505	77
BE008	439	67	767	80	158	45	455	69
BE009	621	95	1246	129	225	64	698	106
BE010	823	126	1003	104	254	72	693	105
BE011	832	127	1293	134	306	87	810	123
BE012	567	87	892	93	255	72	571	87
Clare	785	120	1306	136	240	68	777	118
Seaton P.	991	152	991	103	285	81	756	115
Dalkeith	988	151	686	71	335	95	670	102
Rosedale	654	100	963	100	353	100	657	100

#### Performance by region

Table 2: The BE accessions for each state which out-performed Rosedale (based on overall comparison for each state). The % comparison to Rosedale (=100%) is given in brackets.

SA	southern NSW	northern NSW	QLD
BE011 (138%)	BE010 (121%)	BE009 (108%)	BE001 (141%)
BE001 (116%)	BE011 (120%)	BE001 (106%)	BE011 (138%)
BE010 (113%)	BE001 (119%)		BE009 (119%)
	BE002 (115%)		
	BE009 (106%)		

Table 3: Days to flowering from sowing date for WA, northern NSW and SA (average over 5 years); Hardseededness data from SA (average of 4 sites), northern NSW and WA.

Line/cultivar	Days to flowering			Hard seed %		
	WA	northern NSW	SA	WA*	northern NSW+	SA*
BE001	140	118	132	22	60	61
BE002	105	100	110	83	81	81
BE003	111	99	111	69	78	88
BE004	105	99	106	75	56	90
BE005	105	99	103	69	na	78
BE006	111	99	112	79	na	96
BE007	105	98	105	61	na	77
BE008	112	99	111	70	na	83
BE009	105	99	113	59	na	71
BE010	111	100	117	34	na	69
BE011	118	112	127	33	68	60
BE012	118	100	118	54	74	84
Clare	na	118	135	na	67	41
Rosedale	118	100	123	57	58	84
Seaton Pk.	na	na	123	na	50	33
Dalkeith	na	na	105	na	na	75

\* Seed stored for 4 months in alternating temperature cabinet 60°C/15°C.

+ Seeds were hand picked from burrs, stored at 25°C/25°C for 1 month.

na - not available.

## Discussion

The accessions BE001, BE009, BE010 and BE011 are the top performing lines. BE001 will not be chosen as a Rosedale replacement due to its late maturity (BE001 has similar maturity to Clare). BE011 would be a strong contender to replace Rosedale, it has similar maturity to Rosedale (SA and WA flowering data, Table 3). In northern NSW, BE011 (112 days) flowers later than Rosedale (100 days). Hardseededness of BE011 is generally lower than Rosedale, which may favour BE011 in phased farming systems. Possibly Rosedale is too hard seeded for regular recruitment of seedlings and may be better suited to 1:1 pasture crop rotations. BE010 may also be a suitable replacement for Rosedale. Based on WA and SA flowering data the line BE009 flowers at least 10 days earlier than Rosedale and has superior dry matter production, as a result it may be valuable as an earlier flowering ssp. *brachycalycinum* cultivar. In addition, BE009 has high resistance to Red Legged Earth Mite at the seedling stage and similar hard seed levels to Rosedale. BE009 would be suited to frequent cropping systems.

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