

PRELIMINARY INVESTIGATION OF LOCALLY ADAPTED ECOTYPES OF *TRIFOLIUM SUBTERRANEUM* SSP. *BRACHYCALYGINUM* CV. CLARE IN SOUTH AUSTRALIA

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Summary. *Trifolium subterraneum* ssp. *brachycalycinum* cv. Clare is widely used in farming and is a favoured pasture legume. However, for the cereal areas of South Australia its disadvantages of late maturity and low level of hard seed pose problems. The aim of this preliminary investigation was to isolate naturalised strains of Clare from long-term stands (not reseeded for a significant period) to see if any have self-selected for earlier maturity and/or a higher percentage of hard seed. From an original 60 collections, through two years of seed increase and morphological identification and scoring, lines from 11 sites remained under consideration after the 1994 harvest. Initial results suggest no basic change in maturity but some clear increases in levels of hard seed.

INTRODUCTION

In the ASCALIP (Australasian Subterranean Clover and Alternative Legume Improvement Program) project in South Australia some promising potential cultivars of *Trifolium subterraneum* ssp. *brachycalycinum* are being uncovered (1). However, Clare remains a favoured cultivar amongst the farming community, mainly for its generally superior vegetative production. As Clare's main disadvantage is its low level of hardseededness, it was decided to investigate persistent, long-term stands which had not been re-seeded in recent years, had been regularly grazed and, preferably, had undergone some cropping phases during that period. It was felt that, if Clare had persisted under these circumstances, it may well have become naturalised to the point of self-selecting for a higher level of hardseededness, as was found to be the case in New South Wales (2, 3).

From previous surveys carried out by Ted Higgs (pers. commun.) we were able to pin-point four sites in the Adelaide Parklands, many parts of which were still used for grazing dairy cattle as recently as the 1950's. Similarly, sites were chosen at Brown Hill Creek; near-metropolitan in the foothills. For rural areas we started with the Stanley Flat property from which the original seed came in 1941, included the Upper South-East property near Keith where the seed was multiplied prior to release as cultivar Clare in 1950 and then, via the rural/research grapevine identified the remaining sites in Lower and Mid North areas, the oldest being 40 years without re-seeding.

Clare is a most distinctive plant and, until recently, no other member of *Trifolium subterraneum* could be confused with it. Numerous collection trips have been undertaken to countries bordering the Mediterranean Sea without finding any plant which could reasonably be said to be an antecedent of Clare. There has, therefore been much speculation as to the origin of the plants supplied to the Waite Institute in 1941 by Joseph Edward Butler, farmer, of Stanley Flat, 7 kilometres north of Clare. Plants which he said at the time had taken over from Mount Barker. While we did find Clare on the property in this investigation, it was very much in the minority. As to the question of origin, the major options appear to be mutation, out-crossing or introduction.

METHODS

Sites were mapped (and, if appropriate, pegged) during the spring of 1992, including recording environmental data consistent with a Germplasm Collection Expedition. During the summer of 1992/93 burrs were collected from all the sites. In April 1993 these were hand-threshed and hand-scarified prior to sowing in Jiffy pots for propagation on raised tables. When the seedlings were established they were planted out on rows of black plastic with 24 plants per line, in double rows and allowing 1 metre separation between lines. The lines were scored for Winter Vigour, Days to Flowering and Spring

Production. When flowering was well-advanced, detailed morphological examination was carried out by Mr David Little and Dr Carolyn deKoning which resulted in the original 60 lines being subdivided, thus creating an extra 40 variations. Thus we now provisionally identified Clare, Bacchus Marsh, Bacchus Marsh Type, Mount Barker, Mount Barker Type, Woogenellup, Woogenellup Type, Hairy Woogenellup, Geraldton Type, Seaton Park Type, Dwalganup Type, Howard Type and numerous others which had insufficient co-occurrence of characteristics to justify the use of any cultivar name. This variation could be explained by (a) incorrect identification in Spring 1992, (b) failure of identified plants to leave burrs, or, (c) failure to secure burrs of the target plant. Naturally, we lean to (b) or (c) and would not admit to the possibility of (a).

Lines selected on performance were submitted to testing for hardseededness for four months in an Alternating Temperature Cabinet (60°C/15°C). Based on this morphological categorisation 1994 saw 102 separate lines laid out as in 1993, varied only by the establishment of 12 plants per line instead of the 24 of 1993. Similar records were kept on winter vigour, days to flowering, spring production and hardseededness. The morphological identification process was repeated in 1994 which served to clarify those lines which could reasonably be accepted as Clare.

RESULTS AND DISCUSSION

Only those lines which, by morphology, could be reasonably accepted as being Clare and some other *brachycalycinum* types were considered for short-listing. The list of samples which appear in Table 1 were selected on the basis of performance scores in Winter vigour, Spring production and Days to flowering and submitted to the hard seed testing as described above. Winter vigour and Spring production scores are not presented in this paper but there is some evidence that some equalled or surpassed Clare. As can be seen, the ecotypes show no tendency towards earlier maturity, which mirrors the findings of Greg Lodge (2, 3). However, it is clear that some of the samples show a definite advantage in hard seed percentage over commercial Clare, which is also consistent with Greg Lodge's findings (2, 3). There appears to be sufficient justification for further investigation in greater detail than we were able to carry out. Also, to determine whether they are genetically different from commercially available Clare, electrophoresis studies on isoenzymes are needed.

There is some renewed speculation re the origin of Clare, for, among the overseas introductions supplied to us from Western Australia for seed increase in 1994, was one from Cyprus with characteristics, particularly leaf markings, extremely reminiscent of Clare (C deKoning & R Tuckwell, unpubl. data).

Table 1. Clare and ssp. *brachycalycinum* ecotypes collected in South Australia.

Location/ Cultivar	No. of samples	Type	1993		1994	
			Days to flower +	Hard seed % *	Days to flower +	Hard seed% *
Georgetown	5	Clare	124 - 133	36 - 62	133 - 141	-
Stanley Flat	6	Clare	121 - 132	12.5 - 48	136 - 154	32 - 39
Parklands	7	Brachy type & Clare	126 - 137	33 - 41	135 - 149	31 - 68
Ngapala	5	Clare	123 - 132	34.5 - 49	137 - 151	39

Carrick Hill	5	Clare	124 - 129	27 - 47	137 - 148	60.5
Gomersal	1	Clare	132	40	143	30.5
Craigburn	2	Clare	126 - 137	40	135 - 136	48
Brownhill Creek	4	Brachy type	128 - 142	15 - 41	148 - 156	21.5 - 32
Pekina	2	Clare	128 - 132	37 - 42	135	35 - 45
Kangaroo Flat	2	Clare	-	-	135 - 136	43 - 53
Kapinnie	1	Clare	-	-	135	47.5
Rosedale #	-	Cultivar	117	79	123	58
Clare #	-	Cultivar	124	34	135	34
Nuba #	-	Cultivar	135	50	137	45
Pooginagoric	-	Clare strain	124	36	136	57

+ Number of days to reach flowering from sowing date.

* % hard seed following 4 months storage in alternating temperature cabinet at 60°C/15°C.

Commercial cultivars.

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