Trial 3

New Chickpea Varieties for Low Rainfall Areas

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Studies in the mid to late 1980s showed that desi chickpea is adapted to well drained, fine-textured, neutral to alkaline soils (pH 4.5 to 8.5 in Ca Cl_2) in the low and medium rainfall parts of the Western Australian cereal belt (Siddique and Sedgley 1986, Walton and Trent 1988). The seedling growth of chickpea is restricted buy low winter temperatures however it enters a phase of rapid growth when temperatures increase in spring. Its deep rooting pattern and ability for osmoregulation enable chickpea to continue seed filling for several weeks after species such as faba bean and field pea have matured. Like field pea, chickpea is sensitive to transient waterlogging. More recent studies at a wide range of locations have confirmed these observations (Siddique et al. 1993). Cultivar evaluation during the last three years at 6 to 14 locations shows that the standard chickpea cultivars such as Tyson and Dooen produced seed yields from 0.6 to 2.8 t/ha depending upon the growing season rainfall and location. Although Tyson is the most widely grown cultivar, it is late flowering, has a short stature, small dark seeds and variable seed yields, especially in the cool southern cereal belt.

Early flowering is critical for high yields in short season environments, however the high yield potential of early flowering chickpea cultivars and early sown crops is largely limited by the abortion of flowers and pods in late winter and early spring when mean temperatures are below 15^{o}C (Siddique and Sedgley 1986). Thus, chickpea cultivars with early flowering and the ability to set pods at low temperatures are required. Two reputed cold tolerant lines from ICRISAT India, were grown next to standard cultivars at several sites in 1992. Both lines flowered and formed pods earlier than the standard cultivars and the mean temperature from flowering to first pod formation was about 1.2^{o}C less. Although both cold tolerant lines were not specifically selected for local conditions, they produced seed yields equivalent to or greater than Tyson.

In controlled environments, one of the cold tolerant lines set about 60% of its pods when exposed to night temperatures between 3 and 10^{o}C during flowering, whereas a locally adapted line only set 40% of its flowers (Siddique et al. 1994). The introduced and local lines produced more flowers and seeds as night temperatures were increased from 3 to 10^{o}C. Further studies are in progress to screen a wide range of germplasm for their cold tolerance in the field and in vitro using pollen selection techniques. Crosses between the cold tolerant lines and standard cultivars are being made to transfer cold tolerance into locally adapted backgrounds.

Recently, seven introduced lines from India were compared with the standard cultivar Tyson at two sites (Tables 1 and 2) in Western Australia. These lines flowered 5 to 14 days earlier than Tyson and also had greater plant height, mean seed weight and harvest index. Many lines also demonstrated their ability to set pods at low spring temperatures and on average across both sites, all lines out yielded Tyson by 6 to 30%. Some of these lines showed superior quality parameters (composition, cooking time, milling recovery, etc.) when compared with the standard cultivar Tyson. In a survey in the Indian sub-continent (van Rees, Siddique and McClelland 1995) seeds from these new lines had a greater consumer preference than Tyson, Amethyst or Dooen. These lines are being evaluated further and multiplied, and it is expected that some may be released for commercial production in 1996/97.

Table 1. 1995 grain yields of new and existing chickpea lines at Birchip, Three Springs (WA) and Mullewa (WA).

Variety	**Birchip sandy soil GSR 375 mm**	**Three Springs WA GSR 271 mm**	**Mullewa WA GSR 243 mm**
	t/ha	t/ha	t/ha
ICCV 88202	1.50	2.28	1.33
1CCV 88201	1.47	2.60	1.32
ICC 14880	1.53	2.43	1.30
T1587	1.72	2.06	1.24
CTS 11308	1.69	1.83	1.23
T 1069	1.50	2.07	1.12
CTS 60543	1.92	-	-
Desavic	1.86	-	-
Amethyst	1.78	-	-
Dooen	1.69	2.05	1.11
Tyson	-	1.75	1.08

Editors note: the chickpea sown on sandy soil in the 1995 Birchip trial were severely affected by simazine damage. The Indian lines seemed to be less tolerant to simazine compared to the local varieties (for further information of simazine damage on chickpeas see results of Trial 5).

Table 2 Some characteristics of new chickpea lines compared to the standard lines

Line/variety	Origin/release	Characteristics
Amethyst	NSW	Slightly susceptible to cold temperatures and frost at flowering/podding Slightly taller than Tyson, is upright and does not lodge easily More tolerant to waterlogging than Tyson Highly susceptible to Phytophthora
Desavic	SA, Vic	Joint release in 1993 Intended to replace Tyson in low rainfall areas due to its higher yield, larger seed and greater height Erect habit, medium tall height and medium maturity Susceptible to waterlogging and Phytophthora Milling quality is poor
Tyson	India	First released in Aust. 1978 Early to medium maturity Poor seedling vigour Can show susceptibility to iron deficiency Susceptible to Phytophthora Wide adaptation, medium height, high osmotic adjustment capacity, good milling quality
Dooen	Vic	Susceptible to lodging and does not have drought tolerance of Tyson Medium tall (cm>Tyson) habit and medium maturity High seedling vigour Moderate tolerance to waterlogging Susceptible to Phytophthora Does not tolerate high rates of trifluralin

T1587	India	Cold tolerant - sets pods at low temperatures Very early flowering - 10 to 15 days earlier than Tyson Taller than Tyson 8 to 10% higher yielding than Tyson Faster cooking time than Amethysts
CTS11308	India	Cold tolerant - sets pods at low temperatures Very early flowering - 10 to 15 days earlier than Tyson Taller than Tyson Fusarium wilt and root rot resistant
CTS60543	India	Cold tolerant - sets pods at low temperatures Very early flowering - 10 to 15 days earlier than Tyson Taller than Tyson Fusarium wilt and root rot resistant
ICC14880	India	Semi erect, taller than Tyson 7 to 14 days earlier than Tyson
T1069	India	Very early flowering - 10 to 15 days earlier than Tyson Taller than Tyson
ICCV88202	India	Cold tolerant - sets pods at low spring temperatures Very early flowering - 10 to 18 days earlier than Tyson Fusarium and wilt root rot resistant Seed colour pale golden yellow
ICCV88201	India	Cold tolerant - sets pods at low spring temperatures Very early flowering - 10 to 18 days earlier than Tyson Fusarium and wilt root rot resistant

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