Conder - Broad adaptation of a peanut variety selected for irrigation

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ABSTRACT

The first Australian-bred peanut variety specifically adapted to irrigation is “Conder.” The major advantage of Conder over previous varieties is its higher yield potential in irrigated and high rainfall environments. When variety trial results were grouped by their average yield, Conder had the greatest advantage over the Streeton variety in the highest yielding group of trials. Comparison of yield development in terms of water-use at one site, with and without irrigation, found Conder to have greater transpiration efficiency and Streeton to have higher harvest index. Pods of Conder grown under well-watered conditions have a clean attractive appearance, which can generate a bonus payment for the in-shell market. Many dryland growers have been pleased with its yield under a medium to severe end-of-season drought, but quality of dryland Conder is variable.

KEY WORDS

Variety, adaptation, irrigation, drought, resistance, traits.

INTRODUCTION

Peanuts are considered a drought resistant crop of the semi-arid tropics. However they can be grown quite profitably under irrigation. Prior to the 1990’s, peanut variety development in Australia had been targeted at dryland production. Streeton, a variety with adaptation to dryland environments was released in 1994. Since 1993 the Queensland Department of Primary Industries peanut variety development program, with funding support from the Grains Research and Development Corporation has been selecting for, and evaluating performance in irrigated environments. The 1999-2000 season was the first widespread commercial planting of Conder, the first locally-bred peanut variety to be released and specifically recommended for irrigated production. Commercial grading data is now available.

Wright *et?al* (2) have analysed the drought adaptation of peanut using a water-use model originally proposed by Passioura (1): Y = HI x TE x T where yield (Y) is considered as a product of the harvest index (HI), the transpiration efficiency (TE) and the total water transpired (T).

The aim of this study is to compare both the yield of Conder and Streeton in variety trials; and their mechanisms of water-use, with and without irrigation. Quality factors affecting price are noted.

MATERIALS AND METHODS

Since the 1992-93 summer, Conder and Streeton have been included in fully irrigated regional variety trials (RVTs). The adaptation of Conder and Streeton across 29 environments of differing yield potential is compared by taking their mean yield over groups of RVTs with similar mean yield.

In the 1999-2000 season Conder and Streeton were entered as checks in a series of experiments evaluating drought-resistant selections with or without irrigation at Kingaroy. A split plot analysis of variance with experiments as blocks, and presence or absence of irrigation as main-plots, was used to compare all the check varieties for yield and its components according to the water-use model. Results of only Conder and Streeton in the trait experiments are considered; and means are compared by protected Least Significant Difference. HI is estimated by harvested yield divided by a shoot dry matter (SDM) sample, TE is estimated by established correlation with chlorophyll density measured by a SPAD meter, and T is derived from the estimates of TE and SDM (Nageswara rao and Wright, unpublished data).

RESULTS AND DISCUSSION

In 29 RVTs prior to the release of Conder it averaged 9% higher yield than Streeton (Table 1). When trials are grouped according to mean yield, Conder has a higher yield than Streeton in all groups but the greatest advantage is 14%, in the group of trials with mean yields higher than 3.5?t/ha. This group includes sites in North, Central and South Queensland; and included both irrigated and rainfed trials.

In the combined analysis of the trait experiments the irrigated blocks had significantly greater kernel yield and harvest index than the rainfed treatments, but were not significantly different in SDM, TE and T (Table?2). There are significant differences (P<0.01) among varieties for all traits and a significant variety by irrigation interaction for T.

Table 1. Mean kernel yields of Conder and Streeton from 29 Regional Variety Trials.

	All trials	Trials with a Mean Kernel Yield of -		
		1.5 - 2.5 t/ha	2.5 - 3.5 t/ha	>3.5 t/ha
Conder (kg/ha)	3197	2136	3126	4978
Conder (% Streeton)	109	106	106	114
Streeton(kg/ha)	2932	2006	2941	4375

Table 2. Mean sums of squares of 5 traits from a combined analysis of 4 varieties over 8 experiments.

Source	Kernel Yield	SDM	HI	TE	T
Irrigation	$1.6x10^{7}$**	24526	0.152**	0.742	3476
Error 1	$4.1x10^{5}$	132331	0.004	0.401	29058
Varieties	$7.7x10^{6}$**	137109**	0.074**	0.148**	33026**
Variety x Irrigation	$4.0x10^{5}$	38192	0.001	0.005	9003*
Error 2	$1.6x10^{5}$	15935	0.003	0.031	3210

The yield of Streeton and Conder was not significantly different in the trait experiment (Table 3), but Streeton had significantly greater HI (P=0.01) and Conder had significantly greater TE (P=0.05). Other varieties differed significantly in T (P=0.01, data not shown) and had significant interaction with irrigation for T (P=0.05), but Conder and Streeton had a 6% difference in T that was not significant.

Table 3. Means of Conder and Streeton for yield and traits from the trait experiments 2000.

	K. Yield (kg/ha)	SDM (g/m^2)	HI	TE ($g/m^2/mm$)	T (mm)
Conder	2861	1000	0.289	2.49	404
Streeton	2969	902	0.333	2.41	381
LSD (P=0.05)	232	73	0.03	0.05	32
LSD (P=0.01)	307	96	0.04	0.14	43

The small yield difference (836 kg/ha, P=0.01) between the irrigated and rainfed environments (c/f Table?1) prevents extrapolation from the trait experiment to the wide range of environmental yield potential represented in Table?1. On the basis of the RVT data, the similar yield of Streeton and Conder at the yield potential of trait experiments is not unexpected. However, the physiological mechanisms by which these yields are achieved by the two varieties are different. Conder achieves a significantly greater (P=0.01) SDM through higher T and TE. Streeton produces the same yield by a significantly greater HI.

Wright *et?al* (3) have established that most variation of TE in peanuts is due to variation in photosynthetic capacity (rather than variation in stomatal conductance). This, and the lack of interaction of TE with irrigation, suggests that the greater TE of Conder would contribute to higher productivity in both water-limited and non-limited environments.

Grades of commercial crops of Conder varied: the best irrigated crops had up to 38% of pods earning the Nut-In-Shell bonus, but dryland crops averaged 8.3% in the low value hand-picked-kernel grade compared to an average of only 4% for dryland Streeton crops (R.B. Hansen, pers. comm.).

CONCLUSION

Conder and Streeton have different adaptation. Even in environments where they do not differ in yield they achieve the same yield by a different use of the water resource. Crossing Conder with Streeton may allow combination of superior HI and TE for higher productivity in both irrigated and rainfed environments. This study allows no inference as to which traits confer the yield advantage of Conder in high yield potential environments.

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