
PROJECT: Peanut Varieties for Northern Australia

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Location: Douglas Daly Research Farm (DDRF)

Objectives:

To evaluate the growth, yield and disease tolerance characteristics of a range of new peanut varieties.

To identify improved and adapted lines for commercial production in the NT, which meet market specifications.

Introduction:

This trial is a three year collaborative project between DBIRD, the Queensland Department of Primary Industries and Fisheries (QDPIF), the Grains Research and Development Corporation (GRDC) and the Peanut Company of Australia (PCA). The trial is in its third and final year. Each year a number of new peanut lines are sown in replicated plots to evaluate yield, disease tolerance, growth habit and kernel and shell percentage. Much of this research is focused on identifying high yielding, disease resistant high oleic oil varieties suitable for the NT. The market is demanding high oleic varieties due to their increased shelf life and health properties. PCA is currently phasing out low oleic oil varieties and replacing them with varieties containing high levels of oleic oil. Two of these high oleic oil varieties, "McMahon" and "Ford", are being assessed under irrigation this year at DDRF. Both varieties will be used as seed crops to be processed and sold as seed by PCA.

Method:

Eleven varieties were evaluated in 2002 and 19 varieties in 2003 and 2004. The varieties were hand-planted in replicated plots under centre pivot irrigation at DDRF. Plot size is 5 m long by two rows (row width 0.9 m). The trial is a randomised block design with four replicates. The plots are planted to achieve a plant population of 120,000 established plants per hectare. The crop is grown under full irrigation and receives between 5 and 6 ML/ha of water depending on seasonal conditions.

Planting date is scheduled for mid March. Harvest date in 2002 was on 28 August for the varieties marked (#) and 11 September for the remaining varieties (Table 1). Harvest in 2003 was on 19 August for the varieties marked (#) and on 26 August for the remainder (Table 2). Harvest of the 2004 trial will be reported in the 2005 report.

Results:

The varieties were analysed as two separate groups, i.e. according to the organisation to which they belong and the grading standards they use, that is PCA or QDPIF. The difficulty in evaluating peanut lines arises when bunch and runner types are compared directly. Because bunch and runner types are usually graded differently and go to different markets - the nut in

shell market or shelled/salted market - a direct comparison of yield and grade is sometimes misleading.

Additional analysis of total kernel yield grade and shelling percentage will indicate which varieties have the best economic potential for the Northern Territory. After this year, a complete analysis of all the varieties will be undertaken. Overall most varieties in both groups performed well in terms of total nut in shell (NIS) yield per hectare. Differences were observed in shell percentage, kernel weight and disease tolerance.

Table 1. Yield and grades for the 2002 trial (average of all replicates)

Variety	Clean NIS yield (t/ha)	Kernel yield (t/ha)	Jumbo (%)	Grade 1 (%)	Grade 2 (%)	MFG (%)	Splits (%)
Conder#	6.77	4.95	12.4	18.2	12.8	3.2	24.9
D67-1-p15-1^	6.73	4.94	8.2	14.5	21	9.6	15.3
Chiefley^	5.85	4.68	54.1	8.3	3.6	0.9	12.1
B185-2-p11-4#	5.71	4.2	17.3	20.5	14.7	2.7	16.7
D67-1-p20-1^	5.7	4.31	10.1	18.3	20.6	4.9	19.2
Menzies^	5.41	4.27	51	9.3	5.5	1.5	10.5
D67-1-p5-1^	5.27	3.78	19.6	17.9	13.4	3.3	15.3
Florunner^^	5.2	4.12	44.9	11	7.3	2.5	11.8
SO95^	4.94	3.87	52.5	7.9	4.5	1.2	10.8
D75-1-p10-2#	4.86	3.75	54	6	3.4	0.8	12.2
D75-1-p10-8#	4.65	3.53	55.4	5.3	2.5	0.7	11.5

* Pre-cleaned sample

^ Wallabies damaged two replicates prior to threshing, only two replicates were included in this table

^^ Due to damage as above, only one replicate was included in this table

Harvested two weeks earlier than the other varieties

Table 2. Yield and grades for all 2003 trial varieties (average of all replicates)

Treatment	Clean NIS yield (t/ha)	Kernel yield (t/ha)	Jumbo (%)	Grade1 (%)	Grade 2 (%)	MFG (%)	Splits (%)
Menzies	5.6	4.5	50.2	6.8	4.6	0.5	13.1
Florunner	5.6	4.6	46.3	10	5.2	0.7	12
UF 2	6.2	5	51.9	5.9	3.9	0.5	10.9
Sun Oleic 95	5.9	4.7	46.2	5.5	3.6	0.4	17.9
#Chifley	6.2	5.1	43.6	5.9	3.9	0.5	22.4
UF 4	6.4	5.1	58.7	4.3	2.4	0.4	8
UF 1	6.1	4.8	47.9	6	4.3	0.6	13.2
#UF 6	6.1	4.8	42	4.6	2.5	0.3	24.7
LY	6.1	5	47.5	11.4	6.7	0.8	8.4
Conder #	7.78	5.6	15.9	18.8	12.6	2.1	20.3
D75-1-p10-9 #	6.16	4.6	43.4	7.7	5.1	2.1	13.4
N93091C	6.44	4.7	30.2	14.3	7.6	1.4	17.9
Streeton	6.46	4.7	2.97	24.5	21.97	2	18.99
C209-6-49 #	5.04	3.7	35.3	9.7	6.2	2.3	16.3
D75-1-p10-2	5.07	3.7	48.8	4.6	3.1	1.5	14
Middleton	6.42	4.8	26.1	17.3	9.4	1.4	18.2
Wheeler #	7.01	5.2	23.6	17.8	8.96	1.6	19.8
N92023E	6.21	4.4	27.8	13.7	6.5	1	19.5
NC 7 #	6.42	4.7	26.3	15.9	9.9	1.8	17.5

Harvested one week earlier than the other varieties

PCA varieties

When varieties from PCA were analysed as a group there was no significant difference in kernel yield. Figure 1 shows the (weighted) means of the varieties based on kernel yield (t/ha). There is a large amount of variation amongst the replications for variety UF 2. One of the replications was not included in the results due to an error while threshing the sample.

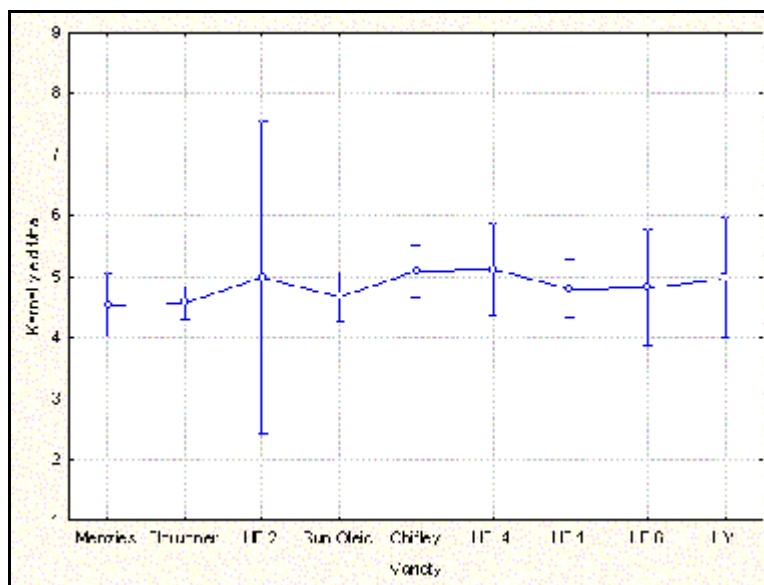


Figure 1. Weighted means PCA varieties for kernel yield at 95% confidence intervals

Analysis of variance (ANOVA) showed the varieties did not differ significantly from each other when using kernel yield as a predictor. The analysis did indicate significant differences between replicates, most likely due to site variability.

Table 3. ANOVA results for the 2003 PCA variety trial

Effect	SS	Degrees of freedom	MS	F	P
Replication*	2.4031	3	0.8010	5.508	0.005964
Treatment	1.3654	8	1.707	1.173	0.359827
Error	3.0543	21	0.1454		

* Significantly different (P<0.05)

QDPIF varieties

When the QDPIF varieties were analysed as a separate group it showed that Condor, the highest yielding variety was significantly better than C209-6-49 and D75-1-P10-2 but did not differ significantly from any other variety.

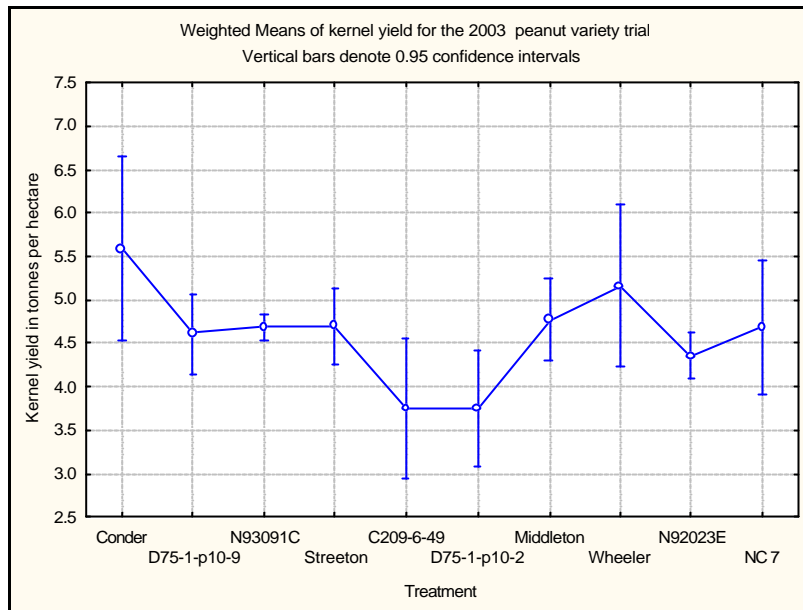


Figure 2. Weighted means for QDPIF varieties for kernel yield at 95% confidence interval

Table 4. ANOVA Results for QDPIF 2003 variety evaluation

Effect	SS	Degrees of freedom	MS	F	P
Replication	0.4958	3	0.1653	0.933	0.438094
Treatment*	11.4135	9	1.2682	7.162	0.000030
Error	4.7808	27	0.1771		

* = Significantly different (P>0.01)

Table 5. Analysis of QDPIF varieties, kernel yield

Variety	Mean kernel yield (t/ha)
Conder	5.58 a
Wheeler	5.15 ab
Middleton	4.77 ab
Streeton	4.69 ab
NC-7	4.68 ab
N93091C	4.77 ab
D75-1-P10-9	4.61 ab
N92023E	4.35 ab
C209-6-49	3.74 b
D75-1-P10-2	3.74 b

Means followed by different letters are significantly different (P>0.01)

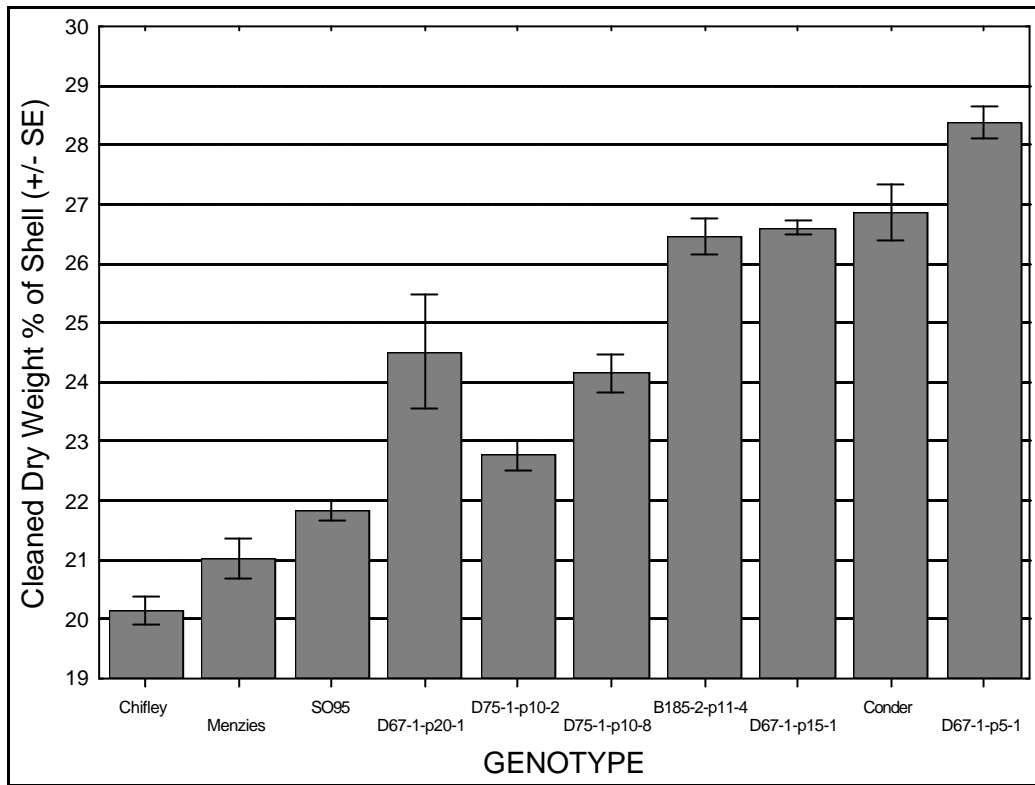


Figure 3. Shelling percentages of selected varieties from 2003, DDRF

Table 6. Disease type, incidence, and severity ratings for the varieties

Variety name	Leaf spot per 50 leaflets	Limb rot severity	Peg rot severity	Tap root rot severity	Aspergillus crown rot severity
Menzies	2.4	Low	Low	Low	Low
Florunner	2.45	Low	Low	Low	Low
UF 2	0.85	High	High	High	High
Sun Oleic	2.45	High	High	High	High
Chifley	3.2	Low	Low	Low	Low
UF 4	3.45	High	High	High	High
UF 1	4.5	Low	Low	High	High
UF 6	3	Low	Low	High	High
LY	1.9	High	High	Low	Low
Conder	1.53	Low	Low	Low	Low
D75-1-p10-9	2.76	Low	Low	Low	Low
N93091C	1.85	High	High	High	High
Streeton	2.25	Low	Low	Low	Low
C209-6-49	3.96	High	High	Low	Low
D75-1-P10-2	3.15	Low	Low	Low	Low
Middleton	2.2	High	Low	Low	Low
Wheeler	3.4	Low	Low	High	High
N92023E	1.15	High	High	High	High
NC 7	3.26	Low	Low	Low	Low

Leaf spot refers to *Cercospora* leaf spots

Limb rot caused by *Rhizoctonia solani*

Peg caused by *Rhizoctonia solani*

Tap caused by *Pythium* spp.

Crown rot *Aspergillus niger*

Low disease rating was quantified by the presence of disease on two or fewer limbs out of five assessed.

High disease rating was quantified by the presence of disease on four or more limbs out of five assessed.

Discussion:

Two years of this three-year trial have been completed. The third year's trial crop is in the ground at the time of writing. In year one issues such as plant populations, wallaby and broilga damage affected the trial. In year two, strategies were put in place to deal with these issues. Drying racks were constructed to dry the harvested varieties and prevent access to wallabies. Maize strips were planted at intervals throughout the trial to form a visual barrier and inhibit the movement of broilgas into the crop. This worked well and damage by broilgas was restricted to the outer extremity of the bulk area, leaving the trial area relatively unaffected.

The trials have been managed using "best practice" which has included recommended fertiliser, watering and disease and insect control measures. When the PCA varieties were compared for total nut NIS yield, kernel yield and tolerance to disease, it was found that Chifley and Menzies performed consistently well. Both lines had good kernel yields, high grades and low disease levels, but were not significantly better than any other PCA or most QDPIF varieties in terms of total yield.

All the University of Florida lines UF 1, 2, 4 and 6 performed well. In terms of NIS yield, kernel and jumbo percentage, these varieties ranged from 42% jumbos in UF 6 to 58% jumbos in UF 4.

Out of the QDPIF varieties, Conder gave the highest NIS yield. However, it also had a high shell percentage and a lower percentage of jumbo than many varieties. However, it is difficult to compare Conder directly with varieties such as Chifley and Menzies, as Conder is a large kernel bunch type, which is graded differently and sold in a different market i.e. the nut in shell market. As shell content and jumbo percentage are important parameters in determining freight costs and final price, suitable varieties must have high kernel yields, high jumbo percentages and low shell contents to be commercially viable in the NT.

Pathology staff at Katherine assessed disease tolerance for all varieties. Varieties were assessed on percentage of leaf spot infections and limb blight tolerance. Disease has been assessed visually for incidence and severity and ranked for each variety. Table 3 provides the results of the disease survey. In 2002 and 2003 disease was rated visually on the day that the varieties were harvested. In 2003 a QDPIF plant pathologist rated the varieties for disease three weeks prior to harvest.

The ability of a variety to resist disease infection is an important attribute. Conder, Menzies, Florunner, D75-1-p10-9, Streeton, NC7 and D75-1-p10-2 showed good disease resistance or tolerance. Wheeler showed a high rate of infection from *Pythium* and *Aspergillus niger*. Middleton had a high incidence of *Rhizoctonia* limb rot. N92023E and N930913C showed the highest incidence and severity of all diseases monitored. Menzies, Florunner and Chifley showed the least infection from disease. UF 4, Sun Oleic and UF 2 showed the highest disease incidence. UF 1 and 6 were infected by *Aspergillus niger* and *Pythium* and showed low incidence of *Rhizoctonia solani*. Lyons was affected by *Rhizoctonia solani* but did not show severe infection from *Aspergillus niger* or *Pythium*.

While many of the varieties exhibited infection to a range of pathogens it is difficult to determine the impact of these diseases on yield parameters. Disease tolerance cannot be fully determined in these trials. UF 1, which was rated as having a high incidence of *Pythium* root rot and *Aspergillus* crown, and UF 4 which was rated as having a high incidence of all diseases produced 6.1 and 6.4 t/ha, respectively, which are some of the highest yields of the PCA varieties. Wheeler was rated as having severe *Pythium* and *Aspergillus* infections, but it produced the second highest yield in the 2003 trial.

The varieties were grown under best management practice, which includes a program of fungicide application. This masks the severity and impact of some of the diseases. Using chemical control makes it difficult to identify varieties, which are either susceptible or resistant to various diseases. To ascertain the impact of various diseases and determine the most resistant/tolerant varieties, a specific trial designed to measure the relationship between disease incidence and yield parameters is required.