COWPEA RESEARCH IN THE NORTHERN TERRITORY 1977-1981

No. 114

AGDEX 125/31

ISSN 0158-2763

NORTHERN TERRITORY
DEPARTMENT OF INDUSTRIES AND DEVELOPMENT

C O W P E A R E S E A R C H

I N T H E

N O R T H E R N T E R R I T O R Y

1977-1981

by

A.G. Cameron and the late R.J. Fritz

May 1988

Division of Primary Production
G.P.O. Box 4160
DARWIN N.T. 5794
AUSTRALIA

Technical Bulletin No. 114

CONTENTS

CONTENTS

LIST OF TABLES

SUMMARY

Eighty five cowpea lines were evaluated in observation and cutting trials at Berrimah Research Farm, Douglas Daly Research Farm and Katherine Experiment Farm between 1977 and 1981.

Of the lines evaluated for fodder production, some were identified which had both high fodder and seed yields. One of these was later released as cultivar Arafura.

None of the lines evaluated between 1977 and 1980 for grain production were the large black-eye type preferred by consumers. Some lines evaluated only in 1981 are that type.

ACKNOWLEDGEMENTS

The authors acknowledge the many departmental staff whose efforts assisted in carrying out the projects reported in this publication. Special mention is made of Mrs M.I. Connelly and Mr K. Haycock for technical assistance, of Mr P.G. Harrison for advice and of Miss S. Parker and Mrs H. Hore for assistance in the preparation of the manuscript.

INTRODUCTION

Cowpea (*Vigna unguiculata*) is an ancient crop grown throughout the tropics and subtropics (Summerfield *et al* 1974). It can be utilized in a number of ways, including human consumption of green or dry seed.

In Australia, cowpeas have generally been grown as a forage, fodder, green manure or cover crop.

Cowpeas have been grown and evaluated in the Northern Territory over a number of years (Norman and Wetselaar 1960, Phillips and Norman 1962, Arndt *et al* 1963, Edey 1963, McEllister 1965, Cameron *et al* 1984, Winter *et al* 1985). Many of the cultivars and introductions evaluated were not well adapted to the environmental conditions of the Top End of the Northern Territory.

In 1977 a range of new cowpea lines was introduced from the International Institute of Tropical Agriculture in Nigeria. These new lines and a range of other cultivars and introductions were evaluated in the project described in this publication.

This research was conducted to identify and select cowpeas which could be grown for grain or seed production.

At the time, 500 tonnes of cowpea grain was being imported into Australian annually for human consumption. There was also a potential market in Queensland of 100 tonnes of seed per year for a fodder cowpea for use as a green manure crop in sugar cane rotations. This market still exists.

The only commercial cultivar freely available in the Northern Territory in 1977 was the poorly adapted Caloona.

TRIALS

Trials were carried out during four wet seasons with selected lines being grown for seed increase in irrigated plots during the intervening dry seasons.

The trials and seed increase crops will be reported in chronological order.

Details of the lines sown in all trials are presented in Appendix 1. Identification of cowpea lines in the text will be by Commonwealth Plant Introduction Number (CPI) unless it is a recognized cultivar.

TRIAL 1 - PRELIMINARY EVALUATION OF COWPEAS 1977/78 WET SEASON

METHOD

Fifty cowpea lines were sown at two sites in the Top End of the Northern Territory during December 1977. The sites were Berrimah Research Farm (BRF, Darwin AAR 1600mm) on Hotham red earth soil sown 12 December and Katherine Experiment Farm (KEF AAR 890mm) on Tippera clay loam soil sown 20 December.

Seed was sown by hand in single unreplicated plots 3m long consisting of 2 rows at 40cm spacing (50 seeds per plot) with 3m between plots. This gave an effective plot area of 3.6m^2.

Fertilizers applied at sowing were 200kg/ha superphosphate, 100kg/ha muriate of potash, 200kg/ha Ess-minel and 10kg/ha zinc sulphate heptahydrate.

These lines were evaluated by visual observations for growth, flowering, seeding and retention of green leaves during the wet and early dry seasons.

Emergence counts were carried out 7 days after sowing at BRF and 14 days at KEF. Further counts to determine survival of seedlings were carried out 28 days after sowing at KEF and 35 days at BRF.

Twenty-four of the lines were sown under identical circumstance at both sites, but were cut twice to determine dry matter yield. The plots were harvested on days 50 and 85 after sowing. At each harvest, one half of the plot was harvested. The harvest dates were 31.01.78 and 07.03.78 at BRF and 08.02.78 and 15.03.78 at KEF.

Fifteen lines for which there was a limited quantity of seed were sown in observation plots only at BRF. The rows were 1 to 3m long depending on seed availability.

Seed was harvested where possible from all plots.

RESULTS

1. Emergence

Emergence was good at both sites being 74.3% at BRF and 84.3% at KEF. There were 14 lines at BRF with an emergence less than 60%, but only two less than 50%, CPI29776 with 40% and 80210 with 48%. At KEF only four lines had an emergence of less than 60% with the two less than 50% being 45588 with 24% and 45589 with 42%.

Only 2 lines had a low emergence at both sites, 45579 and 45589. Seed of low germination is suspected to have caused the poor emergence of these two lines.

2. Survival

The percentages of emerged seedlings which survived, measured by counts at day 28 (KEF) and 35 (BRF) was high at both sites, being 88.4 at BRF and 94.5 at KEF.

At BRF, five lines had a survival of less than 50%, being 80203 (16%), 80209 (13%), 80220 (30%), 80221 (8%) and 80224 (40%). There was a large drop in the number of surviving plants between 21 and 35 days after sowing. This was caused by Bean Fly (Ophyomyia phaseoli) attack. These five lines all had a high survival of emerged seedlings at KEF.

3. Growth

Of the 65 different lines sown, 32 were recorded as having growth ratings of excellent at either BRF or KEF. Eleven lines were rated excellent at both sites. These are listed in Table 1.

The lines with outstanding growth were 45569, 80202, 80208 and 80210 at BRF and 80208 at KEF.

One line, 78218 which was sown only at BRF showed poor growth, while three 45584, 78219 and 80224 showed only fair growth at both BRF and KEF.

Sward heights were also recorded. These are presented in Appendix 2.

TABLE 1 - Cowpeas with growth ratings of excellent at BRF or KEF 1977/78 wet season.

Identification	Site		Identification	Site	
	BRF	KEF		BRF	KEF
24219	V	V	80205		V
34821	V	N	80206	V	N
39133	V	N	80208	V	V
39137	V	N	80210	V	V
45569	V	N	80211	V	V
61093		V	80212		V
61274	V	V	80213	V	V
77945	V	V	80214		V
77946	V	N	80215	V	V
78217	V	N	80216		V
80198	V		80217	V	
80199	V	V	80221		V
80201		V	80222		V
80202	V	V	80223		V
80203		V	Caloona		V
80204	V		Santiago	V	V

V = Growth rating of excellent. N = Not sown Katherine.

4. Dry matter yield

Dry matter yields for the 24 lines harvested are presented in Appendix 3, and yields per plant are presented in Appendix 4. The dry matter yields of the seven highest yielding lines at both BRF and KEF are presented in Table 2.

TABLE 2 - Dry matter and seed yields of the highest yielding cowpeas at both BRF and KEF 1977/78 wet season.

Line	DM Yield (kg/ha)		Line	Seed Yield (kg/ha)	
	BRF	KEF		BRF	KEF
77945	5022	3378	39137	2839	
80201	4222	3922	61274	2206	1575
80202	5067	2900	80199	2775	
80203	5100	3367	80202	2525	
80208	3722	6467	80215	2478	
80213	4900	2911	Santiago	2392	
Santiago	4044	3878			

Four of the lines yielded approximately 5000kg/ha dry matter at BRF while at KEF 80208 was the only line to yield over 4000kg/ha at 6467kg/ha.

5. Plant Chemical Composition

The plant contents of nitrogen, phosphorus and potassium of the cowpeas harvested at BRF and KEF are presented in Appendix 5. Mean contents for each site and harvest date are presented in Table 3.

TABLE 3 - Mean nutrient contents of cowpeas at BRF and KEF 1977/78 wet season.

Element	Site/Date/Nutrient Percent			
	BRF		KEF	
	31.1.78	7.3.78	8.2.78	15.3.78
N	2.4	2.3	2.3	1.6
P	.30	.27	.16	.09
K	1.7	0.8	3.2	2.2

The 24 lines averaged over 14% crude protein (CP) at both harvests at BRF and the early harvest at KEF, while in the second harvest at KEF they averaged 10% CP. At BRF, the three lines with the highest crude protein on 7.3.78, 85 days after sowing were 80208 (20.0%), 80202 and 80203 (18.8%). At KEF, the three highest on 15.3.78 were 78216, 80217 and Santiago with 11.9%CP.

Plant levels of phosphorus were good at BRF and low at KEF while for potassium the reverse applied. These levels are directly related to soil nutrient levels. The Hotham soil at BRF is low in available potassium, but had been cropped a number of times previously which had built up soil phosphorus levels. The Tippera soil at Katherine has a high level of available potassium and a low level of available phosphorus and had not been cropped previously.

Lines 80202 and 80203 had consistently high contents of nitrogen, phosphorus and potassium at both sites.

6. Flowering

The plots were regularly observed for flowering, production of green pods and maturity of pods and seed. Records of days to first flowers are presented in Appendix 6. Where lines had a concentrated flowering period, the time of peak flowering was also recorded. This data is in Appendix 7. Flower colours and flower position in relation to the canopy were observed only at BRF. This information is presented in Appendix 8.

7. Seed Production

Maturity dates are in Appendix 9. Seed yields per plot and per plant are presented in Appendix 10 and Appendix 11 respectively. Some seed yields were reduced by damage caused by Red-wing parrots at BRF and Galahs at KEF. At KEF, seed had been harvested from only 16 lines when cattle in the surrounding paddock broke through the fence on 19.3.78 and consumed all standing material.

The lines with the highest seed yields are in Table 2.

It should be noted that these yields were from small plots. Yields of the same order as those in Table 2 could not be expected from larger areas.

Line 61274 was the only high yielding line harvested at KEF before the cattle grazed the plots, but a number of lines yielded well at BRF.

8. Seed Quality

The quality of the seed harvested was determined by visually recording the quantity of damaged and mouldy seed for each of the 50 lines sown at both BRF and KEF. These results are presented in Appendix 12. All of the seed harvested at KEF was of good quality, while only 27 of the 50 lines produced good seed at BRF, and seed quality of 11 lines was extremely poor.

This difference is due to the longer wet season at BRF, where pods of early flowering lines become mouldy following storms later in the season.

CONCLUSIONS AND DISCUSSION

Data was collected on the growth and reproductive patterns of the lines sown. Birds are potentially a problem with cowpea seed crops.

Sixteen lines were selected for seed increase during the 1978 dry season. These are listed in Table 4. The lines to be evaluated as fodder plants were selected on growth rating and/or dry matter yield, and seed yield. Those lines to be evaluated as grain legumes were selected on seed yield and even seed set and maturity. Caloona and Red Caloona were included as reference lines.

TRIAL 2 - SEED INCREASE 1978 DRY SEASON

METHOD

Eighteen lines (Table 4) were sown in well watered, well fertilized, unreplicated plots at BRF. Four hundred seeds of each line were sown by hand on 31.5.78 in two 20m rows at 40cm spacing, giving an effective plot area of 20.6m².

RESULTS

Establishment of 78217 and 80218 was poor, of 78216, 78220 and 80208 was fair, while that of the other lines was good.

Seed yields and germination percentages are in Table 4. The highest yields were equivalent to 1400-1690kg per hectare.

TABLE 4 - Seed yields and germination of cowpeas 1978 dry season.

Identification	Seed yield (g/plot)	Germination Percent	Hard Seed Percent
61274	2718	94	
77940	3017	100	
78216	1008	92	3
78217	621		
78220	884		
80199	2517	91	2
80202	2222		
80203	1819		
80205	1542		
80208	1147	96	
80210	1906	98	
80213	1633		
80215	2610	88	
80218	1207	93	1
80225	3475	47	48
Caloona	2822	92	7
Red Caloona	2468		
Santiago	2973	72	25

CONCLUSION

Following this seed increase phase, 10 lines were selected to grow in evaluation trials during 1978/79. Five lines were selected as fodder cowpeas and five lines as grain legumes. These will be specified as each subsequent trial is discussed.

TRIAL 3 - PRELIMINARY EVALUATION OF COWPEAS AT BRF AND KEF 1978/79 WET SEASON

METHOD

Twenty-six lines were sown by hand in unreplicated plots at both BRF and KEF on 28.12.78 and 9.1.79 respectively. Each plot consisted of three 3m rows at 25cm spacing. Fertilizers applied at sowing were superphosphate (200kg/ha) at both sites and muriate of potash (100kg/ha) at BRF.

The lines shown are listed in Appendix 1. Three lines grown in 1977/78, 80208, 80225 and Caloona were included for comparison with the 23 lines which were not sown in Trial 1. These lines were evaluated by visual observation.

RESULTS/DISCUSSION

Emergence was good at both sites except for 20427 - poor at BRF, 29776 - poor at KEF, 30786 - poor at BRF and KEF and 78218 - fair at both sites.

Survival of emerged plants was poor for 30779 and 30786.

Details of height, days to first flowers and days to seed maturity are presented in Appendices 2, 6 and 9 respectively.

At BRF only 80208 was rated as having excellent growth while at KEF another four lines, 68799, 80206, Aloomba and Brandon also had excellent growth.

Five lines were rated as having good seed yields at KEF - 78217, 78220, 80206, 80208 and 80225 with 80225 being rated highest. Three lines 33039, 78218 and Caloona yielded poorly. Good retention of mature seed was shown by 29776, 33039, 80206 and 80208 and poor seed retention was shown by 78217, 78220, 80206, Caloona and Phoenix.

Brandon was the only line selected for further evaluation because of its good growth and late flowering.

TRIAL 4 - EVALUATION OF COWPEAS SELECTED FOR FODDER PRODUCTION 1978/79 WET SEASON

METHOD

Five replicates of five selected lines, 80199, 80202, 80208, 80210 and 80215 were sown with Caloona in a randomized complete block design at BRF on 23.11.78 and KEF on 10.1.79.

At BRF two cowpeas, 80210 and Caloona were sown at three later sowing dates 28.12.78, 30.1.79 and 22.2.79 to determine the effects of time of sowing on performance.

All plots were sown by hand at a rate calculated to give a final population of 6.7 plants per metre of row (89,000 plants/ha) in 4.5 x 10m plots of six rows at 75cm spacing.

Fertilizers applied were superphosphate (200kg/ha) at both sites and muriate of potash (100kg/ha) at BRF. Half of the fertilizer was applied at sowing and half one month later. Dacthal® at 10kg/ha was applied for grass control at BRF for the 27.11.78 and 28.12.78 sowings.

Plant counts were carried out between 2 and 6 weeks after sowing.

Observations were made of growth and reproductive patterns, and pests and diseases.

The plants were cut from 1.5 x 2m areas of the plots on 2 occasions to measure dry matter yield. The first harvest at BRF was on 23.1.78, 61 days after sowing (DAS). The second harvest of each line was between 6.2.79 (80199, 80210, 80215, 75 DAS) and 20.2.79 (80202, 89 DAS). At KEF the first harvest was between 28.2.79 (80210, 49 DAS) and 28.3.79 (80202, 92 DAS). The only line harvested a second time was 80208 on 28.3.79.

Seed was harvested from one 1.5 x 2m quadrat from each plot at the end of the wet season. Harvest dates at KEF were 11.4.79 (91 DAS) for Caloona and 80215 and 2.5.79 (112 DAS) for the other four lines.

RESULTS

Details of height, dry matter yield, days to first flowers, days to peak flowering and green pod production, days to maturity, and seed yield are presented in Appendices 2, 4, 6, 7, 9 and 10 respectively.

1. Emergence/Populations

Emergence was good at BRF (95%) but much less at KEF (76%) where the plots became overgrown with grass weeds. The trial area received only one rough cultivation and no herbicides were applied by co-operators in Katherine. Populations were between 79,000 and 105,000 plants per hectare at BRF four weeks after sowing and between 59,000 and 79,000 at KEF five weeks after sowing.

At BRF, the populations at the first DM harvest 61 DAS were between 65,000 and 80,000 plants per hectare, while at the second harvest between 75 and 80 DAS the range was 53,000 to 76,000 plants per hectare. At KEF, the populations at DM harvest ranged from 47,000 to 109,000 between 49 (80210) and 92 (80202) DAS. The only line with a population higher than expected (89,000) at either site was the small seeded Caloona, which had some hard seed (Table 4).

The later sowings at BRF were abandoned after they became overgrown with grass weeds. Cultivations failed to kill tussocks of established grasses during and between periods of wet weather and no Dacthal® was available. The third and fourth sowings suffered severe bean fly attack when insecticides could not be applied because of wet weather (Appendix 18).

Aphids were noticed at BRF on 18.12.78 on plants from the first sowing on 23.11.78. The infestation was highest on 80210 and Caloona and low on the other lines except for one plot of 80208. Aphid numbers were lowest on 80202 and 80215. This aphid infestation did not seem to affect either survival or performance.

2. Dry matter Yields

Yields were low (Table 5). Over the two sites the best yielding lines were 80202 and 80208.

TABLE 5 - Dry matter and seed yields and seed germination of cowpeas grown for fodder production 1978/79 wet season.

Line		Dry matter (kg/ha)		Seed Yield	Germination Percent
	Site	Harvest 1	Harvest 2	kg/ha	
80199	BRF	1931	2686		
	KEF	1534		297	48
80202	BRF	1554	2613		
	KEF	2443		146	42
80208	BRF	1744	2705		
	KEF	1636	1995	70	2
80210	BRF	1983	2333		
	KEF	621		317	8
80215	BRF	1720	2054		
	KEF	690		65	44
Caloona	BRF	1179	2595		
	KEF	1271		101	67

Line 80210 was harvested from the second sowing at BRF yielding 252 kg/ha dry matter.

3. Plant Chemical Composition

The nutrient contents for this trial (Appendix 13) were similar to those from 1977/78 except that nitrogen contents were slightly lower, phosphorus contents lower at BRF and higher at KEF and potassium contents were higher at BRF.

The trial area at BRF did not have the cropping history of the area used in 1977/78.

4. Seed Yields

No seed was harvested at BRF because pods were produced and matured during wet weather. All pods and seed were mouldy.

Yields and germination percentages of seed harvested at KEF are in Table 5. Both yields and quality were lower than expected. Yield was reduced by galahs and quality by rain in March/April (Appendix 18)

DISCUSSION/CONCLUSIONS

Plant populations were too low to allow the cowpeas to compete with the grasses present. The row spacing needed to be reduced from 75cm.

Lines 80202 and 80208 had the highest dry matter yields over the two sites. The other lines matured too early to be good fodder (hay) crops in the Top End.

Caloona is a poor line as leaf is dropped early and pods shatter badly as they dry out.

All plots were sown by hand and were not even, especially with the small seeded Caloona.

Late November is too early to sow cowpeas for hay as it is too wet when they are at their optimum for dry matter yield and quality, between peak flowering and when the pods begin to ripen.

TRIAL 5 - EVALUATION OF COWPEAS SELECTED FOR GRAIN PRODUCTION 1978/79 WET SEASON

METHOD

Five replicates of five selected lines, 61274, 77940, 80218, 80255 and Santiago were sown with Caloona in a randomised complete block design at BRF on 28.12.78 and KEF on 10.1.79.

At BRF two cowpeas, 77940 and Caloona were sown at one earlier (23.11.87) and two later sowing dates (30.1.79, 22.2.79) to determine the effects of time of sowing on performance.

All details are the same as for Trial 4 except that plots were 3 x 10m consisting of 12 rows at 25cm spacing, and the plots were harvested only once for dry matter. Dry matter harvests were between 16.2.79 (80218, 80225, 50 DAS) and 13.3.79 (Caloona, Santiago, 75 DAS) at BRF and on 28.2.79 (4 lines, 49 DAS) or 15.3.79 (Caloona, Santiago, 64 DAS) at KEF.

Seed harvests were on 28.3.79 (80225, 77 DAS) or 11.4.79 (5 lines, 91 DAS) at KEF.

RESULTS

Details of height, dry matter yield, days to first flowers days to peak flowering and green pod production, days to maturity, and seed yield are presented in Appendices 2,4,6,7 9 and 10 respectively.

1. Emergence/Survival

Emergence was good at BRF (96%) and KEF (88%). Survival at both sites was similar, being 85% at BRF and 88% at KEF.

Populations were between 224,000 and 356,000 plants/ha at BRF two weeks after sowing and between 196,000 and 276,000 plants/ha at KEF five weeks after sowing.

The populations for the later sowings at BRF were much lower than for the 23.11.78 sowing. For 77940 the populations were 252 000, 228 000, 160 000 and 66 000 for the four sowing dates, while for Caloona the corresponding populations were 288 000, 200 000, 146 000 and 118 000.

The later sowings at BRF encountered the same conditions described in Trial 4 - poor weed control, no herbicide applied and severe bean fly attack.

On 18.12.78 there was an aphid infestation on the plots sown 23.11.78. The infestation was high on Caloona and moderate on 77940, without any noticeable effect on survival or performance.

2. Dry Matter Yield

The yields (Table 6) are lower than those for Trial 4 (Table 5) because these lines flower earlier and were harvested earlier.

TABLE 6 - Dry matter and seed yields, and seed germination of cowpeas grown for grain production 1978/79 wet season.

Line	Site	Dry matter kg/ha	Seed Yield kg/ha	Germination Percent
61274	BRF	1266		
	KEF	639	512	34
77940	BRF	1259		
	KEF	1136	303	17
80218	BRF	1339		
	KEF	960	225	22
80225	BRF	1601		
	KEF	1395	420	4
Caloona	BRF	1182		
	KEF	1501	141	67
Santiago	BRF	2286		
	KEF	1956	114	42

Yields for the lines sown 23.11.78 were 2933 kg/ha for 77940 and 2142 kg/ha for Caloona. While these yields compare favourably with those from Trial 4, it must be remembered that the sowing rate and populations were three times higher in this trial.

3. Plant Chemical Composition

Nutrient contents are presented in Appendix 13. Results are similar to those of Trial 4.

4. Seed Yields

No seed was harvested at BRF because pods were produced and matured during wet weather. All pods and seed were mouldy. The yields obtained at KEF and the germination percentage of the seed are in Table 6. Yields of 61274 and 80225 at 512 and 420 kg/ha respectively are good under the growing conditions which prevailed but the quality was poor. Yield was reduced by galahs and quality by wet weather in March/April.

DISCUSSION/CONCLUSIONS

Although the plant populations were higher than those in Trial 4, the cowpea lines in this trial suffered from severe competition from grass weeds.

The early flowering and seed maturity of these lines makes seed susceptible to moulding, particularly in the high rainfall area at BRF.

Caloona showed up as a poor line because of shattering of pods.

Lines 80218 and 80225 appear to be the best for grain production as they are determinate and have an even seed set and maturity. The next best is 61274.

TRIAL 6 - PRELIMINARY EVALUATION OF COWPEAS AT VRRS 1978/79 WET SEASON

METHOD

Fourteen cowpeas were sown by hand in single unreplicated 2m plots on an Emu red earth soil at Victoria River Research Station (VRRS, AAR 635mm) on 31.1.79. The lines sown are listed in Appendix 1.

Fertilizers applied at sowing were superphosphate (200kg/ha) and muriate of potash (100kg/ha).

The plots were observed twice during the wet season, on 27.3.79 and 1.5.79.

RESULTS

Emergence was good except for 78220, 80208 and 80218. Survival of the lines was good except for 78220, where the one plant which emerged had died by 27.3.79.

Growth of the lines was fair except for 78221 which was rated poor. The lines with the best growth were 80202, 80219 and 80225.

The lines rated best for seed production were 78219, 80225 and 80219. All of the lines had some pods shattered and seed shed on 1.5.79. The lines with the highest seed retention ratings were 78216, 80202, 80210, 80219 and 80225. Lines 78218, 78219 and 78221 had poor seed retention ratings.

DISCUSSION/CONCLUSION

The early flowering lines, particularly 78219, 80219 and 80225 were better adapted as grain crops at this site.

Some of the lines, particularly 80202 could be suitable as a fodder crop in the Victoria River District if sown earlier than the lines were sown in this trial.

TRIAL 7 - CROPS SECTION (KATHERINE) COWPEA SOWINGS 1978/79 WET SEASON

METHOD

Crops section in Katherine grew four cowpeas in unreplicated 10m² plots, sown 3.1.79. Superphosphate (200kg/ha) was applied at sowing and Treflan® (1l/ha) was applied as a pre-emergent herbicide. Line 80208 was sprayed with Lannate® on 15.3.79.

Seed was harvested on 10.5.79, 127 days after sowing.

RESULTS

Emergence was good.

Seed yields (kg/ha) were 1650 (80208), 1326 (Aloomba), 391 (Brandon) and 204 (Meringa).

Seed quality of 80208 and Aloomba was good, while that of Brandon and Meringa was poor and the seed was insect damaged.

CONCLUSION

Line 80208 yielded better than the commercial cultivars.

TRIAL 8 - SEED INCREASE NO. 1 1979 DRY SEASON.

METHOD

Twelve cowpeas (Table 7) were sown at BRF on 23 and 26.4.79. They were sown in plots of twelve 27m rows at 25cm spacing with 40g seed per row. Effective plot area was 81m² except 80218 at 54m² and 80219 at 13.5m².

Dacthal® was applied at sowing. Fertilizers applied at sowing were superphosphate (200kg/ha) and muriate of potash (100kg/ha). Plots were watered initially by spray irrigation to ensure even establishment, and later by dripper irrigation. Rogor® was applied for bean fly control on 8.5.79.

As some plots appeared to be deficient in nutrients, the plots were sprayed with a fertilizer solution on 5.6.79 (5kg Crop King 88 in 60 l water).

The plots were sprayed with Benlate® on 22.6.79 to control powdery mildew. Infection was bad on 78216 and 78220 and moderate on 80218 and Caloona.

On 26.6.79, the percentages of pods damaged by red-wing parrots and corellas was estimated at 40 for 61274 and 50 for 78216, 78220 and 80218. The plots were sprayed with the bird repellant Mesurol® on 12.7.79. This proved ineffective because the birds did not eat whole pods. They removed only the developing seeds. Cages were later erected over 10m lengths of the 61274, 78216, 78220, 80208, 80218 and 80225 plots and the whole 80219 plot. The birds did not significantly damage the other cowpeas sown.

The cowpeas were examined on 13.7.79 by Plant Pathologist, Mr B. Conde, after some plants showed symptoms of a virus, possibly cowpea aphid borne mosaic virus. The estimated percentages of infected plants were 88 (Meringa), 95.5 (80202), 100 (Brandon, Palmyra).

This virus did not seem to cause any significant problems and was not present in later wet season or dry season sowings to any degree.

The number of plants was counted on 13.8.79.

Seed was harvested from the plots between 23.7.79 and 8.9.79. No seed was harvested from Caloona because of seed loss from shattered pods.

RESULTS

All details are presented in Table 7.

TABLE 7 - Plant counts, days to first flowers, days to maturity, seed yield and seed germination of cowpeas in seed increase No. 1 1979 dry season.

Line	Plant Counts No./M²	First Flowers Days	Seed Maturity Days	Seed Yield (kg/ha)	Germination Percent	Hard Seed Percent
61274	33	39	135	248	95	
78216	23	46	135	225	89	2
78220	20	33	95	84		
80202	20	46	96-98	815	95	
80208	10	46	88	1674	88	
80218	29	33	95	480	98	
80219	16	39	91	250	91	
80225	16	46	98	1020	71	21
Brandon	27	61	135	85		
Caloona	54	39	-	-		
Meringa	53	46	135	523	38	53
Palmyra	21	46	135	147	89	7

Of the lines sown during the previous two wet seasons, seed of 80202 and 80208 matured earlier than for wet season sowings and the other lines matured later. Lines 80218 and 80225 in particular were determinate during the wet season sowings but indeterminate in this dry season sowing.

Both 80202 and 80208 set a good, even crop of pods.

The highest seed yields were from 80208, 80225 and 80202. The yields of 80208 and 80225 were inflated by the seed harvested from outside the 10m strip of plot covered to prevent birds destroying the pods.

All of the seed harvested was of excellent quality.

CONCLUSIONS

Parrots and corellas are a problem in dry season seed crops.

Mesurol bird repellant is ineffective because these birds do not eat the surface of the pods.

Both 80202 and 80208 are better seed producers than the commercial cultivars Brandon, Meringa and Palmyra.

TRIAL 9 - SEED INCREASE NO.2 1979 DRY SEASON

METHOD

Ten cowpea lines were sown at BRF on 1.8.79 and a further four on 7.8.79. The seed was sown using Earth Way Precision Garden Seeders (hand vegetable planters). Each plot consisted of seven 10m rows at 50cm spacing, giving an effective plot area of 35m², except for 80218 and 80219 which were 15m rows for plot areas of 52.5m².

The plots were established under spray irrigation and dripper irrigated after emergence.

Emergence counts were carried out on 13.8.79. Eight plants showing viral symptoms were detected and removed from the Brandon plot on 13.8.79. On 25.9.79, plants with Legume Little Leaf symptoms were removed from the 80202 (6 plants) and Palmyra (2 plants) plots.

Powdery mildew was detected on 78220 on 2.10.79.

Seed was harvested between 12.10.79 and 8.11.79. No seed was harvested from Caloona.

RESULTS

All results except growth ratings are presented in Table 8.

Establishment of Brandon was poor because of a clogged planter.

TABLE 8 - Plant counts, days to maturity, height and seed yield for cowpeas in seed increase No.2 1979 dry season.

Line	Plant Counts No./M²	Seed Maturity Days	Height cm	Seed Yield kg/ha
61274	43	99	75	1756
78216	22	72	45	865
78220	25	83	50	916
80199	23	76	50	1406
80202	28	76	70	1483
80208	21	84	60	734
80218	21	77	45	670
80219	21	77	55	928
80225	17	78	60	825
Brandon	9	92	50	39
Caloona	39		50	
Meringa	16	99	60	475
Palmyra	15	92	60	83
Santiago	22	92	60	28

The lines with the best growth on 2.10.79 were 61274, 80202, 80208 and Santiago. These four lines were rated as having good growth while the others were rated fair.

Days to seed maturity for Seed Increase No. 2 (August sowing) were all less than for Seed Increase No. 1 (April sowing).

The germination of 78220 was 92%. The other lines were not tested.

CONCLUSIONS

Seed yields were excellent for 61274, 80199 and 80202, each produced more than twice the yield of the best commercial cultivar Meringa.

Brandon (poor establishment), Palmyra and Santiago had very poor seed yields.

TRIAL 10 - EVALUATION OF COWPEAS SELECTED FOR FODDER PRODUCTION 1979/80 WET SEASON

METHOD

Five cowpeas, 80202, 80208, Brandon, Meringa and Palmyra were sown at BRF and KEF during December 1979. Five replicates of each line were sown in 2 trials at separate row spacings, 20 and 40cm. Each plot consisted of eight 10m rows with six seeds sown per metre of row. Plot sizes were 10 x 1.6m at 20cm spacing and 10 x 3.2m at 40cm spacing. Laneways between plots were 1.5m.

The plots were sown at KEF on 18.12.79 and BRF on 28.12.79 using a planter constructed using eight Precision Garden Seeders.

Fertilizers applied at sowing were superphosphate (200kg/ha) at both sites and muriate of potash (100kg/ha) at BRF. Dacthal® was applied at sowing at 10kg/ha. At BRF Rogor® was applied on 7.2.80 to control beanfly. Mortality from beanfly attack before this spraying was estimated at 1%.

Emergence counts were carried out at BRF on 11.1.80 and KEF on 30.1.80. Plants were counted in four 0.75m² quadrats in each plot except at BRF/40cm spacing where numbers were counted in whole plots because of low and variable establishment.

The plots were observed a number of times during the wet season when growth and reproductive ratings were recorded.

Samples to determine dry matter yields were harvested from two 0.75m² quadrats per plot on 19.3.80 at KEF (92 DAS) and 25.3.80 at BRF (88 DAS).

Seed was harvested from the 80202 and 80208 plots at KEF on 9.4.80 (two 0.75m² quadrats/plot) and the other 3 lines on 14.5.80 (two 1m² quadrats/plot). At BRF two 1m² quadrats/ plot were harvested on 22.4.80.

RESULTS

Details of height, dry matter yield, days to first flowers, days to seed maturity and seed yield are presented in Appendices 2,4,6,9 and 10 respectively.

The Dacthal® was ineffective at KEF. There was severe competition from grasses during the early growth phase. By 28.2.80 the cowpeas, except Brandon which had established poorly, were competing well with the grass weeds. The cowpeas outgrew the grasses and formed a complete canopy later in the wet season.

1. Emergence / Populations

Emergence was only 45% of the expected population. The reason for this may have been the planters sowing at a lower rate than expected because of wheels slipping in the cultivated seedbed.

Emergence was lowest at BRF/40cm spacing at 28%. The plant populations were between 13 000 and 44 000 plants per hectare. This trial was abandoned because of the low plant population and competition from grass weeds. The emergence was between 42 and 55% for the other 3 trials. Line 80208 had the lowest emergence particularly at BRF, averaging 34%. The other 4 lines averaged between 41 and 54%.

The final populations are presented in Table 9.

2. Dry matter yields

The highest yielding lines were 80202 and 80208 although they were not significantly higher than Meringa or Palmyra (Table 9).

TABLE 9 - Dry matter and seed yields and seed germination of cowpeas grown for fodder production 1979/80 wet season.

Line	Site Spacing (cm)	Population No./m²	Dry matter kg/ha	Seed Yield kg/ha	Germination percent
80202	BRF/20	8 a	4464 b	1278 b	51
80208		6 a	4381 b	1137 b	41
Brandon		5 a	2924 a	106 a	49
Meringa		8 a	3976 ab	212 a	34
Palmyra		8 a	3153 ab	172 a	32
80202	KEF/20	9 c	5124 b	1217 b	92
80208		7 bc	5184 b	832 a	82
Brandon		4 ab	2204 a	455 a	77
Meringa		11 c	4869 b	657 a	74
Palmyra		8 bc	4613 b	602 a	60
80202	KEF/40	7 c	4628 b	1249 b	92
80208		5 bc	4128 b	989 b	82
Brandon		2 ab	1357 a	300 a	77
Meringa		5 bc	3223 b	484 a	74
Palmyra		6 bc	3465 b	487 a	66

Within each site/spacing, values followed by the same letter are not significantly different at the 1% level of probability.

Brandon was significantly lower yielding at both sites and at both row spacings than the other cowpeas. At KEF there were significantly less plants than 80202 at 40cm spacing and less plants than both 80202 and Meringa at 20cm spacing, but at BRF plant numbers were not significantly lower.

At KEF, yields from the 40cm spacing averaged 24% less than that at the 20cm spacing.

3. Plant Chemical Composition

The nutrient contents (Table 10) were lower on average than in the previous years because they were harvested later.

TABLE 10 - Nutrient contents of cowpeas grown for fodder production 1979/80 wet season.

Line	Site	Spacing(cm)	N%	P%	K%
80202	BRF	20	2.2	.27	1.2
	KEF	20	1.6	.11	2.0
		40	1.6	.11	2.2
80208	BRF	20	1.9	.24	1.0
	KEF	20	1.4	.11	1.9
		40	1.3	.10	1.9
Brandon	BRF	20	2.3	.26	1.2
	KEF	20	1.6	.11	2.0
		40	1.5	.10	1.9
Meringa	BRF	20	2.1	.27	1.1
	KEF	20	1.6	.11	2.6
		40	1.7	.13	2.7
Palmyra	BRF	20	2.0	.27	1.1
	KEF	20	1.6	.11	2.3
		40	1.5	.11	2.5

There is little difference between the lines or spacings except that 80208, the earliest maturing line had slightly lower levels of all nutrients.

4. Senescence

At BRF, 80202 and 80208 senesced earlier than the three commercial cultivars. Even so, all lines were past the optimum for hay production on 12.4.80 (Table 11) because of the amount of leaf they had shed.

TABLE 11 - Estimated green leaf percentages of cowpeas grown for fodder production 1979/80 wet season.

Line	Site	Green leaf Percent/Date					
		13/2	27/2	25/3	2/4	10/4	15/4
80202	BRF		100	99	50		5
80208			100	99	50		5
Brandon			100	100	60		60
Meringa			100	100	75		75
Palmyra			100	100	80		60
80202	KEF	100				65	
80208		100				60	
Brandon		100				65	
Meringa		100				70	
Palmyra		100				80	

5. Seed Yields

Lines 80202 and 80208 had good seed yields at both BRF and KEF while the 3 commercial cultivars had poor yields at BRF (Table 9).

Yield of 80202 was significantly higher than Brandon, Meringa and Palmyra at both sites and yield of 80208 was significantly higher at BRF and at the 40cm spacing at KEF.

Seed Quality (Table 9) was poor at BRF. Quality was good for 80202 at KEF, and fair for the other four lines.

CONCLUSIONS

Cowpeas can produce good dry matter yields at BRF but the lines are at an optimum for hay production late March when there is still a good chance of rain. BRF is not suitable for wet season seed crops as pods are produced when there is a risk of rain which causes moulding and poor quality seed.

The Katherine environment is more suitable than Darwin for hay and seed production of cowpeas.

The two selected lines 80202 and 80208 did not produce significantly higher dry matter yields than Meringa and Palmyra but they had higher seed yields.

The final populations were low, but these twining cowpea lines showed good ability to compensate, except at BRF at 40cm spacing. This contrasts with Trial 4 with similar populations where growth was poor. The differences in favour of the cowpeas in this trial were better preliminary cultivation, herbicide was applied, and the row spacing was closer.

TRIAL 11 - EVALUATION OF COWPEAS SELECTED FOR GRAIN PRODUCTION 1979/80 WET SEASON

METHOD

Five cowpeas, 61274, 80199, 80218, 80219 and 80225 were sown at BRF and KEF. Five replications of a randomized complete block design were sown at BRF on 21.2.80 and KEF on 30.1.80. Plots were 10 x 1.6m and 20 x 1.6m at BRF and KEF respectively, consisting of 8 rows of 20cm spacing with 12 seeds sown per metre of row.

Fertilizers applied at sowing were superphosphate (200kg/ha) at BRF and KEF and muriate of potash (100kg/ha) at BRF. Dacthal® was applied at 10kg/ha to control the emergence of grass weeds. At BRF Rogor® was applied 2 weeks after emergence for beanfly control.

Emergence counts were carried out at KEF on 28.2.87 and BRF on 10.3.80.

At KEF, the plots were sprayed with Lannate® on 14.3.87.

On 2.4.80 at BRF pod borers had caused severe damage to flowers and green pods. By 11.4.80 they were severely attacking all lines.

Seed was harvested on 9.4.80 at KEF and 7.5.80 at BRF. Two 0.75m² quadrats were harvested from each plot.

RESULTS

Details of height, days to first flowers and seed yield are presented in Appendices 2,6 and 10 respectively.

1. Emergence

Emergence was good at BRF (Table 12), averaging 90% of the expected figure, but was poor at KEF averaging 48%. Emergence was patchy at KEF and was reduced where water had collected in hollows in the plots. Plant counts at harvest at KEF were higher than the emergence counts because the quadrats were placed where the stands were uniform.

2. Growth

At BRF on 10.3.80, plants of all the lines showed symptoms of hormonal herbicide damage to the leaves caused by spray drift. Heights and growth ratings for the 5 lines were identical.

TABLE 12 - Emergence counts, plant counts at seed harvest, seed yield and seed germination of cowpeas grown for grain production 1979/80 wet season.

Line	Site	Emgergence No./m²	Plants at Harvest No./m²	Seed Yield kg/ha	Germination Percent
61274	BRF	34			
	KEF	19	26	1059	96
80199	BRF	35			
	KEF	8	11	824	90
80218	BRF	41		750	16
	KEF	19	25	836	88
80219	BRF	48		56	5
	KEF	28	35	879	81
80225	BRF	31		30	2
	KEF	15	25	1008	87

3. Seed Yield

Seed was harvested from only 3 lines at BRF (Table 12), because of damage by pod borers. There was no significant difference between the yields of the five lines at KEF, all of which were good. The early flowering 80218 had by far the best yield at BRF.

Seed quality was good at KEF (Table 12), particularly 61274, and poor at BRF. Some pods of 80219 shattered in all plots at BRF.

CONCLUSION

BRF and the Darwin area is not suited for cowpea grain production during the wet season because of a combination of factors including beanfly, pod borers and wet weather during ripening.

There was little difference between the five cowpeas at KEF.

During the dry season the authors corresponded with the companies which imported culinary cowpeas to determine the type preferred by consumers. This type was a large seeded black-eye cowpea. None of the lines grown in this trial were of that type.

TRIAL 12 - EFFECT OF SOWING TIME ON COWPEAS SOWN 11 TIMES 1979/80 WET SEASON

METHOD

Five cowpea lines, 80202, 80208, Brandon, Meringa and Palmyra were sown fortnightly from 3.12.79 to 22.4.80, a total of 11 sowings. At each sowing, two replicates of each line were sown in a completely random design. Plots consisted of three 3m rows, with six seeds sown per metre of row. Inter-row spacing was 40cm from 3.12.79 to 11.2.80 and 20cm from 25.2.80. Plot sizes were 3 x 1.2m and 3 x 0.6m at 40 and 20cm spacings respectively.

Fertilizers applied at each sowing were superphosphate (200kg/ha) and muriate of potash (100kg/ha). Dacthal® was applied at each sowing. Plots were sprayed with Rogor® 1 to 2 weeks after emergence to control beanfly.

Emergence counts were carried out between 1 and 3 weeks after sowing.

Observations were made on the plots, and records were kept of growth and reproductive patterns.

On 7.3.80 some plants from all sowings had symptoms of hormonal herbicide damage.

Dripper lines were laid out on all plots on 20.3.80.

On 24.3.80, the cowpeas sown on 10.3.80 were accidentally sprayed with Reglone®. Survival following this spraying ranged from 23% for 60208 through 27% (Palmyra), 30% (Meringa), 36% (80202) to 56% for Brandon, averaging 32%.

Seed was harvested from a $1m^2$ area of each plot on 7.5.80.

RESULTS

1. Emergence

Emergence counts for the 11 sowings are presented in Appendix 14.

Approximately 54 seeds were sown in each plot.

Emergence at all sowings was less than expected. Over all sowings, percentage emergence ranged from 36% (Brandon) to 80% (80202). The best emergence at an individual sowing ranged from 54% (Brandon) to 95% (80202).

The sowings with the best emergence were 4.1.80 to 11.2.80, all being 73-78%. Emergence averaged less than 65% (35 out of 54) at sowings where no significant fall of rain occurred within 4 days after sowing ie. 14.12.79, 10.3.80. This occurred at the later sowings even when establishment was with dripper irrigation.

2. Growth

Records of height, maximum growth rating, days to maximum growth rating, days to optimum time for hay production and estimated percentage green leaf are in Appendix 14.

Sward height was maximized with earlier sowings and declined after the 5th sowing on 25.1.80 except for Brandon which attained a constant height from all 11 sowings.

Maximum dry matter ratings were high for the first 4 sowings (3.12.78 - 14.1.80), intermediate at the fifth and low for all lines at the 6th and later sowings.

Times to maximum dry matter rating are presented only for the first 5 sowings (Appendix 14). After the 5th sowing, there was no obvious maximum. These times were similar for the 5 lines.

On comparing the time to optimum for hay production (between peak flowering and the beginning of pod ripening), 80202 and 80208 were on average approximately 19 days earlier than the commercial cultivars.

The estimated percentages of green leaf showed 80202 and 80208 to senesce earlier than the commercial cultivars. From the first 3 sowings, each cowpea senesced at the same time, independently of sowing date. For the next 2 sowing dates this was also the case. The later sowing dates were not followed through to maturity.

3. Flowering and seeding

The five lines flowered at the same time (Appendix 14).

All of the lines had peaks of flowering and/or green pod production from the first 2 sowings. Brandon had these peaks up to the 4th sowing, 80208 up to the 5th and 80202 up to the 6th. After the 6th sowing, there were insufficient observations to determine good patterns of flowering and pod production. The times to peak flowering and green pod production were similar for the lines at each sowing and decreased as the time of sowing advanced.

On 12.3.80, there was some damage to green pods of all sowings by red wing parrots, and some pods were mouldy. By 16.4.80 some mature pods in 80202 and 80208 had been damaged by parrots. This continued until 11.6.80 when the trial was abandoned. On that date, all green pods in all plots had been damaged. Because of this, seed was harvested only from the first four sowings.

On 11.6.80 there were aphids on some plants of 80208, Brandon, Meringa and Palmyra but the infestation did not affect performance. There was powdery mildew on some 80208 plants. There were symptoms of a reaction to a hormonal herbicide on some 80202, 80208 and Brandon plants.

Meringa and Palmyra had no defined seed maturity date (approximately 140 days). Brandon matured later than 80202 and 80208 (Appendix 14). Lines 80202 and 80208 had similar maturity dates at the first 3 sowings but 80202 was earlier by 15 days at the 4th and 5th sowings.

Seed yield of 80202 and 80208 was approximately double that of the commercial cultivars. There was no effect of sowing date on seed yield except for Brandon which was lower at the 3rd and 4th sowings.

Seed quality was poor. Germination increased as sowing date advanced. Brandon (62%) had the best germination, with the other lines being between 30 and 48%.

CONCLUSIONS

All of the lines are not suitable for dryland hay or seed crops in the Darwin area.

The optimum time to cut them for hay is late March/Early April when rain can be expected.

They all produce pods/seeds which ripen during wet weather, which greatly reduces the quality of seed produced.

TRIAL 13 - EVALUATION OF SHORT SEASON COWPEAS AT VRRS 1979/80 WET SEASON

METHOD

Five cowpeas, 78216, 78220, 80199, 80219 and 80225 were sown at VRRS on 9.1.80. Five replications of a randomized complete block design were sown using Precision Garden Seeders. Each plot consisted of eight 10m rows at 20cm spacing, with 12 seeds being sown per metre of row. Fertilizers applied at sowing were superphosphate (100kg/ha) and muriate of potash (50kg/ha).

Because of heavy rain between late December 1979 and early March 1980 (Appendix 18), VRRS was isolated for over two months, and there was no access by road. The visits to sow and harvest this cowpea trial were both made by light aircraft.

On 20.3.80 establishment counts were taken from two 0.75m² quadrats per plot, the plots were rated visually for growth and reproductive characters, 80199 was harvested to determine dry matter yield and seed was harvested from a selected area of one plot of each line.

RESULTS

Establishment was uneven because the land preparation with a disc plough left the soil surface uneven. There was depressions and furrows in all plots where water had collected.

The populations were low except for 80219, but there was very little weed competition.

On 20.3.80, 70 days after sowing, all lines except 80199 were flowering. Line 80199 was the least advanced, having an estimated 45% green leaf (Table 13). The other lines had senesced, and most plants were dead except that all lines had some actively growing plants around the edge of depressions where water had collected.

The lines were 50cm high except 78220. Line 80199 had the highest growth rating with 80219 and 80225 next best. There were green pods on 80199 and 80225. All lines were at or past seed maturity.

Nutrient contents of the samples from 80199 contained 2.0%N, 0.15%P and 2.8%K.

TABLE 13 - Establishment, estimated green leaf, seed yield, estimated pod shattering and seed germination of cowpeas at VRRS 1979/80

Line	Estab. No./m²	Green Leaf Percent	Dry Matter kg/ha	Pod Shattering Percent	Seed Yield kg/ha	Germination Percent
78216	13	1		3	923	75
78220	11	3		3	779	78
80199	16	45	4080	0	756	85
80219	33	3		40	853	75
80225	16	5		0	760	78

CONCLUSIONS

Despite some difficulties in monitoring this trial at a remote site where access is limited during the wet season, it was apparent that the five lines grew well. The seed yields from selected areas show that these cowpeas are capable of producing good yields of good quality seed in this environment, in a year when rainfall is high (Appendix 18).

The dry matter yield of 80199 is equal to some of those obtained at BRF and KEF in Trial 10. Cowpeas could be grown as a fodder crop at VRRS and other areas of the Victoria River District.

TRIAL 14 - SEED INCREASE 1980 DRY SEASON

METHOD

Seven cowpeas (Table 14) were sown during March 1980 at BRF. A further crop of 80202 was sown on 30.7.80.

Row spacing was 20cm. The sowing rates used in kg/ha were 55 (62174), 99 (80199), 68 (80202(1)), 73 (80202(2)), 78 (80208), 77 (80218), 110 (80219) and 98 (80225). Fertilizers applied at sowing were superphosphate (200kg/ha) and muriate of potash (100kg/ha).

Plots were watered by overhead spray irrigation except 80218, 80219 and 80225 which were watered by dripper irrigation.

Lines 80218, 80219 and 80225 were accidentally sprayed with Reglone® on 24.3.80. The percentages of plants which survived this spraying were 48% for 80218, 64% for 80219 and 41% for 80225. This greatly reduced the final yield.

On 27.5.80 there was some powdery mildew on 80202 but it was not a serious problem.

Red-wing parrots commenced feeding on the cowpeas on 30.5.80. Fish net was erected to protect the cowpeas from the parrots. This was completed too late, and crop losses were estimated at over 50%. The parrots were eating the green pods, but most of the loss was caused by them knocking mature pods to the ground.

The areas were header harvested between 20 and 25.6.80 except 80218, 80219 and 80225 which were harvested by hand.

With the second crop of 80202, fish net was erected as a barrier to prevent pied geese from trampling the crop. Following the header harvesting of this crop, the pods on the ground were windrowed with a hay rake. The windrows were then fed through the header.

RESULTS

All details are presented in Table 14.

Establishment was excellent for all of the lines.

Reglone reduced the final population and hence yield of three lines, while parrots and geese (80202, second sowing) reduced the yield of the other lines.

TABLE 14 - Area sown, emergence counts, seed yields and seed germination of cowpeas grown for seed increase 1980 dry season.

Line	Area Sown m²	Emergence No./m²	Seed Yield kg/ha	Germination Percent
61274	762	49	384	81
80199	403	58	644	47
80202(1)	1320	62	390	72
80202(2)	3700	54		87(a) 62(b)
80208	512	63	411	48
80218	379	43	103	
80219	94	50	308	
80225	261	37	191	

(a) Header harvested (b) Windrowed pods.

The seed yields shown in Table 16 should be at least doubled to indicate a realistic figure for the yield of the lines. Yield of the second crop of 80202 was estimated at 1000kg/ha but the results of the 2 separate harvests were not recorded.

The germination of 80199 and 80208 was low. These two lines have thin seed coats which were damaged during header harvesting.

CONCLUSIONS

These cowpeas can produce a good yield of good quality seed when grown under irrigation during the dry season, but isolated areas of seed crops are at risk of damage by birds during the dry season.

Choice of header may be important, as lines with thin seed coats can be damaged during harvest.

TRIAL 15 - COWPEA BULK AREA SOWINGS 1980/81 WET SEASON

METHOD

Five cowpeas, 61274, 80199, 80202, 80208 and Meringa were sown in larger areas at 3 sites, BRF, KEF and Douglas Daly Research Farm (DDRF, Blain Sandy Red Earth, AAR 1140mm) to measure dry matter and seed yields.

The areas sown were 800m² at DDRF, 1078-1748m² at KEF and 1400-2500m² at BRF. Row spacings were 20cm at BRF and KEF and 17.5cm at DDRF. Sowing dates were 29.1.81 at KEF, 8.1.81 at DDRF and 9-10.2.81 at BRF. The sowing rates were between 25 and 50kg seed/ha at BRF. Expected populations were 250 000 plants/ha at BRF and KEF and 400 000 plants/ha at DDRF.

The cowpeas at BRF were sprayed with Rogor® on 27.2.81.

At BRF the plots were observed a number of times during the growth of the crops. Only one was harvested for dry matter yield, Meringa on 23.4.81 (five 1m² quadrats).

At DDRF observations were carried out three times, five 1m² quadrats were harvested for dry matter from each plot on 23.3.81, five 1m² quadrats were taken for seed yield from 61274, 80199 and 80202 on 30.4.81 and seed was harvested by header from 80199 and 80202 and five 1m² quadrats for dry matter were taken from Meringa on 1.5.81.

At KEF the areas were observed a number of times, five 1m² quadrats were harvested for dry matter from each plot on 2.4.81, five 1m² quadrats harvested for seed yield on 13.4.81 and seed was harvested by header from 61274, 80199, 80202 and 80208 and five 1m² quadrats were harvested for dry matter from 80208 and Meringa on 14.4.81.

RESULTS

1. BRF

Populations (plants/ha) on 24.2.81 were 158,000 (61274), 102,500 (80199), 77,000 (80202), 111,000 (80208) and 146,500 (Meringa). The stands were uneven except for 61274.

Sowing was late because of a wet January (860mm, Appendix 18) which delayed land preparation and made weed control difficult.

Populations were lower than expected. This may have been caused by problems with the planter wheels slipping in wet soil, planting too deep and/or competition from grass weeds.

There were aphids present and obvious beanfly damage on 24.2.81.

Most of the area was grassy on 23.4.81, and the quality of seed present was poor. There was less than 25% cowpea in the 61274 area and an estimated 30% in the 80202 area. Meringa was the best plot, with one third good, but one third also poor.

The dry matter sample taken from the good area of Meringa on 23.4.81 yielded 2730kg/ha dry matter. The nutrient contents of the sample are presented in Appendix 15.

2. DDRF

All of the details, except green leaf percentages are in Table 15.

The populations of 80199 and 80202 were low while the others were good.

On 12.3.81 all of the cowpeas were 65-75cm in height, had a growth rating of good and 100% green leaf.

Dry matter yield on 23.3.81 was similar for all lines (Table 15). A second harvest was taken from Meringa, the latest maturing line on 1.5.81. At this harvest, the population was 18 plants/m² and dry matter was 5620kg/ha.

Nutrient contents of the samples are presented in Appendix 15.

TABLE 15 - Populations, dry matter yields, seed yield and seed germination of cowpeas at DDRF 1980/81 wet season.

Line	Population No./m²	DM Yield kg/ha	Quadrat Seed Yield kg/ha	Germination Percent	Header Seed Yield kg/ha
61274	38	3476	1478	26	
80199	17	4338	1383	26	400
80202	30	4600	1210	53	350
80208	18	4240			
Meringa	27	3970			

All of the lines senesced and lost leaf very quickly at the end of the March (Table 16).

TABLE 16 - Estimated green leaf percentages of cowpeas at DDRF and KEF 1980/81 wet season.

Line	Green Leaf Percent/Dates				
	DDRF			KEF	
	24/3	30/3	19/5	2/4	13/4
61274	100	8	5	10	1
80199	100	2		20	2
80202	100	10		40	5
80208	100	50	20	65	55
Meringa	100	60	30	75	75

The quadrat seed yields taken from the three cowpeas with the most even seed set and maturity 61274, 80199 and 80202 were all good (Table 15). Quality was poor, particularly for the early flowering 61274 and 80199, because of weather damage.

Line 61274 was not header harvested on 30.4.81 because of the presence of a high number of green pods (Table 17). Recovery by the harvester of 80199 and 80202 was only 30 percent of the quadrat yield.

TABLE 17 - Flower, green and mature pod numbers and seed yield of cowpeas at DDRF on 30.04.81 and KEF on 13.04.81

Line	Flowers No./m²		Green Pods No./m²		Mature Pods No./m²		Seed yield g/pod	
	DDRF	KEF	DDRF	KEF	DDRF	KEF	DDRF	KEF
61274	4		23		148	103	1.0	0.9
80199	1	2	14	1	128	121	1.1	0.8
80202	1		12		111	108	1.1	1.0
80208						72		1.4
Meringa		7		8		23		0.8

On 19.5.81, there was some good seed on 61274, many pods but not much good seed on 80208, and almost no good seed on Meringa. There was not sufficient seed to warrant header harvesting the plots.

3. KEF

A summary of the results is presented in Table 18.

Emergence was good or excellent (61274, 80202). Populations had declined to 65-73% of the initial figure by 2.4.81 (63 DAS) except for 80208 which had remained constant.

On 4.3.81 there were pod borers in pods of 61274 and 80199, 80199 was suffering from severe grass competition, and there were some low areas in the 80208 plot caused by leaf cutting ants.

By 2.4.81 all of the lines were 70-80cm high, had growth rated as good and had flowered and set seed. There were flowers only on Meringa which was the least advanced of the lines.

TABLE 18 - Populations and dry matter and seed yields of cowpeas at KEF 1980/81 wet season.

Line	Emergence No/m²	Dry matter kg/ha	Quadrat Seed Yield kg/ha	Header Seed Yield kg/ha
61274	48	3882	934	614
80199	20	4008	912	450
80202	56	4230	1090	368
80208	25	5030	1036	148
Meringa	31	4408	180	

Dry matter yields of the lines were good, with 80208 best (5030 kg/ha).

On 14.4.87 plant populations had fallen to 65% and 48% of the initial populations for 80208 and Meringa respectively. Dry matter yields had also dropped to 3870 and 3895kg/ha for 80208 and Meringa respectively.

Nutrient contents of all of the samples are in Appendix 15.

All of the lines had begun to senesce and drop leaf on 2.4.81 (Table 16).

Details of the quadrats harvested for seed on 13.4.81 are in Table 17.

Quadrat seed yields were good (Table 18) except for Meringa which was poor (180kg/ha). Header yields ranged from 14% of the quadrat yield (80208) through 34% (80202), 49% (80199) to 66% (61274). The lower recoveries for 890202 and 80208 may have been because these 2 lines were not as advanced as the two earlier flowering lines, leading to problems with green leaves and stems in the header.

The yield potential of Meringa is limited by the number of pods set (Table 17).

CONCLUSIONS

These bulk area sowings demonstrated that all of the cowpea lines are more suited to conditions at KEF compared with those at BRF. At DDRF they grew well but there was still enough wet weather during pod ripening to seriously affect seed quality.

Seed yield of the four selected lines were good but recover by header harvester was not very efficient.

Meringa is the latest maturing but seems to grow more slowly than 80202 and 80208 early in the wet season. It is the best line to grow for hay but seed yield is poor.

Of the four selected lines, 80202 appeared to be the most suitable for release as a new cultivar because of high dry matter and seed yields. Line 80208 grows well but individual plants are large, stems are thick and it is not as suitable for hay production. A further disadvantage is a thin seed coat which, like that of 80199, is more easily damaged during header harvesting than that of the other selected lines.

TRIAL 16 - COWPEA POPULATION TRIAL 1980/81 WET SEASON

METHOD

Meringa and 80202 were sown at BRF on 5.2.81 in a split plot experiment with plant population as the main plot treatment and cowpea line as the sub-plot treatment. Four replicates of the design were sown.

Main plot size varied from 4 x 2.8m at the highest to 4 x 9.6m at the lowest population. Different populations were obtained by varying the row spacing (20-80cm) and seeds per metre of row (5 or 10). All plots were sown with the seeder used in previous trials. Fertilizers and Dacthal® were applied as for previous trials at BRF.

Populations were counted on 24.2.81. The plots were sprayed with Rogor® on 27.2.81.

The trial was observed a number of times during the wet season.

RESULTS

The populations were much lower (approximately half) of those expected (Table 19) because of the wheels of the planter slipping in the wet soil and mortality caused by beanfly.

TABLE 19 - Expected and actual populations of cowpeas in a population trial 1980/81 wet season.

Expected Population Plants/ha	Actual Populations	
	80208	Meringa
62 500	28 900	66 500
93 750	46 200	76 900
125 000	73 800	75 800
250 000	140 500	184 600
500 000	193 300	271 700

On 24.2.81 there were aphids present in low numbers and some obvious beanfly damage.

The different populations did not affect plant height, maturity, flowering or pod production of either cowpea.

Heights were 25-45cm on 30.3.81, 45-55cm on 10.4.81. On 24.2.81 80208 was 50-60cm and Meringa was 50-75cm. The average height of Meringa was 5cm higher than 80202 except on 10.4.81.

There was a linear increase in growth rating with increase in population for both cowpeas on 30.3.81. This effect was less obvious with 80202 on 10.4.81 and gone by 24.4.81. The higher growth ratings of the two highest populations were maintained until 24.4.81 for Meringa. Mean growth ratings were identical for 80202 and Meringa for the early observations and slightly lower for 80202 on 24.4.81. On this date 80202 was more advanced and was dropping leaves.

Estimated green leaf percentages on 11.5.81 were 45 for 80202 and 85 for Meringa. By this time 80202 had finished flowering and had a high number of green pods and some mature pods present. Meringa was still flowering with some green and mature pods present.

By 1.6.81 all seed had been consumed by corellas.

CONCLUSIONS

In this trial, the different populations had no effect on the characters recorded except for better early growth with increasing plant population.

These twining cowpeas have the capacity to compensate in later growth for low initial populations.

TRIAL 17 - GROWTH AND REPRODUCTIVE PATTERNS OF COWPEAS SOWN 4 TIMES 1980/81 WET SEASON

METHOD

Meringa and 80202 were sown at BRF on 4 occasions during the 1980/81 wet season, 9.12.80, 30.12.80, 13.2.81 and 9.3.81. Five replications of a randomized complete block design was sown at each sowing date. All plots were sown at 20cm row spacing, with plots being 3 x 1.4m. Expected populations were 250 000 plants/ha. Fertilizers and Dacthal® were applied as in previous trials. Rogor® was applied 7 days after each sowing to prevent beanfly damage.

Emergence counts were carried out after the sowings except for 30.12.80 because of the extremely wet weather (Appendix 18). Counts were carried out three times between 15/12 and 31/12 after the 9.12.80 sowing. Plant numbers increased from 113 000 to 127 000 plants/ha for 80202 and from 89 000 to 145 000 for Meringa. Populations wre much better for the last 2 sowings averaging 270 000 for the 13.2.81 sowing and being 270 000 and 419 000 for the 9.3.81 sowing for 80202 and Meringa respectively.

The plots were observed a number of times during the trial. One $1m^2$ quadrat per plot was sampled for seed yield from 80202 sown 9.12.80 on 24.4.81 and from the other plots on 13.5.81.

RESULTS

1. Emergence/Establishment

Emergence was approximately one half of the expected population for the first sowing date but was much better for the last 2 sowing dates where a different sowing plate with more sowing apertures was used in the planter.

These results suggest that initially, there were problems with the seeder, that is it was not sowing at the calibrated rate in a wet, uneven seedbed. This could have been due to wheels slipping or losing contact with the ground.

The increase in population between the first and third counts after the first sowing suggests slow emergence which could be related to being sown too deep and/or hard seed (Table 7).

2. Growth

Records of height, growth ratings and estimated percentages of green leaf are presented in Appendix 16.

There were only small differences in the growth of the 2 cowpeas. Meringa was slightly taller and 80202 matured earlier.

On 11.5.81 there were signs of hormonal herbicide damage on Meringa plants from sowing date 4.

The plants from the 3rd and 4th sowings were more erect than those sown earlier.

3. Flowering and Seeding

Line 80202 which flowered and matured earlier than Meringa, also had a more even seed set and maturity. Sowing date had no effect on maturity.

Parrots had damaged some pods of 80202 (Sown 9.12.80) on 30.3.81 and Meringa (Sown 13.2.81) on 11.5.81. No seed was harvested from the last sowing of Meringa because it had been consumed by corellas and red-wing parrots.

Details of flower and pod numbers present at harvest are in Appendix 16. Seed yields are presented in Table 20.

TABLE 20 - Seed yields of cowpeas sown 4 times at BRF 1980/81 wet season.

Sowing Date	Seed Yield (kg/ha)	
	80202	Meringa
9.12.80	228	364
30.12.80	803	573
13.2.81	690	332
09.03.81	760	

Line 80202 had a higher seed yield than Meringa except at the first sowing date where 80202 pods were damaged by parrots. Sowing date did not affect seed yield.

CONCLUSIONS

Line 80202 matures earlier than Meringa and has a high seed yield.

Sowing date did not affect the maturity date or seed production of these 2 cowpeas.

TRIAL 18 - PRELIMINARY EVALUATION OF COWPEAS AT BRF 1980/81 WET SEASON

METHOD

Eight cowpeas, 77722, 86102, 86104, Blackeye, Blackeye No. 5, Blackeye No. 7, Blackeye No. 72, Blackeye 1239 and Blackeye 8152 were evaluated in unreplicated plots under well fertilized, well watered conditions.

The lines were sown on 26.2.81.

RESULTS / CONCLUSIONS

The cowpea with the best vegetative growth was Blackeye 8152 followed by Blackeye No.72. Blackeye No.72 had highest seed yield, followed by Blackeye 8152, 86104 and 86102. The earliest flowering lines were 77122 and 86102, while Blackeye No. 72 was the latest flowering.

Of the six Blackeye types, the lines with the best potential for grain production appear to be Blackeye No. 72 and Blackeye 8152 respectively. The vegetative growth and seed yield of these 2 lines was better than that of Blackeye No. 7 which was released in New South Wales as Banjo.

OTHER RECORDINGS

A number of comments on specific lines or recordings of various characters are presented in Appendix 17.

Included are observed characters, aphid ratings, seed weights and seed nutrient contents. Although 12 lines had high infestations of aphids, only 3 lines (80218, 80220, 80222) were severely affected. Seed crude protein percentages for the 5 cowpeas tested, ranged from 24.4 to 28.1%.

GENERAL DISCUSSION

The series of trials showed that, in the Darwin area, cowpeas are suitable only as a green manure crop during the wet season or an irrigated seed crop during the dry season. Crops sown during the wet season mature too early, with the ideal time to cut them for hay occurring during late March/early April when rain is expected. Pods are also produced and mature at this time. They become mouldy and produce seed of low quality.

The Douglas Daly area should be suitable for hay production in most years and for production of good quality seed from mid to late January sowings.

The results of these trials and previous work (Arndt et al 1963) show that cowpeas can be cut for hay or harvested to produce good quality seed in most years in the Katherine area. Cowpeas can produce good fodder and fair seed yields in the Victoria River District (Table 13), but seed or grain production may be possible only in years of above average rainfall.

Fodder cowpea types can be grown as a green manure crop, for hay or for use as standover feed for deferred grazing. Two new lines had high fodder yields, 80202 and 80208. These lines had good early growth and fodder yields equal to or higher than commercial cultivars and higher seed production. Seed yields averaged over twice those of the best cultivar, Meringa.

Meringa has an advantage in being the latest maturing cultivar and it can be harvested later for hay than the other lines grown.

Line 80202 was released in the Northern Territory as cv. Arafura (Cook 1986). It was selected over 80208 because of a stronger seed coat which was not damaged by header harvesting (Trial 15).

In 1977-1979, a number of lines which were suitable for grain production were identified. These lines had an even seed set and maturity and pods held above the foliage but they did not meet the criteria of the preferred culinary type which is a large seeded blackeye cowpea. Line 80218 was a blackeye type but the seed was too small being approximately half the required size. Banjo, a cultivar released in New South Wales (Cook 1982) has the required seed type but it did not perform as well in an observation trial at BRF (Trial 18) as two other blackeye lines, Blackeye No. 72 and Blackeye 8152.

Timing of cutting is critical for hay production from cowpeas. Quality and yield can drop rapidly at the end of the wet season as leaf is lost (Tables 11 and 16, Norman and Wetselaar 1960).

Birds, mostly parrots reduced the seed yield small isolated areas of cowpeas, particularly with dry season irrigated crops. This would not be such a problem if larger areas are sown.

Beanfly can cause high seedling mortality in cowpeas in the Darwin area, and must be controlled to ensure good establishment. There were no problems with beanfly at the other sites where cowpeas were grown. Aphids were recorded on cowpeas a number of times but they did not affect growth or production except for a few lines (Appendix 17). Pod borers reduce seed yield. They need to be monitored and sprayed if necessary. Good seed yields were produced in most of the trials in this study without spraying. Pod sucking bugs were found on cowpea seed crops but did not cause seed losses.

Powdery mildew was recorded on a number of dry season crops but was not damaging to the lines evaluated.

Competition from grass weeds can be a problem during early growth if establishment is inadequate. Good quality seed sown at close spacing (20cm) to give a population of 200,000 to 300,000 plants per hectare will give a good stand which will smother grass weeds.

The dry matter yields at Katherine of the best cowpeas in these trials are higher (Tables 2, 9, 18) than those reported by previous research workers (Edey 1963, Norman and Wetselaar 1960, Phillips and Norman 1960) except for some years reported by Arndt et al 1963.

The best dryland seed yields obtained, at 1000-1400kg/ha are similar to those obtained by Jallow and Ferguson (1985) for an early wet season sowing in Trinidad under similar environmental conditions to those experienced in the Top End of the Northern Territory (Anon 1975). These yields however are much lower than those reported by Jallow and Ferguson for a late wet season sowing at 1227-2534, averaging 1962kg/ha. They are also much lower than yields reported from Banjo in NSW at 4.3t/ha (Cook 1982) and of other cowpeas in California at 2052 - 3647kg/ha (Nielsen and Hall 1985, Shouse et al 1981).

Cowpea seed yield can be reduced by a number of factors, including high day temperatures (Shouse et al 1981, Warrag and Hall 1983), high night temperatures (Nielsen and Hall 1985, Warrag and Hall 1983), water deficits at flowering or during pod filling (Shouse et al 1981) and short-term waterlogging (Minchin et al 1978). A combination of any of these factors could be responsible for a reduction in cowpea seed yield in the Top End during any wet season.

The crude protein content (24 to 28%) of the seed harvested exceeds the normal range suggested by Summerfield et al (1974), 19 to 26% although not exceeding the 35% reported by Summerfield et al (1974).

CONCLUSIONS

There are a number of cowpea cultivars suitable for forage production in the Top End of the Northern Territory (Cameron 1981). The cultivar Arafura released in the Northern Territory is now also recommended for sowing.

Timing of cutting for hay production is critical as all cultivars mature quickly and drop leaves at the end of the wet season.

Good quality seed can only be produced where pods are not maturing during periods of rainy weather.

Blackeye No. 72 could be investigated as a line to produce the desired culinary cowpea.

BIBLIOGRAPHY

ANON (1975). Climatic Averages South Australia and Northern Territory. Bureau of Meteorology. Dept. Sc. and Consumer Affairs.

ARNDT W., PHILLIPS L.J and Norman M.J.T (1963). Comparative Performance of Crops on Three Soils of the Tipperary Region, NT. CSIRO Div. Land Res. and Reg. Survey tech. Paper No. 23.

CAMERON A.G., (1981). How to Grow Cowpeas. Department of Primary Production Agnote No. 81/17.

CAMERON A.G., MILLER I.L., HARRISON P.G., and FRITZ R.J., (1984). A Review of Pasture Plant Introduction in the 600-1500mm rainfall zone of the Northern Territory. Department of Primary Production Technical Bulletin No. 71.

COOK L.J (1982), Cowpea cv Banjo Description. J.A.I.A.S. 48:127-8.

COOK L.J. (1986). Cowpea cv Arafura Description. J.A.I.A.S. 52:121-2.

EDEY J.M. (1963). Cowpea Variety Trial. Agriculture Branch, NT Administration - Internal Report.

JALLOW A.T. and FERGUSON T.U. (1985). Effects of planting density and cultivar on seed yield of cowpeas (Vigna unguiculata (L.) Walp.) in Trinidad. Trop. Agric. (Trindiad) 62:121-4.

McELLISTER F.V. (1965). Cowpea varity trial Katherine Experiment Farm 1964/65. Agriculture Branch, N.T. Administration. Internal Report.

MINCHIN F.R., Summerfield R.J., Eaglesham A.R.J. and Stewart K.A. (1978). Effects of short-term waterlogging on growth and yield of cowpea (Vigna unguiculata) J. Agric. Sc. 90:355-66.

NIELSEN C.L. and HALL A.E. (1985) Responses of cowpea (Vigna unguiculata (L.) Walp.) in the field to high night air temperature during flowering II. Plant Responses. Field Crops Research 10:181-96

NORMAN M.J.T. and Wetselaar R.(1960) Performance of Annual fodder crops at Katherine, N.T., CSIRO Div. Land Res. and Reg. Survey Tech. Paper No. 9.

PHILLIPS L.J. and NORMAN M.J.T. (1962). Fodder crop - Cash crop sequences at Katherine, N.T. CSIRO Div. Land Res. and Reg. Surrey Tech. Paper No. 20.

SHOUSE P., DASBERG S., JURY W.A. and STOLZY L.H. (1981). Water deficit effects on water potential, yield and water use of cowpeas. Agron. J. 73:333-6.

SUMMERFIELD R.J., HUXLEY P.A. and STEELE W. (1974). Cowpea (Vigna unguiculata (L.) Walp). Field Crop Abstracts 27:301-12

WARRAG M.O.A. and HALL A.E. (1983). Reproductive responses of cowpea to heat stress: Genotypic differences in tolerance to heat at flowering. Crop Sc. 23:1088-92.

WINTER W.H., CAMERON S.G., REID R., STOCKWELL T.G. and PAGE M.C. (1985) Improved Pasture Plants. In Agro-Research for the Semi-Arid Tropics: North-West Australia. Ed. R.C. Muchow pp.227-69.

APPENDIX 1

COWPEA LINES SOWN IN TRIALS DURING THE SEASONS 1977/78 TO 1980/81:- IDENTIFICATION, SOURCE, YEAR(S)/SITE(S) SOWN

Format and Codes Used.

IDENTIFICATION

CPI = Commonwealth Plant Introduction number.
Other identification = Name, other numbers.

SOURCE: Country or Immediate source.

YEAR SOWN:

77/78 = Wet season sowing.
78 = Dry season sowing.

SITE SOWN:

B = Berrimah Research Farm
D = Douglas Daly Research Farm.
K = Katherine Experiment Farm, now Katherine Rural College.
V = Victoria River Research Station.

Identification			Site(s)/Year(s) Sown						
CPI	Other	Source	77/8	78	78/9	79	79/80	80	80/1
20427		India			B				
24219		Cuba	BK						
24221		Cuba			BK				
29776		Thailand	B		BK				
30141		Sri Lanka			BK				
30779		Burma	B		BK				
30786		Burma	B		BK				
33039		Central America	B		BK				
34821		The Philippines	B						
39133		S America	B		BK				
39137		S America	B		BK				
45569	PI170868	USA	B		BK				
45575	PI194206	USA	BK						
45579	P1255811	USA	BK						
45584	PI292909	USA	BK						
45588	PI293567	USA	BK						
45589	PI293584	USA	BK						
50849	10.5.12	Thailand	BK						
58735		Columbia		B					
58736		Columbia			BK				
61090	K3(B)	Burma	BK						
61093	Grey local	Burma	BK						
61094	Red local	Burma	BK						

Identification			Site(s)/Year(s) Sown						
CPI	Other	Source	77/8	78	78/9	79	79/80	80	80/1
61274	Mixed local	Burma	BK	B	BK	B	BK	B	BDK
68799		India			BK				
77122	WIR-105	NSW DOA							B
77940	TVU1256-0B	Nigeria	BK	B	BKV				
77941	TVU3629	Nigeria	B						
77942	TVX7-3K	Nigeria	BK						
77943	TVX944-02E	Nigeria	B						
77944	TVX1193-7D	Nigeria	BK						
77945	VITA 1	Nigeria	BK						
77946	VITA 3	Nigeria	B						
77947	VITA 4	Nigeria	B						
77948	VITA 5	Nigeria	B						
78216	E.C.13060	India	BK	B	V	B	V		
78217	P.33-2-1	India	B	B	BKV				
78218	P3-1	India	B		BKV				
78219	F.S.68	India	BK		V				
78220	PLC-7	India	B	B	BKV	B	V		
78221	I.C.8267	India	BK		V				
80198	TVX33-1G	Nigeria	BK						
80199	TVX289-4G	Nigeria	BK	B	BK	B	BKV	B	BDK
80200	TVX1836-473E	Nigeria	BK						
80201	TVX337-3F	Nigeria	BK						
80202	SVS-3	Nigeria	BK	B	BKV	B	BK	B	BDK
80203	TVX1843-1C	Nigeria	BK	B					
80204	TVX1193-059D	Nigeria	BK						
80205	TVX1836-150G	Nigeria	BK	B					
80206	VITA 3	Nigeria	B		BK				
80207	TVX1836-157G	Nigeria	BK						
80208	VITA 1	Nigeria	BK	B	BKV	B	BK	B	BDK
80209	VITA 5	Nigeria	BK						
80210	TVX1836-9E	Nigeria	BK	B	BKV				
80211	TVX944-02E	Nigeria	BK						
80212	TVX930-01B	Nigeria	BK						
80213	TVX66-2H	Nigeria	BK	B					
80214	TVX1193-7D	Nigeria	BK						
80215	VITA 4	Nigeria	BK	B	BK				
80216	TVX1836-429E	Nigeria	BK						
80217	TVX1836-19E	Nigeria	BK						
80218	TVX2869-P2-2	Nigeria	BK	B	BV	B	BK	B	
80219	TVX1193-95	Nigeria	BK		BKV	B	BKV	B	
80220	TVX 7-5H	Nigeria	BK						
80221	TVX 309-1G	Nigeria	BK						
80222	TVX 6-4H	Nigeria	BK						
80223	TVX 13-31K	Nigeria	BK						
80224	TVX12-01E	Nigeria	BK						
80225	TVX1836-90E	Nigeria	BK	B	BKV	B	BKV	B	
86102	Lalokilocal	New Guinea							B
86104	Gutpela	New Guinea							B

Identification			Site(s)/Year(s) Sown						
CPI	Other	Source	77/8	78	78/9	79	79/80	80	80/1
-	Aloomba	QLD DPI			BK				
-	Blackeye	USA							
-	Blackeye No.5	USA			BK				B
-	Blackeye No.7	USA							B
-	Blackeye N.72	USA							B
-	Blackeye 1239	USA							B
-	Blackeye 8152	USA							B
-	Brandon	QLD DPI			BK	B	BK		
-	Caloona	QLD DPI	BK		BK	B			
-	Meringa	QLD DPI			BK	B	BK		BDK
-	Palmyra	Commerical				B	BK		
-	Phoenix	Commerical			BK				
-	Red Caloona	QLD DPI	BK		V				
-	Santiago	QLD DPI	BK	B	BK	B			

APPENDIX 2

SWARD HEIGHTS OF COWPEAS AT BRF AND KEF 1977/8 TO 1979/80 WET SEASON

Line	Height (cm)					
	1977/78		1978/79		1979/80	
	BRF	KEF	BRF	KEF	BRF	KEF
20427	40					
24219	85	90				
24221			75	70		
29776	50	60	60			
30141			75	60		
30779	60			50		
30787	50	50	40			
33039	50	60		45		
34821	80					
39133	80		50	60		
39137	60		45	60		
45569	60		70	50		
45575	70	75				
45579	70	30				
45584	35	30				
45588	50	60				
45589	60	95				
50849	60	95				
58735			45			
58736			60	70		
61090	40	60				
61093	70	85				
61094	75	90				
61274	60	110	50	45	40	50
68799			45	70		
77940	55	70	50	50		
77941	40					
77942	65	80				
77943	60					
77944	45	65				
77945	85	100				
77946	60					
77947	65	75				
77948	50	70				
78216	45	70				
78217	70		50	50		
78218	30		35	50		
78219	40		40			
78220	50		50	50		
78221	50	60				
80198	60	80				
80199	70	100	50	55	40	50
80200	50		90			
80201	65	85				
80202	65	90	50	70	85	80

Line	Height (cm)					
	1977/78		1978/79		1979/80	
	BRF	KEF	BRF	KEF	BRF	KEF
80203	75	90				
80204	65	75				
80205	50	100				
80206	60		60	75		
80207	30	50				
80208	70	95	70	65	70	80
80209	35	55				
80210	50	105	50	50		
80211	65	85				
80212	40	85				
80213	55	75				
80214	50	40				
80215	60	70	50	50		
80216	65	70				
80217	60	65				
80218	45	70	45	40	40	50
80219	40	55	50	40	40	50
80220	70	60				
80221	50	80				
80222	55	65				
80223	50	75				
80224	40	40				
80225	65	55	55	50	40	50
Aloomba			70	70		
Blackeye No.5			50	50		
Brandon			50	50	60	75
Caloona	95	110	60	75		
Meringa	60	70	85	85		
Palmyra					85	80
Phoenix			60	60		
Red Caloona	75	65				
Santiago	70	85	75	70		

APPENDIX 3

DRY MATTER YIELDS OF COWPEAS AT BRF AND KEF 1977/78 WET SEASON

Line	Dry Matter g/m²			
	50 DAS		85 DAS	
	BRF (31/1/78)	KEF (8/2/78)	BRF (7/3/78)	KEF (15/3/78)
77940	40	113	62	137
77942	20	103	123	139
77944	53	82	106	59
77945	100	139	502	338
77947	72	77	309	281
78216	57	55	55	89
80201	36	69	422	392
80202	34	143	507	290
80203	41	117	510	337
80204	23	66	144	135
80208	91	168	372	647
80213	87	62	490	150
80214	77	64	50	86
80215	36	88	356	291
80216	87	103	188	97
80217	105	101	273	230
80218	83	77	94	69
80219	52	56	64	38
80220	46	79	251	88
80222	52	91	194	130
80223	34	107	107	211
Caloona	36	93	274	320
Red Caloona	48	92	78	90
Santiago	65	74	404	388

DAS = Days After Sowing

APPENDIX 4

DRY MATTER YIELDS OF COWPEAS AT BRF AND KEF 1977/78 TO 1979/80 WET SEASONS

Line	Dry Matter Yield (g/plant)					
	1977/8		1978/9		1979/80	
	BRF	KEF	BRF	KEF	BRF	KEF
61274			8.5	4.4		
77940	14.0	30.8	13.7	6.1		
77942	27.8	31.3				
77944	23.8	18.5				
77945	113.0	76.0				
77947	69.5	63.3				
78216	12.9	23.9				
80199			45.2	19.1		
80210	95.0	88.3				
80202	114.0	65.3	48.4	47.0	56.7	62.5
80203	114.8	75.8				
80204	32.5	30.4				
80208	83.8	145.5	42.7	43.3	74.7	82.4
80210			32.2	8.8		
80213	110.3	33.8				
80214	17.3	19.3				
80215	80.0	65.5	43.1	15.0		
80216	42.3	23.3				
80217	61.5	51.8				
80218	21.3	17.4	6.8	5.1		
80219	14.5	12.5				
80220	56.5	19.8				
80222	43.8	29.3				
80223	24.0	47.5				
80225			17.5	20.8		
Brandon					54.8	61.9
Caloona	61.6	72.0	15.7	9.7		
Meringa					47.3	53.9
Palmyra					38.5	57.6
Red Caloona	17.5	20.8				
Santiago	91.0	87.3	8.5	7.1		

APPENDIX 5

NUTRIENT CONTENTS OF COWPEAS AT BRF AND KEF 1977/78 WET SEASON

Line	N%				P%				K%			
	Day 50		Day 85		Day 50		Day 85		Day 50		Day 85	
	BRF	KEF	BRF	KEF	BRF	KEF	BRF	KEF	BRF	KEF	BRF	KEF
77940	2.6	2.4	2.2	1.6	.29	.14	.24	.09	1.2	2.5	0.6	1.8
77942	2.6	2.3	2.3	1.6	.29	.16	.30	.09	1.5	2.9	1.1	2.0
77944	2.0	2.2	2.3	1.7	.30	.16	.26	.09	1.7	3.1	0.6	2.0
77945	2.7	2.2	2.8	1.6	.30	.15	.28	.09	1.4	3.7	0.5	2.2
77947	2.5	2.5	1.9	1.4	.30	.16	.23	.09	1.9	3.4	0.6	2.5
78216	2.1	2.2	1.6	1.9	.25	.16	.22	.07	1.4	2.6	0.7	2.0
80201	2.7	2.7	2.3	1.7	.28	.18	.26	.10	1.9	3.3	0.9	2.4
80202	2.4	2.6	3.0	1.8	.28	.17	.34	.10	1.8	3.7	0.8	2.5
80203	2.6	2.5	3.0	1.8	.29	.16	.30	.10	1.9	3.4	0.9	2.4
80204	2.2	2.7	2.2	1.4	.27	.19	.24	.09	1.4	3.7	0.9	2.2
80208	2.3	2.4	3.2	1.8	.28	.18	.28	.10	1.5	3.9	0.9	2.5
80213	2.5	2.5	2.1	1.7	.33	.15	.25	.10	2.2	4.0	0.7	2.8
80214	2.1	2.3	1.4	1.6	.29	.15	.18	.08	1.8	2.7	0.8	2.0
80215	2.8	2.3	2.1	1.6	.34	.14	.29	.09	2.2	3.6	0.9	2.5
80216	2.1	2.1	2.1	1.8	.28	.14	.29	.09	1.4	3.0	0.7	1.9
80217	2.3	2.4	2.6	1.9	.28	.17	.29	.11	1.7	3.1	0.8	2.3
80218	2.3	2.0	1.8	1.4	.37	.16	.25	.09	2.1	3.4	1.1	2.5
80219	2.2	1.9	1.7	1.5	.33	.14	.24	.08	1.8	2.5	0.6	1.8
80220	2.9	2.1	2.6	1.7	.36	.14	.29	.10	1.8	2.6	0.9	1.8
80222	2.4	1.9	2.0	1.5	.35	.14	.27	.07	1.8	2.8	0.9	2.1
80223	2.4	2.1	2.0	1.5	.29	.17	.28	.10	1.9	3.1	1.0	2.1
Caloona	2.8	2.3	2.9	1.7	.24	.16	.28	.11	1.5	3.5	0.7	2.1
Red Caloona	2.1	2.7	1.9	1.3	.27	.17	.26	.08	1.7	2.7	0.7	2.2
Santiago	2.7	2.5	2.5	1.9	.27	.17	.29	.10	1.3	4.1	0.6	2.5

APPENDIX 6

DAYS TO FIRST FLOWERS OF COWPEAS AT BRF AND KEF 1977/78, AND 1978/80 WET SEASONS

Line	Days to First Flowers					
	1977/78		1978/79		1979/80	
	BRF	KEF	BRF	KEF	BRF	KEF
20427			56			
24219	77	57				
24221			56	65		
29776	42					
30141			56	65		
30779	37					
30786	44					
33039	44					
34821	48					
39133	44					
39137	50		56	65		
45569	44					
45575	55	43				
45579	42	43				
45584	42	45				
45588	77	50				
50849	42	43				
58735			56			
58736			56			
61090	77	38				
61093	44	43				
61094	48	43				
61274	44	43	40	49	35	51
68799			56	65		
77940	42	38	48	49		
77941	42					
77942	48	43				
77943	42					
77944	37	43				
77945	50	50				
77946	48					
77947	44	43				
77848	48	50				
78216	35	35				
78217	35					
78218	35					
78219	36	35				
78220	38					
78221	38	38				

Line	Days to First Flowers					
	1977/78		1778/79		1979/80	
	BRF	KEF	BRF	KEF	BRF	KEF
80198	44	45				
80199	55	43	61	63	35	51
80200	44	35				
80201	48	43				
80202	50	50	75	63	61	57
80203	44	43				
80204	42	43				
80205	44	43				
80206	65		56	65		
80207	42	38				
80208	55	50	56	63	61	57
80209	55	50				
80210	42	43	48	63		
80211	42	38				
80212	42	38				
80213	50	38				
80214	37	43				
80215	44	43	48	63		
80216	38	43				
80217	42	38				
80218	36	35	48	35	32	51
80219	38	38			35	51
80220	42	43				
80221	65	43				
80222	42	43				
80223	44	43				
80224	48	38				
80225	36	38	48	35	32	51
Aloomba			56	47		
Blackeye No.5			56	65		
Brandon			56	65	61	57
Caloona	44	38	40	49		
Meringa			56	65	61	72
Palmyra					61	57
Phoenix			56	65		
Red Caloona	35	35				
Santiago	77	57	75	63		

APPENDIX 7

DAYS TO PEAK FLOWERING AND GREEN POD RATINGS OF COWPEAS AT BRF AND KEF 1977/78 AND 1978/79 WET SEASONS

Line	Days to peak flowering rating			Days to peak green pod rating		
	1977/78		1978/9	1977/78		1978/9
	BRF	KEF	BRF	BRF	KEF	BRF
24219		77-84		91	84	
29776	48-50			55		
30786	85			77-85		
33039	50			55		
39133				77		
39137	85			77-85		
45569				77		
45575	77			91	77	
45579		43-50		55	77	
45588					84	
45589				85	77-84	
50849		45		55	77	
61090	77	43-45		85-91		
61093		77			84	
61094				77	77	
61274	85			85-91	77	
77940	48-50	45	48	85-91	77	54
77942	77				77	
77943				55		
77944	48	43-45		55	50	
77945	50			107	77-84	
77946	85			85		
77947	77-85	77		91	77-84	
77948				77	77	
78216	42-44	43-50		55	50	
78217	65			77		
78218	42-44			55		
78219	77	43-45		55	77	
78220	44			55		
78221	50	43-45			77	
80198		77		77	77-84	
80199	77	45		77-85	84	69
80200	77	45		77-85		
80201	77-85	77		91	77	
80202	85	77		91	84	
80203	77	50			77-84	
80204	48-50	45-50		55	77	
80205				77-85	77	

Line	Days to peak flowering rating			Days to peak green pod rating		
	1977/78		1978/9	1977/78		1978/9
	BRF	KEF	BRF	BRF	KEF	BRF
80206	85			77-85		
80207		43-45			77	
80208				77-85	77-84	
80209					84	
80210	77	45	61-63	77	77-84	75
80211		43-45		55	77	
80212	48	43-45			84	
80213	77	50		77-85	77-84	
80214	48-50	45		55	77	
80215	85			91	77	69
80216	42-48	43-45		55		
80217	44-50	45		55	50	
80218	42-44	43-45		55	50	
80219	42-44	43-45		48-50		
80220		43-50		77-85	77	
80221		45		77	77-84	
80222	48-55	43-45		55	50	
80223	77			77	77-84	
80224	77	77				
80225	42-44	43-45		55	50	
Caloona	77	77		91	77-84	
Red Caloona	42-44	43-45		50-55	77	
Santiago				85-91	77-84	

APPENDIX 8

FLOWERING CHARACTERISTICS OF COWPEAS AT BRF 1977/78 WET SEASON

Codes Used:

FLOWER COLOUR - Primary and Secondary

M = Mauve
W = White
Y = Yellow

POSITION IN CANOPY

A = Above
W = Within

Line	Flower Colour Primary	Secondary	Position in Canopy
29776	W,Y		W
30779	W,Y		MOST W
30786	M		W
33039	M		W
34821	Y		W
39133	M		W
39137	Y		MOST W
45569	M		W
45575	W	M	W
45579	M		A
45584	M		A
50849	M		W
61090	M		W
61093	M		A AND W
61094	M		W
61274	M		W
77940	M		W
77941	M		W
77942	Y		W
77943	M		W
77944	M	Y	MOST W
77945	Y		W
77947	W	M	W
77948	Y		A
78216	M,W,Y		A
78217	M,W,Y		MOST A
78218	W,Y		A
78219	M		A
78220	Y	M	A
78221	M,W	Y	A
80198	M		W
80199	M,W,Y		A
80200	M		W
80201	W	M	W
80202	M		W

Line	Flower Colour Primary	Secondary	Position in Canopy
80203	M		W
80204	M		W
80205	Y		W
80207	W,Y		W
80210	Y		W
80211	M		W
80212	W,Y		A AND W
80213	Y		W
80214	M,W		W
80215	W	M,Y	W
80216	M,W,Y		A AND W, Most near top
80217	W	M	W
80218	M,W,Y		A
80219	M,Y		A
80220	M,W		W
80221	W		W
80222	W	M	W
80223	W	M	W
80224	M	Y	A
Caloona	M		W
Red Caloona	M		A AND W

APPENDIX 9

DAYS SEED TO MATURITY OF COWPEAS AT BRF AND KEF 1977/78 TO 1979/80 WET SEASONS

Line	Days to Maturity				
	1977/8		1978/79	1979/80	
	BRF	KEF	KEF	BRF	KEF
24219	113				
24221			91		
29776			91		
30141			91		
30779	85		91		
30786			91		
33039		85		91	
39133			91		
39137			91		
45569			91		
45575	107				
45579	107	77			
45584	107	84			
45588	113				
45589	107	84			
50849	107	84			
58736		91			
61090	107	84			
61093	113				
61094	107				
61274	107	84	91		69
68799			91		
77940	107	84	91		
77942	107	84			
77943	85				
77944	77	84			
77945	113				
77947	113				
77948	85				
78216	85	84			
78217	85		91		
78218	77		91		
78219	85	84			
78220	77		91		
78221	91	84			
80198	107				
80199	107		91		69

Line	Days to Maturity				
	1977/8		1978/79	1979/80	
	BRF	KEF	KEF	BRF	KEF
80200	107				
80201	113				
80202	113		112	116	113
80203	113				
80205	107	84			
80206			91		
80207	107				
80208	113		112	116	113
80209	107				
80210	91		112		
80211	91				
80213	113				
80214	85				
80215	113		91		
80216	77				
80217	85	84			
80218	85	84	84	75	69
80219	85	84	91	75	69
80220	107				
80221	91	84			
80222		84			
80223	107				
80224	107	84			
80225	85		84	75	69
Aloomba			91		
Blackeye No.5			91		
Brandon			91	116	148
Caloona	113		91		
Meringa			91	116	148
Palmyra				116	148
Phoenix			91		
Red Caloona	85	84			
Santiago	113		91		

APPENDIX 10

SEED YIELD OF COWPEAS AT BRF AND KEF 1977/78 TO 1979/80 WET SEASONS

Line	Seed Yield (g/plant)				
	1977/78		1978/79	1979/80	
	BRF	KEF	KEF	BRF	KEF
20427	6.8				
29776	9.5				
30779	3.3				
30786	13.2				
33039	7.0				
34821	6.1				
39133	6.1				
39137	32.4				
45569	11.1				
45575	6.8				
45579	13.6				
45584	2.4	12.7			
45588	8.2				
45589	17.0	25.9			
50849	7.7	3.7			
61090	0.8				
61093	11.2				
61094	16.3				
61274	22.7	14.5	3.5		4.0
77940	5.7	14.9	1.7		
77941	8.3*				
77942	2.1	6.2			
77943	5.8				
77944	4.5	4.8			
77945	15.3				
77946	18.2				
77947	25.8				
77948	5.7				
78216	0.8	2.2*			
78217	6.1				
78218	2.3*				
78219	0.8	2.3*			
78220	3.3*				
78221	5.5	5.1			
80198	7.9				
80199	23.2		3.7		7.5
80200	6.8				
80201	37.9				
80202	20.7		2.8	16.2	15.9
80203	8.8				
80204	6.0*				
80205	2.9	8.2			

Line	Seed Yield (g/plant)				
	1977/78		1978/79	1979/80	
	BRF	KEF	KEF	BRF	KEF
80206	7.3				
80207	4.8				
80208	10.5		0.5	19.3	21.6
80209	7.7				
80210	13.0		4.5		
80211	12.9				
80212	4.0				
80213	16.9				
80214	3.5				
80215	30.1		14.4		
80216	4.1				
80217	6.5				
80218	3.5		1.2		3.3
80219	3.2*	4.1*			2.5
80220	8.7				
80221	25.5				
80222	2.7	4.5			
80223	5.6				
80224	1.6	0.5*			
80225	2.9*	3.3	1.6		4.1
Brandon				2.0	12.8
Caloona	4.1		0.8		
Meringa				2.5	7.8
Palmyra				2.1	7.8
Red Caloona	1.4*	2.8			
Santiago	21.5				

* Seed lost due to Red Wing Parrots (BRF) or Galahs (KEF). Estimated losses were 50% for 78216 at KEF and 40% and 80% for 80219 at BRF and KEF respectively.

APPENDIX 11

SEED YIELD OF COWPEAS AT BRF AND KEF 1977/78 WET SEASON

Line	Seed Yield (g/m^2)		Line	Seed Yield (g/m^2)	
	BRF	KEF		BRF	KEF
24219	83		78221	60	73
29776	60		80198	111	
30779	32		80199	333	
30786	132		80200	36	
33039	53*		80201	215	
34821	57		80202	303	
39133	77		80203	15	
39137	341*		80204	94	
45569	147		80205	29	112
45575	39		80206	97*	
45579	123		80207	43	
45584	31	131	80208	144	
45588	68		80209	8	
45589	96	95	80210	178	
50849	59	37	80211	194	
61090	8		80212	47	
61093	127		80213	260	
61094	98		80214	53	
61274	265	189	80215	291	
77940	90	168	80216	38	
77941	68*		80217	81	
77942	24	98	80218	38	
77943	61*		80219	46	58
77944	26	79	80220	20	
77945	230		80221	17	
77946	218*		80222	40	72
77947	280		80223	71	
77948	53		80224	7	8
78216	6	36	80225	34	32
78218	19*		Caloona	32	
78219	6	36	Red Caloona	14	33
78220	41		Santiago	287	

* These plots were smaller. Yields have been adjusted to the equivalent of a 3m plot.

APPENDIX 12

SEED QUALITY OF COWPEAS AT BRF AND KEF 1977/78 WET SEASON

Codes Used:

QUALITY

G = Good, <30% cracked, split, shrivelled and mouldy seed.

P = 30-50% cracked, split, shrivelled and mouldy seed.

XP = >80% cracked, split, shrivelled and mouldy seed.

Line	Quality		Line	Quality	
	BRF	KEF		BRF	KEF
24219	XP		80203	XP	
45575	P		80204	G	
45579	G	G	80205	G	G
45584	G	G	80207	XP	
45588	G		80208	XP	
45589	XP	G	80209	XP	
50849	G	G	80210	G	
61090	XP		80211	G	
61093	G		80212	XP	
61094	G		80213	G	
61274	G	G	80214	G	
77940	G	G	80215	G	
77942	G	G	80216	XP	
77944	G	G	80217	G	
77945	G		80218	P	
77947	P		80219	P	G
77948	P		80220	P	
78216	XP	G	80221	G	
78219	G	G	80222	P	G
78221	P	G	80223	G	
80198	P		80224	XP	G
80199	G		80225	P	G
80200	G		Caloona	P	
80201	G		Santiago	G	
80202	G		Red Caloona	P	G

APPENDIX 13

NUTRIENT CONTENTS OF COWPEAS AT BRF AND KEF 1978/79 WET SEASON

Line	Site	Date	DAS	N%	P%	K%
61274	BRF	21/2	55	2.9	.19	2.4
	KEF	28/2	49	2.9	.19	4.3
77940	BRF	23/1	61	2.4	.19	2.0
	BRF	21/2	55	2.5	.15	1.7
	KEF	28/2	49	2.6	.17	2.6
80199	BRF	23/1	61	2.3	.16	2.0
	BRF	6/2	75	2.2	.18	1.9
	BRF*	6/2	75	3.1	.30	1.3
	KEF	15/3	64	2.4	.28	2.7
80202	BRF	23/1	61	2.4	.17	2.4
	BRF	20/2	89	2.1	.18	2.2
	KEF	28/3	77	1.8	.16	3.1
80208	BRF	23/1	61	2.4	.16	2.5
	BRF	15/2	84	2.5	.19	2.0
	KEF	15/3	64	2.3	.21	3.2
	KEF	29/3	78	1.9	.18	2.7
80210	BRF	3/1	61	2.0	.14	2.0
	BRF	6/2	75	1.7	.13	1.8
	BRF*	6/2	75	3.0	.28	1.4
	BRF	21/2	55	2.8	.18	2.1
	KEF	28/2	49	2.5	.24	2.6
80215	BRF	23/1	61	2.2	.15	2.3
	BRF	6/2	75	2.1	.16	2.2
	BRF*	6/2	75	3.2	.30	1.4
	KEF	15/3	64	2.7	.30	3.5
80218	BRF	16/2	50	2.3	.18	2.1
	KEF	28/2	49	2.2	.18	2.9
80225	BRF	16/2	50	2.6	.17	1.5
	KEF	28/2	49	2.2	.17	2.3
Caloona	BRF	23/1	61	2.6	.16	2.6
	BRF	23/1	61	2.3	.16	2.6
	BRF	14/2	83	2.2	.16	2.0
	BRF	13/3	75	2.2	.22	2.4
	KEF	15/3	64	2.2	.25	2.9
	KEF	15/3	64	2.3	.19	2.9
Santiago	BRF	13/3	75	2.6	.20	2.5
	KEF	15/3	64	2.1	.17	3.7

* Pods and seed only these samples.
DAS = Days After Sowing.

APPENDIX 14

GROWTH AND REPRODUCTIVE CHARACTERISTICS OF COWPEAS SOWN 11 TIMES 1979/80 WET SEASON

A. Emergence counts (Number per plot)

Sowing Date	Identification/Plants per plot					
	80202	80208	Brandon	Meringa	Palmyra	Mean
03.12.79	47.5	44.5	15.5	43.5	39.0	38.0
14.12.79	29.5	24.5	10.0	41.5	19.5	25.0
04.01.80	47.0	49.5	22.5	45.0	42.0	41.2
14.01.80	51.5	45.0	25.0	46.5	41.5	41.9
25.01.80	48.0	48.5	26.5	39.5	37.5	40.0
11.02.80	45.0	46.5	29.0	36.0	41.5	39.6
25.02.80	48.0	46.5	20.5	36.5	35.5	37.4
10.03.80	39.0	34.5	21.5	31.5	37.5	32.8
24.03.80	47.5	31.5	12.5	19.0	32.0	28.5
07.04.80	35.5	33.5	13.0	30.5	22.0	26.9
21.04.80	34.5	27.5	18.0	35.5	37.0	28.5
Mean	43.0	39.3	19.5	36.8	35.0	34.7

B. Maximum height recorded and height at maturity (cm)

Sowing Date	Identification/Heights									
	80202		80208		Brandon		Meringa		Palmyra	
	Max	Mat	Max	Mat	Max	Mat	Max	Mat	Max	Mat
03.12.79	90	60	90	60		30	100		105	80
14.12.79		60	75	60	45	40	90		60	60
04.01.80	100	80	90	80		50	70		80	
14.01.80		70		60	35	30	80		60	
25.01.80		60		60	40		60		60	
11.02.80		30	40		40		40		40	
25.02.80	30		30		30		30		30	
10.03.80	35		30		30		35		30	
24.03.80	35		25		30		35		40	
07.04.80	25		30		30		35		35	
21.04.80	30		25		30		35		35	

C. Maximum dry matter rating and days after sowing for maximum rating

Scale 0 = No dry matter to 10 = Maximum.

Date	Line/Rating/Days									
	80202		80208		Brandon		Meringa		Palmyra	
	Max	Days	Max	Days	Max	Days	Max	Days	Max	Days
03.12.79	10	121	10	121	7	121	10	121	10	121
14.12.79	8	110	8	110	7	110	10	124	8	110
04.01.80	10	89	9	89	9	89	10	103	10	89
14.01.80	9	79	8	79	8	79	9	93	9	109
25.01.80	7	68	7	68	6	82	7	82	7	68
11.02.80	3		3		3		3		3	
25.02.80	2		3		3		3		3	
10.03.80	3		2		3		3		3	
24.03.80	3		2		4		4		4	
07.04.80	2		2		2		3		3	
21.04.80	3		2		3		3		3	

D. Days to optimum time of harvest for hay production

Date	Line/Days				
	80202	80208	Brandon	Meringa	Palmyra
03.12.78	86-100*	86-100	86-121	86-121	121
14.12.79	75-89	75-89	75-110	110	100
04.01.80	68	68	89	89	89
14.01.80	44-79	58-79	79-93	79-93	93
20.01.80	68	68	68-82	68-82	82
11.02.80	65	65	82	65	82
25.02.80	66	51-66	66	66-107	107
10.03.80	52	52	52-93	52-93	93
24.03.80	38	38-79	69-79	79	79
07.04.80	64	64	64	64	64
21.04.80	50	50	50	50	50

* Where a range is presented, the optimum occurred within that range

E. Days to first flowers

Date	Line/Days				
	80202	80208	Brandon	Meringa	Palmyra
03.12.79	64-86	53	64-86	64-86	64-86
14.12.79	53-75	53-75	53-75	53-75	75-84
04.01.80	52-63	52-63	63	63	52-63
14.01.80	42-53	42-53	58-79	53-58	53
25.01.80	68	68	68	68	68
11.02.80	51	51	65	65	51-65
25.02.80	51-66	51	51	51	51
10.03.80	52	52-93	52-93	52	52-93
24.03.80	79	79	79	79	79
07.04.80	64	64	64	64	64
21.04.80	50	50	50	50	50

Where a range is presented, the first flowers occurred within that range

F. Days to maximum flowers and green pod ratings

Date	Line/Days									
	80202		80208		Brandon		Meringa		Palmyra	
	F	GS	F	GS	F	GS	F	GS	F	GS
03.12.79	95	100	86-95	100	86-95	95	86-95	100	95	100
14.12.79	84	89	84	84	89	84	84-89	89	84	84-89
04.01.80	68	68-89	63	68-89			103		63	68
14.01.80		79	58	79						
25.01.80		68		68						
11.02.80		65								

Where a range is presented, the maximum occurred within that range.
After the sixth sowing, there were insufficient observations to determine good patterns.

G. Days to seed maturity

Sowing Date	Line/Days		
	80202	80208	Brandon
03.12.79	135	135	150
14.12.79	124	124	139
04.01.80	103	103	118
14.01.80	93	108	139
25.01.80	82	97	

H. Seed Yield

Sowing Date	Line/Seed Yield (kg/ha)					
	80202	80208	Brandon	Meringa	Palmyra	Mean
03.12.79	885	935	485	455	525	657
14.12.79	1070	930	515	490	-	751
04.01.80	765	845	150	300	540	520
14.01.80	880	1135	135	565	440	631
Mean	900	961	321	453	502	

I. Seed germination

G = Germination percentage
F = Fresh ungerminated
H = Hard seed

Sowing Date	Line/Germination												
	80202		80208	Brandon			Meringa			Palmyra			
	G	F	G	G	F	H	G	F	H	G	F	H	Mean
03.12.79	11	9	36	58	1	5	49	2	6	25	7	4	35
14.12.79	35	3	32	54	2	1	41	2	5	-	-	-	41
04.01.80	40	12	52	55	1	2	-	-	-	23	12	2	43
14.01.80	44	13	57	81	0	2	54	1	7	55	4	4	58
Mean	30		44	62			48			34			

J. Estimated percentage of green leaf

Line	Sowing Date	Date / Percentage Green Leaf			
		27/2	2/4	16/4	1/5
80202	03.12.79	100	25	1	0
	14.12.79	100	45	2	0
	04.01.80	100	45	1	0
	14.01.80	100	90	5	1
	25.01.80	100	99	2	0
80208	03.12.79	100	30	2	0
	14.12.79	100	50	1	0
	04.01.80	100	40	1	0
	14.01.80	100	99	15	1
	25.01.80	100	100	30	1
Brandon	03.12.79	100	90	40	10
	14.12.79	100	90	50	10
	04.01.80	100	99	50	10
	14.01.80	100	100	60	20
	25.01.80	100	100	90	70
Meringa	03.12.79	100	90	50	40
	14.12.79	100	99	75	50
	04.01.80	100	99	75	25
	14.01.80	100	100	90	50
	25.01.80	100	100	90	70
Palmyra	03.12.79	100	90	50	40
	14.12.79	100	99	50	25
	04.01.80	100	99	75	40
	14.01.80	100	100	75	20
	25.01.80	100	100	90	80
DAS *	03.12.79	86	121	135	150
	14.12.79	75	110	124	139
	04.01.80	54	89	103	116
	14.01.80	71	79	93	108
	25.01.80		68	82	97

* Days After Sowing for each Date of Observation.

APPENDIX 15

NUTRIENT CONTENTS OF COWPEAS AT BRF, DDRF AND KEF 1980/81 WET SEASON

Line	Site	Date	N%	P%	K%	Cu ppm	Fe ppm	Mu ppm	Zn ppm
61274	DDRF	23/3	2.2	.27	2.6				
	KEF	2/4	1.6	.14	2.5				
80199	DDRF	Jan				5	317	310	29
	DDRF	23/3	2.1	.37	2.5				
	KEF	2/4	1.9	.14	2.2				
80202	BRF	Jan				9	129	120	49
	DDRF	Jan				5	317	310	29
	DDRF	23/3	2.5	.34	2.6				
	KEF	2/4	1.9	.18	2.7				
80208	DDRF	23/3	2.2	.27	2.4				
	KEF	2/4	1.8	.18	2.5				
	KEF	13/4	1.7	.14	2.7				
Meringa	DDRF	23/3	2.2	.33	3.8				
	KEF	2/4	1.9	.16	3.8				
	KEF	13/4	1.9	.14	3.2				
	BRF	23/4	2.3	.21	2.8				
	DDRF	11/5	2.1	.24	2.8				

APPENDIX 16

GROWTH AND REPRODUCTIVE CHARACTERISTICS OF COWPEAS IN A SERIAL SOWING TRIAL 1980/81 WET SEASON

A. Height (cm)

Sowing Date	Line/Date/Height							
	80202				Meringa			
	17/3	30/3	10/4	24/4	17/3	30/3	10/4	24/4
09.12.80	35		35		50		45	
30.12.80	35		40		40		35	
13.02.81	15	30	35	50	20	40	50	85
09.03.81		10	20	45		20	30	60

B. Dry matter ratings

0 = No growth to 10 = Maximum.

Sowing Date	Line/Date/Rating							
	80202				Meringa			
	17/3	30/3	10/4	24/4	17/3	30/3	10/4	24/4
09.12.80	6	4	3	3	7	6	5	5
30.12.80	7	6	5	4	6	6	5	5
13.02.81	1	3	4	4	1	3	4	4
09.03.81		1	2	3		1	3	5

C. Estimated percentage green leaf

Sowing Date	Line/Date/percentage Green Leaf									
	80202					Meringa				
	17/3	30/3	10/4	24/4	11/5	17/3	30/3	10/4	24/10	11/5
09.12.80	79	54	24	6	1	99	93	91	80	1
30.12.80	100	96	96	93	3	100	94	97	70	0
13.02.81	100	100	100	96	1	100	100	100	100	15
09.03.81			100	100	1			100	100	80

D. Number of flowers/m², green pods/m², mature pods/m² and seed yeild per pod(s) at harvest

Sowing Date	Line							
	80202				Meringa			
	F No/m²	G No/m²	M No/m²	S/P g	F No/m²	G No/m²	M No/m²	S/P g
09.12.80	0	2	47	0.5	1	3	44	0.6
30.12.80	0	1	102	0.8	1	5	50	1.2
13.02.81	0	4	75	0.9	0	12	31	1.1
09.03.81	0	5	73	1.0				

APPENDIX 17

OTHER RECORDINGS ON COWPEA LINES SOWN BETWEEN 1977 AND 1981

A. Special Comments

Identification	Comment
30786	Snake bean type.
77941	Pods held vertically.
78219	Pods held vertically.
78220	Most even seed set of all lines sown at BRF in 1977/78.
80224	Pods held vertically.

B. Aphid ratings August 1977

LEVEL OF INFESTATION 0 = no aphids to 10 = high.

EFFECT ON PLANTS 0 = no effect 3 = severe.

Line	Level	Effect	Line	Level	Effect
77940	3	0	80205	4	1
77941	5	2	80206	2	0
77942	2	1	80207	4	1
77943	8	2	80208	3	1
77944	1	0	80209	2	0
77945	3	1	80210	8	0
77946	1	1	80211	9	1
77947	2	1	80212	4	1
77948	4	0	80213	2	0
78216	2	0	80214	7	2
78217	7	2	80215	2	0
78218	1	0	80216	6	1
78219	1	0	80217	6	1
78220	1	0	80218	9	3
78221	2	0	80219	8	0
80198	1	0	80220	8	3
80199	3	0	80221	10	2
80200	2	0	80222	8	3
80201	1	0	80223	8	2
80202	1	0	80224	0	0
80203	7	2	80225	0	0
80204	3	2			

C. 1000 Seed weights and Number of seeds per kilogram

Identification	1000 Seed Weight (g)	Seeds/kg
61274	102.6	9747
78216	133.5	7491
78220	100.0	10000
80199	149.8	6676
80202 (a) 1979	113.8	8787
(b) 1984	118.7	8425
80208 (a) BRF	162.5	6154
(b) KEF	157.4	6353
80218	107.9	9268
80219	133.1	7510
80225	164.8	6068
Aloomba	110.0	9091
Brandon (a) BRF	93.6	10684
(b) KEF	107.2	9328
Caloona	47.0	21277
Meringa (a) BRF	116.9	8554
(b) KEF	120.0	8333
Palmyra	112.5	8889

D. Seed nutrient contents

Identification	Site	Year	N%	P%	K%
61274	KEF	81	4.2	.49	1.5
80199	KEF	81	4.2	.46	1.5
80202	BRF	81	4.0	.55	
	KEF	81	4.5	.58	1.5
	BRF	82	3.9	.50	
	KEF	84	4.0	.46	
	KEF	84	4.1	.39	
80208	KEF	81	4.2	.56	1.7
Meringa	KEF	81	4.4	.49	1.5

APPENDIX 18

RAINFALL RECORDS FOR THE SITES/SEASONS WHERE COWPEAS WERE SOWN BETWEEN 1977 AND 1981

Rainfall in mm

Month	BRF				DDRF
	1977/8	1978/9	1979/80	1980/1	1980/1
August	0	0	0	26	0
September	8	8	12	0	0
October	31	250	167	111	34
November	130	276	47	115	155
December	306	195	211	303	214
January	565	474	664	860	440
February	201	189	320	231	369
March	72	230	209	380	124
April	51	65	29	55	19
May	10	45	0	6	0
June	10	0	0	0	0
July	12	0	0	0	0
Total	1396	1732	1659	2091	1355

	KEF				VRRS	
Month	1977/8	1978/9	1979/80	1980/1	1978/9	1979/80
August	0	0	0	0	0	0
September	0	0	0	0	1	28
October	7	4	29	0	68	18
November	79	25	93	20	15	28
December	298	142	37	82	144	77
January	404	212	111	377	117	194
February	159	237	215	223	125	395
March	20	234	412	27	97	77
April	6	142	262	0	0	0
May	0	0	23	0	14	2
June	0	0	9	0	0	0
July	0	0	0	0	0	0
Total	973	996	1191	729	481	819