NORTH AFRICAN REGIONAL PROJECT ON FOOD LEGUME IMPROVEMENT

TUNISIA - ICARDA COOPERATIVE PROGRAM

Progress Report 1982/83

ICARDA
P. O. Box 5466
Aleppo, Syria

INRAT
2080 Ariana
Tunisia

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P R E F A C E

This report contains the results of a collaborative research program on food legumes between the Tunisian Program and ICARDA. The program was carried out within the Institut National de la Recherche Agronomique de Tunisie (INRAT), and conducted by Mr. Habib Halila (Head, Food Legumes, INRAT), Dr. Howard Gridley (Food Legume Breeder, ICARDA) and Mr. Patrick Houdiard (Research Associate, ICARDA) with the technical help of Mr. Hamouda Abdelkefi, Mr. Taoufik Ouslati, Mr. Hedi Ghanmi, Mr. Mokhtar Dridi, Mr. Moncef Farhani, Mr. Noureddine Ben Abdallah and Mr. Mustapha Jebabri (Ingenieurs-Adjoints, INRAT and Fretissa Farm).

1. INTRODUCTION.

This report gives the results from the second year of a cooperative project on food legume improvement between INRAT (Institut National de la Recherche Agronomique de Tunisie) and ICARDA. Last season's report contained a résumé on the initiation and research objectives of the project. The former will not be repeated and the latter still remain the development of improved cultivars of faba beans, chickpeas and lentils and of a superior and appropriate production technology, that together can ensure the farmer a more stable and improved economic return from the cultivation of these legume crops.

In last season's report the FAO data on food legumes in Tunisia showed that from the period 1966-70 to 1971-75 there was a 20% increase in the area sown to faba beans, whereas that for chickpeas and lentils remained static. More recent data from 'La Direction de la Production Végétale (DPV)' of the Ministry of Agriculture on the area, production and seed yield of these crops from 1971-72 to 1980-81 are given in table 1.1; the area and production data are also shown graphically in figure 1.1. Faba Beans and chickpeas showed a modest increase in area and production during the 10 year period, whereas lentils showed a dramatic decline during the first five years and

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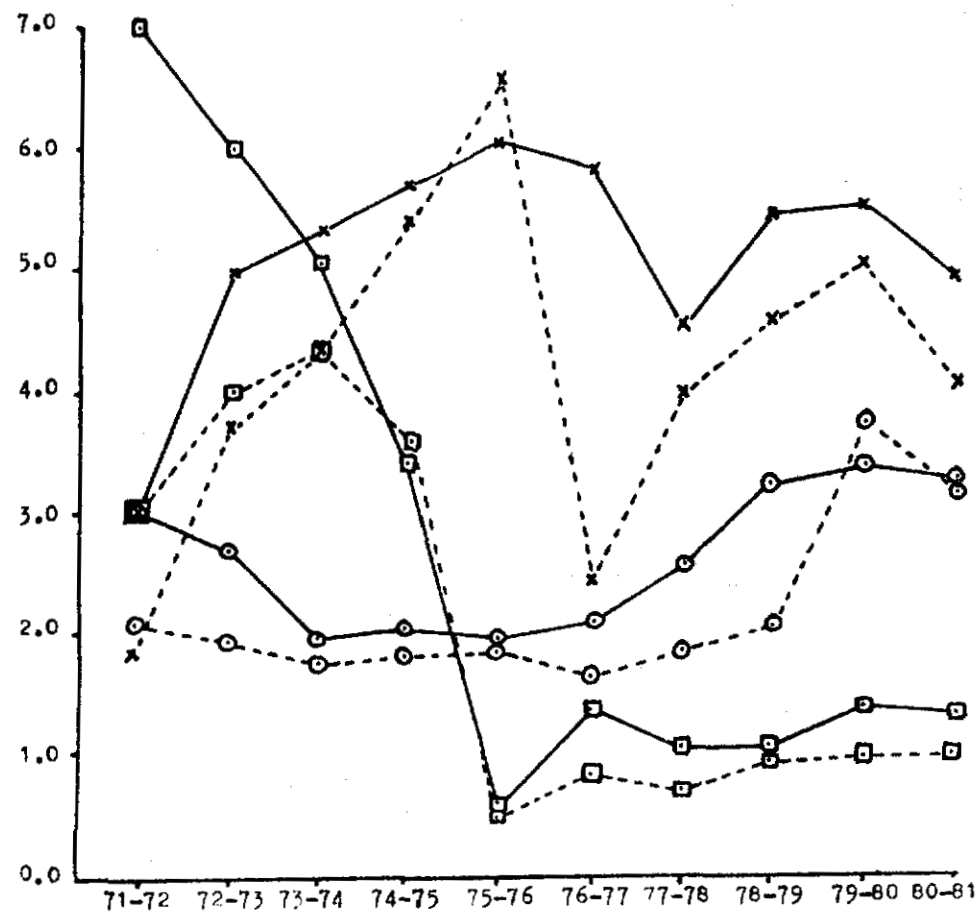
thereafter were steady at around a 1000 hectares and metric tonnes respectively. Yield levels, however, showed no discernible trend. As a mean over the period faba beans accounted respectively for 64% and 71% of the total area and production of these crops, whilst the corresponding figures for chickpeas were 33% and 31%, and for lentils were 4% and 9%. Also during the 10 years these three crops accounted for 80-90% of the total legume production and area in the country.

TABLE 1.1 AREA, PRODUCTION AND SEED YIELD OF FABA BEANS (F), CHICKPEAS (C) AND LENTILS (L) IN TUNISIA FROM 1971-72 TO 1980-81.

Season	Area (1000 hectares)			Production (1000 metric tonnes)			Seed Yield (kg/ha)		
	F	C	L	F	C	L	F	C	L
1971-72	30.0	30.0	7.0	18.0	21.0	3.0	600	700	430
1972-73	50.0	27.0	6.0	37.0	19.0	4.0	740	700	670
1973-74	53.5	19.9	5.1	43.5	17.6	4.3	810	880	830
1974-75	57.9	20.6	3.4	54.1	18.4	3.6	930	890	1060
1975-76	61.2	19.8	0.6	66.5	19.2	0.5	1090	970	770
1976-77	58.5	21.7	1.4	24.8	16.9	0.8	420	780	540
1977-78	45.9	25.9	1.1	40.0	18.8	0.7	870	730	640
1978-79	54.9	32.5	1.1	46.8	21.8	0.9	850	670	820
1979-80	55.4	34.2	1.4	51.2	37.6	1.0	920	1100	710
1980-81	49.4	32.8	1.3	40.9	32.0	1.0	830	970	800
Mean	51.7	26.4	2.8	42.3	22.2	6.3			

(a) Source : 'Etude du secteur des légumineuses à graines'. Ministère de l'Agriculture, Direction de la Production Végétale, Tunis, Juin 1982.

FIGURE 1.1 AREA AND PRODUCTION OF FABA BEANS, CHICKPEAS AND LENTILS IN TUNISIA FROM 1971-72 TO 1980-1981.



——: Area (x 10^{-4} for faba beans and chickpeas, x 10^{-3} for lentils).

----: Production (" " " " " " ").

X---X: Faba beans, θ---θ: Chickpeas, ⊡---⊡: Lentils.

2. THE RESEARCH PROGRAM.

2.1 Experiments and Locations.

The agronomic experiments and breeding trials and nurseries were grown at one or more of four locations, namely Béja, El-Kef, Mateur and Moghrane, situated in the principal crop growing areas in the north and west of the country (figure 2.1). Details of the experiments for each of the three crops grown at the different locations is given in table 2.1, 2.2 and 2.3 respectively for faba beans, chickpeas and lentils.

The ICARDA derived breeding trials contained advanced breeding lines, segregating populations as well as genotypes being assessed for disease resistance. The advanced (AYT) and preliminary (PYT) yield trials contained genotypes selected for a superior performance during the last season. The total number of entries evaluated this season in the different breeding trials and nurseries were 481 for faba beans, 115 for winter sown and 432 for spring sown chickpeas and 308 for lentils.

Last year the agronomic trials examined crop responses to differing sowing dates and Rhizobial inoculation treatments and to differring levels

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FIGURE 2.1 LOCATION OF EXPERIMENTAL TRIALS AND NURSERIES IN TUNISIA, 1982-83.

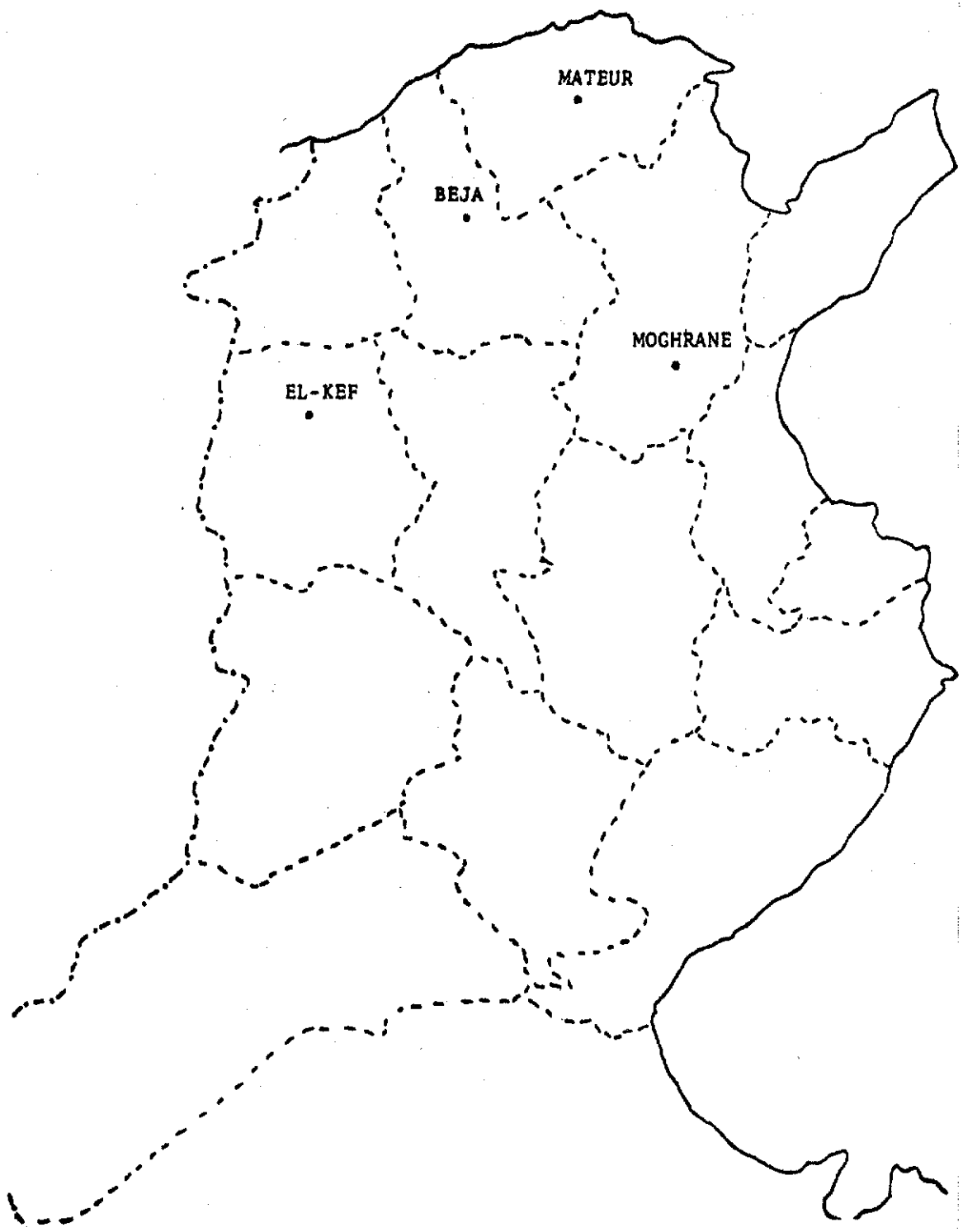

TABLE 2.1 FABA BEAN BREEDING AND AGRONOMY EXPERIMENTS CONDUCTED DURING 1982/83.

Experiments	Number of Replicates	Number of Entries/ Treatments	Location Béja	Kef	Mateur	Moghrane
Breeding Trials						
International Yield Trials (S) (1)	4	24	x	x	x (2)	x (2)
" " " (L) (1)	4	24	x	x	x (2)	x (2)
" Trials	3	15	x	x	x	
" F3 Trials	3	12	x	x	x	
Preliminary Yield Trials (S1)	2	12	x	x		
" " " (S2)	2	16	x			
" " " (L1)	3	12	x	x		
" " " (L2)	4	14	x	x		
Advanced Yield Trials (L)	4	12	x	x		
Breeding Nurseries						
International Screening Nursery (S)	1	50	x	x	x	
" " " (L)	1	33	x	x	x	
High Protein Content Entries	1	46	x			
European Cultivars Screening Nursery	1	21	x			
National Screening Nursery	1	62	x	x		
Disease Nurseries						
International Orobanche Nursery	4	17	x	x		
" Rust "	2	24	x			
" Ascochyta "	2	20	x			
" Chocolate Spot "	2	35	x			
Disease Screening Nursery	1	32	x			
Agronomy Trials						
Date of sowing/Population Trial (L)	3	20	x	x		x
" " " " (S)	3	20	x	x		x
Weed Control Trial	4	12	x	x		

(1) L/S : large and small seeded trials.

(2) Two replicates only grown.

TABLE 2.2 CHICKPEA BREEDING AND AGRONOMY EXPERIMENTS CONDUCTED DURING 1982/83.

Experiments	Replicates	Entries/ Treatments	Location Béja	Kef	Mateur	Mogh-rane
A. WINTER PLANTED						
Breeding Trials						
International Yield Trial	4	12	x	x		x
" F3 Trial-1	3	16	x	x		
" " " -2	3	16	x	x		
Preliminary Yield Trial	2	7	x			
Advanced " "	4	13	x	x		x
Breeding Nursery						
National Screening Nursery	1	44	x	x		
Disease Nursery						
International Ascochyta Blight Nursery	2	51	x	x		x
Agronomy Trial						
Winter/Spring Sowing Comparison	3	4	x	x	x	x
B. SPRING PLANTED						
Breeding Trials						
International Yield Trial	4	24	x	x	x	
" Large Seeded Yield Trial	4	20	x	x	x	
Preliminary Yield Trial-1	3	14	x	x		
" " " -2	2	16	x	x		
Advanced Yield Trial -1	4	17	x	x		
" " " -2	3	16	x	x		
F4 Population Trial	3	7	x	x		
'Tall Types' Yield Trial	3	22	x			
Breeding Nurseries						
International Screening Nursery	1	71	x	x		
National " "	1	44	x	x		
Disease Nurseries						
ICRISAT Root Rot/Wilt Nursery	2	75	x			
ICRISAT Stunt Nursery	2	18	x			
Fusarium Nursery	2	116	x			
Agronomy Trials						
International Weed Control Trial	4	12	x			
Fertilizer/Inoculation Trial-1	4	8	x	x		
" " " -2	4	6	x			
Date of Sowing/Population Trial	3	20	x	x		
Seed Treatment Trial-1	4	13	x			
" " " -2	4	16	x			
Fungicide Trial	3	12	x			

TABLE 2.3 LENTIL BREEDING AND AGRONOMY EXPERIMENTS CONDUCTED DURING 1982/83.

Experiment	Number of Replicates	Number of Entries/ Treatments	Location Béja	Kef	Mateur	Moghrane
Breeding trials						
International Yield Trial - L (1)	4	21	x	x	x	
" F3 Trial (Early types)	2	30	x			
Preliminary Yield Trial	3	16	x	x		
Advanced " "	4	10	x	x		x
Breeding Nurseries						
International Screening Nursery-L	1	43	x	x	x	
" " " -Early	1	65	x	x	x	
" " " -Tall	1	63	x	x	x	
National Screening Nursery	1	60	x	x		
Disease Nursery						
Orobanche Nursery	3	8	x	x		x
Agronomy Trials						
Weed Control Trial	4	12	x	x		
Date of Sowing/Population Trial	3	20	x	x		x

(1) Large Seeded Trial.

of plant population, and of phosphate and nitrogen application. This season the work was expanded to further examine the effectiveness of different herbicides on natural weed populations and of seed dressing treatments on disease incidence.

Although the rainfall was adequate for crop growth the distribution was abnormal in that approximately 80% of the total rainfall fell before the end of December. This somewhat delayed planting, but more importantly produced during March and April relatively hot and dry conditions, which were adverse to natural disease development. As a result disease development was insufficient in all three crops to allow effective screening of the genetic material under test. Unfortunately facilities for artificial inoculation are not presently available, although it is expected that a start will be made on developing these next season.

2.2 Analyses and Results.

All the replicated experiments were analysed as randomised blocks, and in discussing results the term significant has been used to describe a probability level equal to or less than 0.05; in certain instances the probability level has

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been noted in the text. Also, only if the analysis of variance produced a significant ($P \leq 0.5$) 'F' value has a least significant difference (LSD) value been calculated, in order to assess whether the test entries had values that were significantly different from that of the check.

The following individual crops reports are a summary of the full research results, which are given in relevant appendices at the end of a report. All values given in the appendices and tables are the mean of the relevant number of replicates, and those underlined significantly exceeded the local check in that trial.

3. FABA BEAN IMRPOVEMENT PROGRAM.

Last season both trials and farmers' crops were severely attacked by Chocolate spot, and a late season attack by the stem borer was widespread. Also noted were locally severe infections of Orobanche spp., Alternaria leaf spot, Rhizoctonia root rot, Ascochyta blight and stem nematode. This season the environmental conditions were not conducive to natural disease development and thus the results presented below concentrate on seed yield. The full seed yield results from all trials and nurseries are given in appendix A (app. A), with a summary of the results contained in the following crop report. The local check used in the experiments was a Tunisian local cultivar grown by farmers, and is referred to either as the local check or simply the check.

3.1 Results and Discussion.

3.1.1 International Yield Trials (IYT), ex-ICARDA

A large seeded (IYT-L) and a small seeded (IYT-S) international yield trial were grown at Béja, El-Kef, Mateur and Moghrane. Unfortunately the seed yield results from the last location could not be analysed statistically owing to a large number of missing plots. In the IYT-L at the other three locations a number of entries

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exceeded the local check by a considerable margin (app. A, table A1), but the 'F' test was not significant at any location, and only ILB 1799 (39 MB) exceeded the local check at all three locations. In the small seeded trial (app. 1, table A2), there was a significant ($P < 0.01$) difference between entries at Béja but not at El-Kef and Mateur. At Béja seven entries significantly exceeded the check with a mean increase of 55%, and although these entries also exceeded the check at El-Kef not all did so at Mateur (table 3.1).

In an F_3 population trial (app. A, table A3) significant differences between populations were only evident at one of the three locations, namely, El-Kef, although at this location all populations yielded less than the check. At Béja and Mateur some populations outyielded the local check but only X81S 42 did so at both. In another F_3 population trial, comprised of early flowering types (app. A, table A4), population differences for seed yield were only significant at Béja, although no population significantly exceeded the check. At Mateur all but three populations exceeded the check but none did so at El-Kef, and only one population, namely, X81S 106, exceeded the check at more than one location.

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TABLE 3.1 SEED YIELD (kg/ha) OF SUPERIOR ENTRIES IN AN IYT-S AT BEJA (B), EL-KEF (K) AND MATEUR (Ma) IN 1982/83.

Entry		Location			Mean	% Check
Designation	Pedigree	B	K	Ma		
ILB 1217	Renia Blanka	2269	2509	2700	2493	125
1820	Giza 4	2144	2400	1931	2158	108
X75 TA146	79S 78978	2800	2228	2032	2353	118
ILB 1816	78S 48561	2244	2412	2788	2481	124
407	" 49395	2325	2400	1094	1940	97
X77sd 11	80S 45676	2156	2178	1844	2059	103
ILB 5	74 TA 12	2138	2175	2106	2140	107
Tunisian Local	Check	1494	1862	2631	1996	100
S.E.		204.0	133.8	292.1		
d.f.		51	69	22		

3.1.2 Advanced (AYT) and Preliminary (PYT) Yield Trials.

The seed yield results of one large seeded AYT and two large seeded PYT's (1 and 2), grown at Béja and El-Kef, are given in appendix A, tables, A5, A6 and A7 respectively. Entries differed significantly ($P < 0.01$) in all trials, but only one entry, namely, ILB 398 (76 TA 56246), in the AYT at Béja significantly outyielded the check, and many entries yielded less.

The seed yield results of a small seed PYT-1 grown at Béja and El-Kef and a PYT-2 grown at Béja are given in appendix A, tables A8, and A9 respectively. Although the entries differed significantly in all three trials, no entry significantly outyielded the check, and again many yielded less.

3.1.3 International (ISN-ex ICARDA) and National (NSN) Screening Nurseries (non-replicated).

The seed yield results from a large and small seeded ISN, grown at Béja, El-Kef and Mateur are given in appendix A, tables A10a and A10b respectively . Also included in the tables are the coefficients of variation (CV) for the three repeated checks in each nursery; these were generally high and varied markedly within a nursery, suggesting that care be taken in interpreting the recorded yield of the test entries.

Be that as it may in the large seeded ISN eight entries exceeded the mean of the local check across locations, and of these only three

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exceeded this check at more than one location; these three were : X77TA 82 (80S 44371), X79S 70 (80S 80026) and X79S 103 (80S 80064). In the small seeded ISN many entries exceeded the local check at individual locations and eight at each of the three locations (table 3.2). These eight plus a further nineteen also exceeded the mean of the local check across locations.

The seed yield results of an NSN, which contained entries from the Pullman Institute (Washington, USA) and was grown at Béja and El-Kef, are given in appendix A, table A11. At both locations the CVs for the two repeated local checks were reasonable, but the only entries exceeding a check were nine at El-Kef, which out-yielded the mean of the small seeded check.

3.1.4 Disease nurseries, ex-ICARDA.

With little or no natural disease development this season it proved impossible to rate entries for disease reaction in the Chocolate spot, Ascochyta and Rust nurseries and a general disease nursery. Accordingly only seed yields were recorded and these are given in appendix A, tables A12, A13, A14 and A15 respectively. Also recorded in these tables is the mean seed yield and CV of the local check, which although not randomised in the nurseries was repeated at regular intervals.

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TABLE 3.2 SEED YIELD (kg/ha) OF SUPERIOR ENTRIES IN AN ISN-S AT BEJA (B), EL-KEF (K) AND MATEUR (Ma) IN 1982/83.

Entry Designation	Entry Pedigree	Location B	Location K	Location Ma	Mean	% Check
ILB 22	78S 49264	1650	2300	1425	1792	123
1816	78S 48561	1668	2100	1525	1764	121
33	74TA 95	1450	2450	1300	1733	119
X75TA 33	80S 43651	1575	2800	1150	1842	126
X77TA 60	80S 43971	2000	2350	1525	1958	134
81	40384	1350	2350	1350	1683	115
86	44474	1350	2350	1100	1600	110
Tunisian Local Check		1345	2030	1000	1458	100

Generally most entries yielded less than the mean of the check, which is not surprising as prior selection has concentrated on disease resistance rather than seed yield *per se*.

3.1.5 Miscellaneous Nurseries.

There were two nurseries in this category; one containing determinate and high protein entries from ICARDA and the other containing entries from the Plant Breading Institute, Cambridge, U.K. The seed yield results from these nurseries are given in appendix A, tables A16 and A17 respectively. In both nurseries the CV for the local check was very high making difficult any meaningful interpretation of the results. However, it was clear that the determinate types were generally poorly adapted as were some of the U.K. entries.

3.2 General Discussion.

Last season (1981-82) the experimental results showed little evidence that any of the genotypes tested possessed a superior seed yield to the local cultivars. Such results, however, may have been confounded by the high level of disease infection, particularly from Chocolate spot and *Orobanche* spp., encountered in experimental trials. This season there was little or

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no natural disease development at any test location, but the results have reinforced those of last season. Together they suggest that significant improvements in seed yield per se over the local cultivar are going to prove difficult.

In spite of the lack of disease problems this season, and the deficiency of past records, the devastation of farmers' crops last season, particularly from Chocolate spot, still indicates that the transfer of disease resistance(s), initially into the local cultivar, must have a high priority. Such a program is currently being undertaken, and hopefully this will at least help to stabilise levels of seed yield from year to year, and ensure a farmer of some return even in epidemic years.

In the meantime, efforts must be continued to improve seed yield per se, and in this context the performance of the F_3 populations this season was particularly disappointing. The aim of these is to supply a pool of genetic variation for selection under local conditions. However, their future usefulness would appear to be limited, as not only did none significantly outyield the local check at the test locations but many were considerably lighter yielding. Furthermore, there was no population that at the minimum gave a seed yield equivalent to that of the check at all test locations, suggesting that reselection is

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not worth undertaking in any of the populations.

During the last two seasons the program in Tunisia has yield tested a few imported cultivars and genotypes from Europe, and a relatively large number of genotypes from ICARDA. The latter were selected for a superior yield performance in ICARDA's base program in Syria and subsequent distribution in international trials and nurseries. However, the lack of significant progress so far suggests that the selection pressure exerted for seed yield in Syria is not effective for conditions in Tunisia, and/or that faba bean genotypes/cultivars have a relatively narrow adaptation.

It would seem unlikely that a continuation of the present breeding strategy will, in the near future, produce significant yield advances per se over the local cultivars. Thus to counteract this selection and adaptation problem it would seem necessary that the future strategy must involve testing and selecting, under local environmental conditions, of a wide range of both early generations breeding lines and populations and germplasm entries from ICARDA's base program, and of cultivars from countries in Europe.

APPENDIX A. RESULTS OF THE FABA BEAN BREEDING TRIALS AND NURSERIES IN 1982/83.

Abbreviations used in tables.

1. Locations : B - Béja
   K - El-Kef
   Ma- Mateur
   Mo- Moghrane

2. Data : Kg/ha - seed yield of entries in these units.
   %Lc - seed yield of entries expressed as a percentage of the Tunisian Local Check.
   Data values - those underlined were significantly ($P \leq 0.05$) superior to the Tunisian Local Check.
   ND - data not available.

3. Statistics : C.V. % - coefficient of variation expressed as a percentage.
   S.E. - standard error of entry mean.
   d.f. - degrees of freedom associated with the standard error.

TABLE A1 SEED YIELD OF ENTRIES IN AN IYT-L AT FOUR LOCATIONS IN 1982/83.

Entry	Pedigree	B		K		Ma		Mo	
		Kg/Ha	%Lc	Kg/Ha	%Lc	Kg/Ha	%Lc	Kg/Ha	%Lc
ILB 1814	Syrian Local Large	1681	86	3050	97	1538	90	657	99
1269	New Mammoth	2434	124	2969	94	2494	147	763	115
1266	Aquadulce	2356	120	2581	82	1531	90	ND	ND
29	75TA 26062	2203	112	2744	87	2400	141	ND	ND
17	78 S 49044	1868	95	2700	86	2450	144	838	126
32	74TA 91	2109	107	3013	96	2663	157	807	122
1817	78 S 49896	1940	99	2838	90	2388	140	888	134
24	74TA 63	2303	117	3000	95	2588	152	663	100
1817	76TA 56809	1984	101	2696	86	2788	164	ND	ND
263	77TA 88311	1450	74	2756	87	2494	147	750	113
1933	Seville Giant	1940	99	3000	95	1625	96	713	108
268	78 S 48426	1825	93	3163	100	2150	126	786	119
10	78 S 49907	2171	110	2944	93	2369	139	750	113
37	74TA 109	1975	100	2931	93	2405	141	744	112
285	78 S 48476	2468	126	2550	81	2451	144	763	115
1799	39 MB	2243	114	3319	105	2575	151	782	118
34	78 S 49841	1721	88	2963	94	2450	144	650	98
444	79 S 97513	1981	101	2888	92	2194	129	825	124
1813	S.L.L. (Long Pod)	1734	88	2644	84	1869	110	757	114
X77TA 88	80 S 44539	2218	113	2756	87	2400	141	719	108
X77TA 82	80 S 44371	1393	71	2788	89	2181	128	763	115
X77sd 70	80 S 46341	1490	76	2869	91	1938	114	600	90
X77TA 64	80 S 44027	1834	93	2525	80	2163	127	907	137
-	Tunisian Local Check	1966	100	3150	100	1700	100	663	100
Mean		1992		2868		2242			
C.V. %		27.7		13.8		21.3			
S.E.		275.9		198.0		337.8			
d.f.		68		68		22			

TABLE A2 SEED YIELD OF ENTRIES IN AN IYT-S AT FOUR LOCATIONS IN 1982/83.

Entry	Pedigree	B		K		Ma		Mo	
		Kg/Ha	%Lc	Kg/Ha	%Lc	Kg/Ha	%Lc	Kg/Ha	%Lc
ILB 1812	Syrian Local Medium	ND	ND	2328	125	2763	105	1063	92
1217	Renia Blanka	2269	152	2509	135	2700	103	1200	104
1820	Giza 4	2144	144	2400	129	1931	73	988	86
9	74TA 22	ND	ND	2062	111	2669	101	925	80
31	87	ND	ND	2474	133	1850	70	ND	ND
31	85	1675	112	2193	118	2256	86	1025	89
49	133	1944	130	2200	118	2363	90	625	54
285	77TA 88118	ND	ND	2018	108	2375	90	ND	ND
287	77MS 88323	1560	104	2168	116	2275	86	725	63
X75TA146	79 S 78978	2800	187	2228	120	2038	77	1000	87
ILB 905	78 S 35513	1888	126	1981	106	2241	85	800	70
1816	48561	2244	150	2412	130	2788	106	1100	96
407	49395	2325	156	2400	129	1094	42	ND	ND
269	74TA 367	1960	131	2293	123	1687	64	1113	97
336	78 S 48437	1788	120	2118	114	2388	91	888	77
269	48821	ND	ND	2205	118	2269	86	638	55
320	48434	1675	112	2003	108	2225	85	675	59
277	-	ND	ND	2168	116	2306	88	ND	ND
339	78 S 48504	1994	133	2043	110	2106	80	738	64
360	74TA 498	2016	135	2225	119	1994	76	900	78
X77sd 48	80 S 45779	1725	115	2080	112	1525	60	1138	99
X77sd 11	45676	2156	144	2178	117	1844	70	825	72
ILB 5	74TA 12	2138	143	2175	117	2106	80	963	84
-	Tunisian Local Check	1494	100	1862	100	2631	100	1150	100
Mean		1988		2197		2205			
C.V. %		20.5		12.2		18.7			
S.E.		204.0		134.0		292.1			
d.f.		51		69		22			

TABLE A3 SEED YIELD OF ENTRIES IN AN F_3 TRIAL AT THREE LOCATIONS IN 1982/83.

Entry	B		K		Ma	
	Kg/Ha	%Lc	Kg/Ha	%Lc	Kg/Ha	%Lc
X 81 S 49	1402	132	1599	70	1828	66
50	1093	103	1796	79	1694	61
54	1432	135	1852	81	2621	95
38	1366	129	2158	94	2189	79
23	971	91	1902	83	2727	99
27	821	77	1566	69	2488	90
42	1071	101	1652	72	3266	118
45	1196	113	1746	76	2683	97
115	1355	127	1963	86	2272	82
124	1152	108	1757	77	2277	82
184	971	91	1857	81	3500	127
4	1271	120	1693	74	2160	78
6	1355	127	1963	86	2344	85
ILB 1814	816	77	1836	80	2844	103
Tunisian Local Check	1063	100	2285	100	2761	100
Mean	1156		1842		2510	
C.V. %	22.2		12.0		32.4	
S.E.	147.9		127.1		468.9	
d.f.	28		28		28	

TABLE A4 SEED YIELD OF ENTRIES IN AN F_3 TRIAL (EARLY FLOWERING TYPES) AT THREE LOCATIONS IN 1982/83.

Entry	B		K		Ma	
	Kg/Ha	%Lc	Kg/Ha	%Lc	Kg/Ha	%Lc
X 81 S 34	471	64	1960	93	2750	151
12	665	91	1677	79	2344	129
106	988	135	1647	78	2017	111
125	443	61	1277	60	3272	180
25	427	58	1806	85	1478	81
3	635	87	1843	87	2439	134
10	488	67	1674	79	3072	169
56	721	98	1952	92	2589	142
32	727	99	1838	87	2361	130
19	566	77	1516	72	1792	99
ILB 1814	882	120	2109	100	1733	95
Tunisian Local Check	732	100	2114	100	1817	100
Mean	646		1788		2305	
C.V. %	30.2		17.3		29.2	
S.E.	112.8		178.5		388.8	
d.f.	22		21		22	

TABLE A5 SEED YIELD OF ENTRIES IN AN AYT AT TWO LOCATIONS IN 1982/83.

Entry	Pedigree/ selection	B		K	
		Kg/Ha	%Lc	Kg/Ha	%Lc
ILB 24	74TA 63	1719	93	1256	63
34	78 S 49841	1331	72	1728	86
398	76TA 56246	2531	138	2012	101
1266	Aquadulce	1468	80	1859	93
1269	*New Mammoth*	2456	133	1968	98
1799	39 MB	2018	110	1943	97
1805	Elegant 5 MC 1	2381	129	1850	93
1814	Syrian Local Large	1768	96	1946	97
1817	Lebanese Local Large	1806	98	1781	89
	Ascott	965	52	565	28
	Talot	1462	79	1506	75
	Tunisian Local Check	1840	100	2000	100
Mean		1813		1702	
C.V. %		26.6		20.3	
S.E.		241.5		174.1	
d.f.		32		33	

TABLE A6 SEED YIELD OF ENTRIES IN A PYT-L N° 1 AT TWO LOCATIONS IN 1982/83.

Entry	Pedigree/ Selection	B		K	
		Kg/Ha	% Lc	Kg/Ha	% Lc
X75TA 115	78 S 33200	1670	87	1779	86
ILB 268	78 S 268	1533	80	1683	82
274	74TA 374	1387	72	1883	91
371	74TA 516	1358	72	1962	95
1814	Syrian Local Large	2037	106	2299	111
1815	Lattakia Local	1575	82	1833	89
1817	76TA 56809	1316	68	1725	97
1821	Turkey Local	1887	98	2008	97
-	Ascott	538	28	437	21
-	Talot	1125	58	1850	90
-	Tunisian Local Check	1926	100	2064	100
Mean		1491		1775	
C.V. %		20.5		18.8	
S.E.		176.8		192.9	
d.f.		20		19	

TABLE A7 SEED YIELD OF ENTRIES IN A PYT-L N° 2 AT TWO LOCATIONS IN 1982/83.

Entry	B		K	
	Kg/Ha	%Lc	Kg/Ha	%Lc
Johnson Wonderful	374	22	550	39
Master Piece Green Long pod	381	23	437	31
Aquadulce	1664	97	1187	84
Bunyards Exhibition	756	44	293	21
Four Seed Green Windsor	312	19	425	30
White Windsor	468	27	381	27
Sutton	465	27	728	52
Three fold White	384	23	456	32
Express	599	35	456	32
Aquadulce Claudia	1790	105	868	62
Fill Basket Windsor	431	25	436	31
Tunisian Local, Check 1	1628		1518	
" " , Check 2	1678	100	1331	100
" " , Check 3	1815		1368	
Mean	911		746	
C.V. %	36.1		29.3	
S.E.	164.5		109.1	
d.f.	38		38	

TABLE A8 SEED YIELD OF ENTRIES IN A PYT-S N°1 AT TWO LOCATIONS IN 1982/83.

Entry	Pedigree/ Selection	B		K	
		Kg/Ha	%Lc	Kg/Ha	%Lc
ILB 269	74TA 367	1037	73	2106	101
287	77MS 88324	1000	71	1725	83
320	78 S 48434	1106	78	1644	79
905	78 S 35513	1125	79	1863	90
1816	78 S 48561	837	59	1175	56
1820	Giza 4	1168	82	1669	80
	FVL P.L. V.(1)	1256	89	1775	85
	FVL P.L. B.(2)	1268	89	1906	92
	Ascott	200	16	713	34
	Talot	906	64	1900	91
	Tunisian Local Check	1418	100	2081	100
Mean		1029		1687	
C.V. %		18.2		11.4	
S.E.		132.4		136.2	
d.f.		10		10	

(1) Local population - green seeded.

(2) Local population - white seeded.

TABLE A9 SEED YIELD OF ENTRIES IN A PYT-S N° 2 AT BEJA IN 1982/83.

Entry	Pedigree/ Selection	Kg/Ha	% Lc
ILB 285	77TA 88118	1312	108
317	77MS 88338	1275	105
352	77MS 88158	987	81
356	77MS 88165	1531	126
INAM 709	INRAM F 315	1406	115
1001	296	968	79
1005	303	1156	94
1006	305	1250	103
1019	317	1181	97
1026	327	1362	112
	FVL P.L. V.	1050	86
	FVL P.L. B.	1362	112
	Ascott	217	18
	Talot	1162	95
	Tunisian Local Check	1218	100
Mean		1163	
C.V. %		21 8	
S.E.		179.1	
d.f.		14	

TABLE A10 a. SEED YIELD OF ENTRIES IN AN ISN-L AT THREE LOCATIONS IN 1982/83.

Entry	Pedigree	B	K	Ma
ILB 263	77TA 88311	900	1050	1350
X75TA43	78 S 33120	1100	1375	1550
ILB 268	78 S 48426	1025	1150	1675
37	74 TA 109	1175	2400	1650
41	76TA 56297	813	1950	1050
1799	79 MB	1250	3200	650
34	78 S 49841	1012	2400	1550
444	78 S 97513	1150	3000	1225
1805	5 MCI	1263	2725	2100
X77TA64	80 S 44027	1325	2300	1950
X75TA116	79 S 79180	1425	2450	775
ILB 1814	79 S 546	925	1900	1275
ILB 1814	79 S 653	1150	2425	1125
X77TA 88	80 S 44539	1150	3400	850
X77TA 31	*80 S 43587*	*1350*	1900	1875
ILB 1814	79 S 4	1250	2525	ND
X77TA 82	80 S 44371	1375	3250	1850
ILB 4	-	1375	2875	2650
X77Sd 70	80 S 46341	1075	2800	2300
X77TA 3	80 S 43051	1125	2125	775
X77TA 89	80 S 44552	900	1550	2550
X77TA 72	80 S 44178	1050	2250	1400
X79 S 12	80 S 80002	1350	2750	2700
X79 L153	80 S 81054	1412	2950	2550
X79 S160	80 S 80128	1050	3000	2500
X79 S171	80 S 80135	1400	2750	2050
X79 S 72	80 S 80028	1100	2850	1950
X79 S155	80 S 80123	1400	3000	1150
X79 S 70	80 S 80026	1062	3350	2950
X79 S103	80 S 80064	1375	3100	3400
CHECK GENOTYPES				
ILB 1814	Syrian Local Large	1125	600	800
		1025	2750	1500
		1875	1900	1650
		1100	3600	1925
Mean		1281	2213	1469
C.V. %		31.0	57.8	32.6
ILB 1270	Reina Blanca	1475	3275	1550
		1462	2475	1850
		1950	3250	2750
		1425	2750	3150
Mean		1578	2938	2325
C.V. %		15.8	13.3	32.3
Tunisian Local		1725	2525	650
		1425	3275	1050
		1450	3075	1875
		1200	3350	3200
Mean		1450	3056	1694
C.V. %		26.7	12.2	66.5

TABLE A10b. SEED YIELD OF ENTRIES IN AN ISN-S AT THREE LOCATIONS IN 1982/83.

Entry		Pedigree	B	K	Ma
ILB	22	78 S 49264	1650	2300	1425
	905	78 S 35513	1050	2050	1100
	1816	78 S 48561	1668	2100	1525
	269	74TA 367	1350	2200	1175
	336	78 S 48437	1300	2150	1150
	33	74TA 94	1450	2450	1300
	360	74TA 498	1250	1850	1100
	356	77MS 88165	1425	3725	825
	287	77MS 88323	1350	2150	900
	328	77MS 88138	1350	2050	850
	1105	79 S 97330	1100	2400	1400
X75TA	150	80 S 50088	1050	2500	1475
X75TA	193	80 S 50106	1100	2000	800
X75TA	3	80 S 43064	1275	2600	750
X75TS	9	80 S 43209	750	1925	825
X75TA	10	80 S 43238	1300	2450	1275
X75TA	16	80 S 43341	700	2000	1050
"	" 19	80 S 43383	800	1900	475
"	" 33	80 S 43651	1575	2800	1150
"	" 42	80 S 43773	700	2300	1225
X77TA	60	80 S 43971	2000	2350	1525
	60	43977	1150	2600	1500
	66	44031	1000	1750	975
	66	44045	800	2000	1100
	66	44056	1300	2200	1025
	70	44150	1700	2250	1475
	72	44203	800	2275	1050
	81	40384	1350	2350	1350
	82	44367	1250	2475	925
	83	44384	1000	2000	1025
	86	44474	1350	2350	1100
	88	44545	1100	2050	1175
	101	44812	1200	2300	975
	101	44815	1300	2750	950
	117	45050	1000	2600	1025
	119	45089	450	2450	575
	148	45579	850	2150	1125
X77Sd	11	80 S 45676	1150	2050	1450
	13	45727	500	2600	1525
	14	45777	550	2250	1450
	48	45779	550	1700	1750
X77TA	48	80 S 43856	1250	2625	1725
	48	43859	1250	2575	1925
	118	45057	950	2250	1425
X77Sd	60	46121	1250	2850	1850
	92	46593	1050	2600	1525

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TABLE A10b(continued)

Entry	Pedigree	B	K	Ma
CHECK GENOTYPES				
ILB 1812	Syrian Local Medium	1575	2400	1575
		1700	2300	1300
		1550	2550	1150
		1000	3000	1425
		800	2600	1475
Mean		1325	2570	1385
C.V.%		30.0	10.4	11.9
ILB 1811	Syrian Local Small	1250	2375	950
		1050	1850	550
		1050	1925	925
		1175	2200	700
		300	1850	1025
Mean		965	2040	830
C.V. %		39.5	11.5	23.9
Tunisian Local Check	Tunisian Local	1000	1700	1325
		1900	1750	400
		1750	2250	1300
		1350	2550	1150
		725	1900	825
Mean		1345	2030	1000
C.V. %		36.7	17.8	39.0

TABLE A11 SEED YIELD OF ENTRIES IN AN NATIONAL SCREENING NURSERY AT TWO LOCATIONS IN 1982/83.

Entry	Béja Kg/Ha	El-Kef Kg/Ha
203154	2700	1850
221516	150	900
222128	300	1250
222216	300	1000
223303	900	700
223418	1200	1500
244062	900	1100
244063	1000	1900
244345	1200	900
251231	1800	1400
251232	2150	2300
251331	2000	2150
253425	1400	2200
253806	2100	2000
253807	1200	1800
253808	1900	1600
253809	2100	1700
254001	2150	1100
254002	2000	1100
254003	1150	900
254004	1500	1400
254005	600	150
254920	2000	2500
262912	1600	1000
262913	1500	2000
270055	500	800
270056	600	350
271634	2200	1600
274004	900	850
275641	800	500
284345	1250	1700
284349	1100	1300
286437	1200	1200
291010	1200	1600
300169	700	1500
306699	250	500
319896	500	1300
319897	400	500
319898	400	750
319899	400	900
319900	300	1300
347262	1800	1500
358261	1250	1600
358263	1400	2000
358264	1800	2000
369495	500	1800
Mean of local check large seeded	4775	3045
C.V. %	16.0	10.0
Mean of local check small seeded	2425	1875
C.V. %	22.7	13.9

TABLE A12 SEED YIELD OF ENTRIES IN A CHOCOLATE SPOT NURSERY AT BEJA IN 1982/83.

Entry	Kg/Ha	Entry	Kg/Ha
BPL 110	1250	BPL 1548	575
112	975	1550	1425
261	650	1556	650
266	1075	1648	950
274	1350	1689	1350
710	1025	1749	950
1179	850	1752	450
1196	2650	1758	500
1278	1100	1764	525
1390	725	1803	1575
1821	1125	1831	1275
Syrian Local Large	1450	1832	1275
Rebaya 40	450	1841	1100
BPL 470	1800	1876	1725
471	925	2485	1775
472	1100		
1538	575	Mean of Local check	1582
1544	950	C.V. %	22.9
1546	1100		
1547	1075		

TABLE A13 SEED YIELD OF ENTRIES IN AN ASCHOCHYTA NURSERY AT BEJA IN 1982/83.

Entry	Kg/ha	Entry	Kg/Ha
BPL 472	1500	BPL 465	1550
460	2000	161	1300
471	1075	2485	1575
ILB 161	2150	Giza 4	900
382	2175	ILB 1814	1550
549	1400	BPL 710	1250
37	1625	BPL 1179	1225
BPL 230	1250	X 75 TA46	1250
365	1725		
369	450	Mean of Local Check	1808
435	1975		
436	1225	C.V. %	14.4

TABLE A14 SEED YIELD OF ENTRIES IN A RUST NURSERY AT BEJA IN 1982/83.

Entry	Kg/Ha	Entry	Kg/Ha
BPL 1179	1300	BPL 1547	1100
710	1200	1548	625
266	900	1763	1550
274	1500	1764	600
460	1625	F 6	1975
461	1800	F 17	2450
470	1625	80Lat15563-3	950
471	1175	80Lat15563-1	1550
472	1600	ILB 1814	1475
1055	1275		
1056	2050	Mean Local Check	2118
1058	1500		
1107	2250	C.V. %	27.0
1538	1275		
1543	1350		

TABLE A15 SEED YIELD OF ENTRIES IN A GENERAL DISEASE NURSERY AT BEJA IN 1982/83.

Entry	Kg/Ha	Entry	Kg/Ha
BPL 161	225	BPL 1089	850
165	1500	1163	1850
230	2000	1394	1400
262	750	1599	1200
444	1425	1873	1300
471	1550	938	1250
666	2350	80 SL15563-1	150
617	1000	-3	600
80Latt.14989-2	1200	-4	1250
15025-2	1350	Rustatt ILB1555	1650
15035-1	800	ILB 1038	50
15041-2	1925	BPL 195	350
BPL 18	1300		
262	1650	Mean of Local Check	2599
321	1750	C.V. %	19.3
325	ND		
357	1900		
444	1100		
666	1900		

TABLE A16 SEED YIELD OF ENTRIES IN THE DETERMINATE AND HIGH PROTEIN SCREENING NURSERY AT BEJA IN 1982/83.

Entry		Kg/Ha	
81 S	26032	433	
	26057	300	
	26060	333	
	26075	400	
	26125	217	
	26145	700	
	26147	733	
	26241	333	
	26253	433	
	26254	200	
	26257	233	
	26263	200	
	26278	433	
	26320	700	
	26325	167	
	26341	433	
	26342	383	
	26349	467	
	26365	150	
	26385	433	
	26416	400	
	26422	600	
	26518	333	
	26526	400	
	26543	267	
	26544	433	
	26550	467	
	26561	233	
	26562	253	
	26563	933	
	26575	933	
	26586	867	
	26672	433	
	26755	1217	
BPL	171	733	
	373	1100	
	505	1100	
	520	1167	
	521	300	
	542	1517	
	552	1033	
	557	1667	
	620	733	
	661	1067	
Tunisian Local		300	
"		500	
"		367	
"		350	Mean : 672
"		233	
"		500	C.V.% : 69.3
"		1333	
"		1433	
"		1033	

TABLE A17 SEED YIELD OF ENTRIES IN A PLANT BREEDING INSTITUTE SCREENING NURSERY AT BEJA IN 1982/83.

Entry	Kg/Ha		
PBI Cambridge line 76	25		
" " " YT99/1	12		
" " " 67	1737		
Banner	0		
Minica	0		
Maris Bead	1675		
Tiger	637		
Herz Freya	125		
PBI Cambridge line 73	1125		
" " " 224	150		
" " " 47/2	0		
" " " 34/1	37		
" " " 335	50		
" " " 6	200		
" " " 615	125		
Polar	150		
Blaze	1625		
Relon	862		
Montica	875		
Cockfield	12		
Tunisia Local Check	1500		
"	250	Mean	608
"	62		
"	162	C.V. %	113.6
"	1175		
"	12		
"	1600		
"	100		
"			

4. CHICKPEA IMPROVEMENT PROGRAM.

Last season there was sufficient natural development of both Ascochyta blight and Fusarium wilt to adequately screen material for resistance to these pathogens. However, this season only the latter developed sufficiently to provide adequate screening, although this coming season it is expected that facilities for the artifical inoculation with Ascochyta blight will be developed. The full results from all the trials and nurseries are given in appendix B (app. B) with a summary of the results contained in the following crop report. The local check used in the experiments was a Tunisian local cultivar, which is grown particularly in the Béja region, and is referred to either as the local check or simply the check.

4.1 Results and Discussion of Winter Planted Trials.

4.1.1 International Yield Trials (IYT), ex-ICARDA.

The seed yield results from an IYT grown at Béja and El-Kef are given in appendix B, table B1; the trial was also grown at Moghrane, but unfortunately harvest problems prevented the collection of any reliable data. Although the 'F' test was not significant at either of the two previous locations, it was encouraging to note that all entries except one, namely, FLIP81-34W, outyielded

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the check at both locations. The performance of the five heaviest yielding entries is shown in table 4.1.

Two IYT's (1 and 2), containing F_3 populations, were grown at Béja and El-Kef and the seed yield results are given in appendix B, tables B2 and B3, respectively. For the $IYTF_3$-1 there was no significant difference between entries at either location, but all populations exceeded the check mean across locations, and the performance of the best five is shown in table 4.2. In the $IYTF_3$-2 the 'F' test was significant at both locations, with the check significantly outyielded by X81TH 48 at Béja and by all populations except X81TH 171 at El-Kef. The performance of the five heaviest yielding populations across locations is shown in table 4.3.

4.1.2 Preliminary (PYT) and Advanced (AYT) Yield Trials.

The seed yield results from a PYT grown at Béja and an AYT grown at Béja and El-Kef are given in appendix B, tables B4 and B5 respectively. In the PYT entry differences were significant, and although no local check was included in the trial all entries except FLIP 81064 and FLIP 81080 significantly exceeded ILC 3279. As this last

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TABLE 4.1 SEED YIELD (kg/ha) OF SUPERIOR ENTRIES IN A WINTER SOWN IYT AT BEJA (B) AND EL-KEF IN 1982/83.

Entry Designation	Pedigree	Location B	Location K	Mean	% Check
ILC 95		1965	2133	2049	125
482	Acc. N°2 26780-68	1850	2506	2178	133
484	26783-68	2215	2199	2207	135
FLIP 81-41W	X79 TH 50	2253	2048	2150	131
50W	X79 TH 151	2203	2365	1883	115
Tunisian Local Check		1713	1563	1638	100
S.E.		195.0		207.8	
d.f.		33		30	

TABLE 4.2 SEED YIELD (kg/ha) OF SUPERIOR F_3 POPULATIONS IN AN IYT N°1 AT BEJA (B) AND EL-KEF (K) IN 1982/83.

Entry		Location			
Designation	Pedigree	B	K	Mean	% Check
X81 TH 56	ILC 1920 x ILC 3279	938	2038	1488	159
111	191 x 202	850	1959	1405	150
112	191 x 482	788	1990	1389	149
120	200 x 484	938	1975	1457	156
126	202 x 484	763	1929	1346	144
Tunisian Local Check		475	1392	934	100
S.E.		213.3		159.0	
d.f.		30		30	

TABLE 4.3 SEED YIELD (kg/ha) OF SUPERIOR F_3 POPULATIONS IN AN IYT N° 2 AT BEJA (B) AND EL-KEF (K) IN 1982/83.

Entry Designation	Pedigree	Location B	Location K	Mean	% Check
X81 TH 29	ILC 610 x ILC 202	1550	1859	1705	141
48	1920 x 201	1763	1959	1861	154
108	72 x 262	950	2104	1527	126
190	272 x 191	1075	2025	1550	128
203	3279 x 3355	1200	2111	1656	137
Tunisian Local Check		1175	1246	1211	100
S.E.		188.3	325.5		
d.f.		28	28		

genotype had a seed yield similar to the check in the IYT (app. B, table B1), such entries may tentatively be considered as superior to the check. Although the entries differed significantly in the AYT no entry significantly outyielded the check, and many yielded considerably less.

4.1.3 Ascochyta Blight Disease Nursery, ex-ICARDA.

The low incidence of blight prevented any disease screening of the entries in this nursery grown at Béja, El-Kef and Moghrane. Accordingly only the seed yield results are given in appendix B, table B6. Although these are of little intrinsic value without Ascochyta ratings, it is perhaps worth noting that ILC-183, -195, -249 and FLIP 81-41W all exceeded the mean of the check at each of the three locations.

4.1.4 National Screening Nursery (NSN).

The seed yield results of the NSN grown in winter and spring at El-Kef are given in appendix B, table B7. Of the 37 entries 16 outyielded the check in winter and 8 in spring, but only 4 did so in both plantings. The correlation between the

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seed yield of the entries in the different plantings was low and non-significant ($r = 0.12$, $df = 41$).

4.1.5 General Discussion.

With little or no Ascochyta blight evident this season the entries in the above trials will not have had any inherent yield advantage over the local check accruing from Ascochyta blight resistance. The poor performance of the entries in the AYT probably reflected their original selection for Ascochyta blight resistance, with little attention paid to seed yield per se. It was therefore encouraging that the more recent material emerging from ICARDA's breeding program in the IYT, namely the FLIP 81-...W genotypes, generally outyielded the check even if not significantly. This was also true for the F_3 populations and there is hope that reselection will produce further improvements in seed yield. However, all the genetic material in these trials has a seed size too small to meet consumer preference in Tunisia, and efforts are and will be made to improve this character. Furthermore, on a note of caution, it was discouraging to note that the performance of the entries ILC-195, -202, -482 and -484, relative to the check and common to the AYT and IYT, differed markedly between trials at the same location. This problem is considered further in section 6.

4.2 Results and Discussion of Spring Planted Trials.

Last season the experiments in a certain area of land at the Béja station were seen to be heavily infected with Fusarium wilt, and a part of this area was designated as a wilt sick plot (WSP) for screening in future seasons. Although the WSP was utilised this season for screening material, it was discovered that another area of land planted to chickpea trials was also heavily infected with Fusarium wilt, and this also provided effective screening. All Fusarium ratings reported were made on a visual basis using a 1 to 9 scale where 1 = no symptoms and 9 = complete kill of the plants in a plot.

4.2.1 International Yield Trials (IYT), ex-ICARDA.

The seed yield results of an IYT at Béja, El-Kef and Mateur are given in appendix B, table B8. Also included in table B8 are visual ratings of the entries to Fusarium wilt infection at Béja. At this location entries differed significantly ($P \leq 0.001$) for both seed yield and Fusarium ratings, and the deleterious effect of the pathogen on seed yield was shown by a negative correlation of -0.89 ($P \leq 0.001$) between the two characters. However, it was encouraging

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that firstly, the five top yielding entries combined a significantly heavier seed yield and significantly lower Fusarium rating than the check (table 4.4). Secondly, that a further six genotypes also significantly outyielded the check although having Fusarium ratings similar to that of the check (table 4.4). However, the yield advantage of these eleven entries was not evident at El-Kef and Mateur where symptoms of Fusarium wilt were not evident (app. B, table B8).

For a large seeded IYT the seed yield results and Fusarium ratings from Béja and the former from El-Kef are given in appendix B, table B9. At Béja entries differed significantly for both characters and these were again negatively correlated ($r = -0.81$, $P \leqslant 0.001$). Of the top five yielding entries at Béja (table 4.5) only ILC 136 significantly outyielded the check, and only this entry and ILC 134 had a significanty lower Fusarium rating than the check. At El-Kef the entries did not differ significantly for seed yield, and here with no evidence of Fusarium infection, ILC 136 yielded the same as the check.

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TABLE 4.4 SEED YIELD (kg/ha) OF SUPERIOR ENTRIES IN AN IYT AT BEJA, EL-KEF AND MATEUR AND FUSARIUM RATINGS (FR) AT BEJA IN 1982/83.

Entry Designation	Pedigree	Béja Location FR	Yield	%Lc	El-Kef and Mateur Locations K	Ma	Mean	%Lc
ILC 237	Coll. N°K 2187	1.5	1450	346	1575	1756	1666	113
493	Acc. N° 28119-69	3.8	1138	272	1481	1431	1456	99
FLIP 81-52	NEC 1540 x P1630	4.0	1194	285	1488	1600	1544	105
-54	219 x F 61	3.5	1656	395	1369	1479	1424	97
-65	741300-4P-4P	3.3	1619	386	1519	1344	1432	97
ILC 4		4.8	1006	240	1438	1638	1538	104
35		5.5	738	176	1438	1531	1485	101
295	12-071-02122	5.3	731	174	1206	1463	1335	91
1929	Syrian Local	5.3	881	210	1325	1425	1375	93
FLIP 81-31	NEC 1656 x E 100	4.3	988	236	1088	1600	1344	91
-40	14 x NEC 132	4.8	931	222	1444	1444	1444	98
Tunisian Local Check		5.0	419	100	1556	1388	1472	100
S.E.		0.31	92.7		169.0		124.1	
d.f.		69	67		66		67	

TABLE 4.5 SEED YIELD (kg/ha) OF SUPERIOR ENTRIES IN AN IYT-L AT BEJA AND EL-KEF AND FUSARIUM RATINGS (FR) AT BEJA IN 1982/83.

Entry	Béja Location			El-Kef Location	
	FR	Seed Yield	%Lc	Seed Yield	%Lc
ILC 83	4.5	500	127	1044	87
136	2.0	1000	254	1194	100
165	4.0	606	154	1050	88
451	4.5	650	165	1088	91
2487	4.0	694	176	1106	93
Tunisian Local Check	5.0	394	100	1194	100
S.E.	0.58	113.0		106.7	
d.f.	56	56		57	

1.2.2 Preliminary (PYT) and Advanced (AYT) Yield Trials.

The seed results from a PYT-1 and PYT-2, both grown at Béja and El-Kef, are given in appendix B, tables B10 and B11 respectively. As the trials were grown on wilt infested land at Béja the Fusarium ratings for the entries are also included in the tables, and in each trial the correlation between these ratings and seed yield was negative and significant ($P \leqslant 0.001$) and greater than -0.93.

In both trials at Béja the local check was almost completely killed by Fusarium wilt and the entries differed significantly for seed yield. In the PYT-1 all except three ICARDA derived entries significantly outyielded the check, and the top four yielding entries were the Béja selections PL.Se. Be.81 -27, -28, -40 and -41, which stemmed from single plant selections for Fusarium resistance in the local cultivar/landrace Amdoun. In the PYT-2 all the PL.Se. Be.81-... selections, derived as above, were significantly better than the check for seed yield and Fusarium resistance, whereas the two ICARDA derived entries (FLIP 80-51 and -30) were moderately susceptible and gave a light seed yield (app. B, table B11). It is also noteworthly that the seed weight of the PL.Se. Be.81-... selections was at least double that of the ICARDA entries (app. B, table B11),

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indicating one of the quality requirements that any new cultivar must possess prior to release. At El-Kef there was no significant difference between the entries for seed yield in either trial.

The AYT-1 was grown at El-Kef and in wilt infested land at Béja and contained a further ten PL.Be.Se. 81-... selections, with Fusarium ratings and seed yield of the entries given in appendix B, table B12. At Béja seed yield and Fusarium ratings of the entries were negatively correlated ($r = -0.95$, $P < 0.001$) and all entries significantly outyielded the check, whereas at El-Kef there was no significant difference between the entries for seed yield. Data on the top five yielding entries in each of the above three trials at Béja are given in table 4.6.

Both the AYT 2 and F_4 population trial contained entries from ICARDA, but in neither trial did the entries differ significantly for seed yield (app. B, tables B13 and B14 respectively). It is noteworthy that in the former trial the entry, ILC 237, yielded 10% less than

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TABLE 4.6 SEED YIELD (kg/ha) AND FUSARIUM RATINGS (FR) OF SUPERIOR ENTRIES IN THE PYT-1, PYT-2 AND AYT-1 AT BEJA IN 1982/83.

Trial								
PYT-1			PYT-2			AYT-1		
Entry	FR	Kg/Ha	Entry	FR	Kg/Ha	Entry	FR	Kg/Ha
PL.Se.Be. 81-40	1.3	1620	PL.Be.Se. 81- 48	1.0	1680	PL.Se.Be. 81-22	1.0	1410
-41	1.7	1390	-149	1.5	1610	- 9	1.3	1260
-28	2.0	1384	-146	1.0	1580	-11	1.0	1243
-27	2.3	1343	-144	1.5	1560	-5	1.3	1221
ILC 2208	2.3	1234	- 78	1.0	1550	-6	1.0	1193
Tunisian Local Check	8.7	16		8.5	49		8.0	49
S.E.		117.2		0.40	123.9			91.5
d.f.		26		30	30			30

the mean of the local checks, whereas in the IYT, grown on wilt infested land at the same location, it yielded 246 % more than the check (table 4.4). Although the F_4 populations gave a similar seed yield to the check, reselection within them could produce further increases.

4.2.3 Miscellaneous Trials.

As a start to improving the mechanical harvesting attributes a range of all types from ICARDA were grown in a trial at Béja. The seed yield of the entries (app. B , table B15), did not differ significantly and only two genotypes, namely, FLIP 82-85 and FLIP 82-86 outyielded the check, ILC 482, which is a standard ICARDA check. In the longer term it is expected that the best adapted tall types will be involved in a crossing program to increase the height of the local cultivar.

Since virus induced stunt has often been observed in Tunisia, a selection of resistant genotypes from ICRISAT was grown in a trial at Béja. Unfortunately insufficient virus infection occured to rate the entries for resistance and only their seed yield is given in appendix B, table B16.

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4.2.4 International Screening Nursery (ISN), ex-ICARDA.

In both this and last season's report, the effectiveness of one row non-replicated plots used in the ISN's to accurately identify superior yielding genotypes has been questioned. An attempt was made this season to improve on such identification by growing two sets of the ISN at each test location; in a sense each ISN was therefore replicated twice, although the same randomisation was used for all sets.

The seed yield results from the two sets grown at both Béja and El-Kef are given in appendix B, table B17. Also included in the table are the coefficient of variation for the check entries, and these varied widely from 7.0% to 51.0%.

At Béja the results were relatively consistent in that the correlation between the seed yield of the entries in each set was 0.81 ($P \leqslant 0.001$, df = 66), and of the 69 entries 27 exceeded the mean of the local check in both sets. Whereas at El-Kef, although 44 entries exceeded the mean of the local check in one set, none did in the other, and the corresponding correlation was - 0.002 ($P \leqslant 0.10$, df = 64).

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Such conflicting results provide little evidence for or against the effectiveness of these ISNs in assessing seed yield, and only further testing in replicated trials will provide an answer.

4.2.5 Fusarium Disease Nurseries.

Mention has already been made above about the performance of entries that were selected for Fusarium wilt resistance within the local landrace 'Amdoun' at Béja. A further series of resistant single plant selections were made in 'Amdoun' at this location in 1982, and the progeny seed from a 126 of these was grown in the wilt sickplot (WSP) at Béja for further testing.

Unfortunately owing to some errors in planting only 49 of these could be clearly identified with their original parents. However, all maintained their resistance (a rating of less than 3 on the 1 to 9 scale) and those with sufficient seed will be tested in a replicated yield trial next season. Many of the remaining progenies in the nursery showed resistance and after reclassification those with sufficient will also be included in the trial.

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It is possible that the sources of resistance so far identified in 'Amdoun' are the same or a similar genetic mechanism. In an attempt to widen the genetic base for resistance firstly, another series of single plant selections for resistance were made within a farmer's field infected with Fusarium wilt at a different location, namely, Mateur, and the progeny from these will be grown in the WSP at Béja next season.

Secondly, an international root rots/wilt nursery from ICRISAT, containing 75 desi entries was grown in the WSP at Béja, and the seed yield results are given in appendix B, table B18. No entry showed symptoms of Fusarium wilt infection, and this included the desi check which is highly susceptible to indigenous races of wilt in the Indian sub-continent. The latter suggests that the strain of the pathogen occuring naturally in Tunisia is less virulent than that in the sub-continent, and that these resistant desi entries could provide an additional and perhaps different source(s) of resistance to those so far located in the Tunisian land race. Next season crosses will be initiated between local cultivars and some of the desi entries.

4.2.6 General Discussion.

The local cultivar Amdoun is widely cultivated, but the demonstration of its extreme

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susceptibility to Fusarium wilt in the WSP at Béja marks a major deficiency in this cultivar. It was therefore encouraging that selections from within Amdoun, and other genetic material derived from ICARDA and ICRISAT, showed a high level of resistance to Fusarium wilt, and some of these genotypes have maintained this level for more than one season. Amdoun is also susceptible, however, to Ascochyta blight which occurs regularly, and thus any new cultivar that might be considered for release must possess resistance to both pathogens. Accordingly crosses are being undertaken next season with the aim of obtaining a range of genotypes combining both types of resistance.

Most of the significant yield improvements obtained over the local check Amdoun stemmed from improved resistance to Fusarium wilt, and whilst such resistance is of great value, efforts must also be continued to improve seed yield per se. However, although some trials had relatively high coefficients of variation for seed yield, little of the genetic material contained in ICARDA international yield trials appeared to possess an inherent and consistent yield advantage over the local check. Therefore, as with faba beans, it may be necessary to consider putting greater emphasis on the testing of early generation breeding lines and populations from the ICARDA base program, prior to their selection for inclusion in international trials.

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APPENDIX B. RESULTS OF THE CHICKPEA BREEDING TRIALS AND NURSERIES IN 1982/83.

Abbreviations used in tables.

1. Locations : B - Béja
   K - El-Kef
   Ma- Mateur
   Mo- Moghrane

2. Data : Kg/ha - seed yield of entries in these units.
   %Lc - seed yield of entries expressed as a percentage of the Tunisian Local Check.
   Data values - those underlined were significantly ($P \leq 0.05$) superior to the Tunisian Local Check.
   ND - data not available.

3. Statistics : C.V. % - coefficient of variation expressed as a percentage.
   S.E. - standard error of entry mean.
   d.f. - degrees of freedom associated with the standard error.

TABLE B1 SEED YIELD OF ENTRIES IN A WINTER SOWN IYT AT TWO LOCATIONS IN 1982/83.

Entry	Pedigree	B		K	
		Kg/Ha	%Lc	Kg/Ha	%Lc
ILC 195	-	1965	115	2133	136
202	VYR 32	1725	101	2110	135
482	Acc. N° 26780-68	1850	108	2506	160
484	Acc. N° 26780-68	2215	129	2199	141
3279	-	1735	101	1995	128
FLIP- 26W	X78TH23/ILC262xILC183	1993	116	1968	126
34W	X79TH29/ILC 51xILC200	1673	98	1990	127
41W	X79TH50/ILC591xILC200	2253	132	2048	131
56W	X79TH151/ILC72xILC897	2203	129	2365	151
57W	X79TH151/ILC72xILC897	1855	108	1910	122
59W	X79TH158/ILC202xILC893	1915	118	2018	129
	Tunisian Local Check	1713	100	1563	100
Mean		1924		2067	
C.V. %		20.3		20.1	
S.E.		195.0		207.8	
d.f.		33		30	

TABLE B2 SEED YIELD OF ENTRIES IN A WINTER SOWN F_3 POPULATION TRIAL N°1 AT TWO LOCATIONS IN 1982/83.

Entry	Pedigree	B		K	
		Kg/Ha	%Lc	Kg/Ha	%Lc
X 81 TH 53	ILC 1920 x ILC 2506	763	161	1729	124
56	1920 x 3279	938	197	2038	146
84	191 x 262	338	71	1807	130
85	191 x 237	520	109	1888	136
101	72 x 191	338	71	1867	134
104	72 x 482	525	110	1957	141
105	72 x 484	438	92	2302	166
111	191 x 202	850	179	1959	141
112	191 x 482	788	166	1990	143
113	191 x 484	650	137	2082	150
120	200 x 484	938	197	1975	142
125	202 x 482	453	95	2107	151
126	202 x 484	763	161	1929	139
146	72 x 73	538	113	2250	162
ILC 482	Acc. N° 26780-68	650	137	2261	162
	Tunisian Local Check	475	100	1392	100
Mean		632		1971	
C.V. %		47.7		14.0	
S.E.		213.3		159.1	
d.f.		13[a]		30	

a - Third replicate used for single plant selections.

TABLE B3 SEED YIELD OF ENTRIES IN A WINTER SOWN F_3 POPULATION N°2 TRIAL AT TWO LOCATIONS IN 1982/83.

Entry	Pedigree	B		K	
		Kg/Ha	%Lc	Kg/Ha	%Lc
X 81 TH 29	ILC 610 x ILC 202	1550	132	1859	149
41	1920 x 72	1013	86	1921	154
48	1920 x 201	1763	150	1454	157
49	1920 x 202	638	54	1917	154
55	1920 x 2956	950	81	1837	147
108	72 x 262	950	81	2104	169
109	72 x 493	1168	99	1840	148
116	191 x 262	1113	95	1946	156
117	191 x 493	N D		1850	148
123	200 x 262	1288	110	1796	144
130	202 x 493	575	49	2242	180
171	92 x 191	1563	133	1563	125
190	272 x 191	1075	91	2025	163
203	3279 x 3355	1200	102	2111	169
ILC 482	Acc.N° 26780-68	1150	98	2129	171
Tunisian Local Check		1175	100	1246	100
Mean		1145		1896	
C.V. %		23.3		14.9	
S.E.		188.3		162.8	
d.f.		13[a]		28	

a - Third replicate used for single plant selections

TABLE B4 SEED YIELD OF ENTRIES IN A WINTER SOWN PYT AT BEJA IN 1982/83.

Entry	Kg/Ha
ILC 3279	1350
FLIP 81004	2041
81078	1866
81070	1958
81084	2000
81064	1632
81080	1316
Mean	1734
C.V. %	10.2
S.E.	124.5
d.f.	6

TABLE B5 SEED YIELD OF ENTRIES IN A WINTER SOWN AYT AT TWO LOCATIONS IN 1982/83.

Entry	B		K	
	Kg/Ha	%Lc	Kg/Ha	%Lc
ILC 72	1590	85	913	71
182	1520	81	1110	86
191	1540	82	873	68
194	1570	84	1088	85
195	1530	81	1085	84
200	1560	83	998	78
202	1340	71	735	57
482	1570	84	1505	117
484	1800	96	1300	101
2548	1560	83	998	78
2912	1180	63	1023	80
Tunisian Local Check	1880	100	1285	100
Tunisian Local Treated	2000	106	1535	119
Mean	1589		1110	
C.V. %	17.1		23.5	
S.E.	136.2		130.6	
d.f.	36		36	

TABLE B6 SEED YIELD OF ENTRIES IN AN ASCOCHYTA BLIGHT SCREENING NURSERY AT THREE LOCATIONS IN 1982/83.

Entry	B Kg/Ha	K Kg/Ha	Mo Kg/Ha
ILC 72	225	2337	600
182	775	1975	825
183	1575	2250	850
187	1200	2100	800
191	1325	1700	1025
195	1450	2750	750
196	950	1250	500
200	950	2000	550
201	825	2200	825
202	1200	1275	700
215	1225	1950	625
249	1800	1725	1075
482	1375	1450	1125
484	1425	1937	1175
2380	1075	1562	700
2506	1450	2350	450
2956	1000	2250	525
3274	975	2375	475
3279	1500	2250	500
3346	1250	2650	650
3400	1150	1950	500
FLIP 81-41W	1775	2800	875
-56W	1025	2450	1125
-59W	1400	2437	675
FLIP 81-67	1225	1750	1000
-75	1200	2600	1200
-269	1525	1812	1175
-293	1412	2087	1000
-343	925	2562	875
ICC 641	1200	75	850
2160	1225	1850	550
3932	812	1475	600
3996	800	1837	425
4107	825	1587	650
4472	750	1175	425
4475	712	1375	600
4935	675	1512	950
5127	1625	2725	475
6262	800	2462	325
6304	1275	1750	450
6306	1512	2012	550
6945	625	1525	425
6981	1250	1775	300
6988	1150	1500	450
6989	875	1625	475
NEC 138-2	1350	2887	650
GG 688	958	1775	550
Pch 15	1350	2325	450
Pch 128	1350	50	475

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TABLE B6 (continued)

Entry	B Kg/Ha	K Kg/Ha	Mo Kg/Ha
CHECK GENOTYPE			
Tunisian Local Check	912	2025	675
	962	1750	550
	950	1600	500
	1075	1400	700
	1050	1412	775
	2400	1275	800
	1900	1625	650
	1475	1550	800
	1875	1462	775
	625	1525	525
	1600	1750	450
	1450	1525	600
	1000	1537	600
	1325	1025	775
	1000	1475	650
	750	1925	600
	1475	1650	1200
	1575	1375	875
	1650	1750	725
	1325	1300	700
	1850	1550	725
	1600	1825	450
	1575	1850	475
	1300	1450	800
	1600	1800	850
	1225	1200	700
	1000	1062	575
Mean of Check	1352	1543	685

TABLE B7 SEED YIELD OF ENTRIES IN A NATIONAL SCREENING NURSERY GROWN IN WINTER AND SPRING AT El-KEF IN 1982/83.

Entry	Winter Kg/Ha	Spring Kg/Ha
359 109	800	1300
315 789	1250	700
359 614	2100	1400
297 263	2300	300
315 811	ND	600
315 787	2350	1300
359 365	1100	1000
212 893	2450	1400
360 050	200	800
359 240	1100	1000
359 123	950	400
297 257	1500	1300
288 313	2700	900
359 049	1950	1100
360 036	2200	1000
315 782	50	100
269 881	1000	1200
251 024	2350	1300
220 776	2100	1100
343 019	1400	1100
	1650	1100
203 142	1800	1000
254 550	2000	800
250 143	1300	1000
211 722	1800	800
343 016	1700	1200
222 770	2050	900
253 227	1200	500
315 786	1700	1000
360 224	2400	900
212 891	2100	1100
315 816	1800	400
360 221	2700	800
271 325	800	700
357 648	1000	900
359 552	200	700
343 014	1350	800
Tunisian Local Check	2300	400
	1600	1000
	1550	1500
	950	2100
	1300	1300
	2300	1100
	2500	700
Mean of Check	1786	1157
C.V. % of Check	32.8	47.8

TABLE B8 SEED YIELD OF ENTRIES IN AN IYT AT THREE LOCATIONS AND FUSARIUM RATINGS (FR) AT BEJA IN 1982/83.

Entry	Pedigree	B			K		Ma	
		F.R.	Kg/Ha	%Lc	Kg/Ha	%Lc	Kg/Ha	%Lc
ILC 4		4.8	1006	240	1438	92	1638	118
35		5.5	738	176	1438	92	1531	110
66		8.8	31	7	1456	94	1431	103
237	Coll. N° K.2187	1.5	1450	346	1575	101	1756	127
263	PI 339223	6.5	394	94	1263	81	1400	101
295	12-071-02122	5.3	731	174	1206	76	1463	105
464	Acc. N° 26595-68	5.5	350	84	1613	104	1506	109
480	" " 26715-68	4.5	588	140	1331	86	1588	114
493	" " 28119-69	3.8	1138	272	1481	95	1431	103
610	Calibre 21/28 S.N°6	4.8	606	145	1219	78	1519	109
1929	Syrian Local	5.3	881	210	1325	85	1425	103
FLIP 80-1	7445-B-2H-LB-1p-BH	7.3	106	25	1456	94	1484	107
2	NEC 1487 x G 543	6.0	485	116	888	57	1544	111
5	1540 x P 4307	6.5	168	40	1619	104	1263	91
81-31	1656 xB100	4.3	988	236	1088	70	1600	115
32	1605 x Ceylon 2	5.8	538	128	1338	86	1450	104
40	14 x NEC 132	4.8	931	222	1444	93	1444	104
45	10 x P 4307	8.0	94	22	1268	81	1420	102
46	10 x P 4307	9.0	25	6	1281	82	1713	123
52	1540 x P 1630	4.0	1194	285	1488	97	1600	115
54	219 x F 61	3.5	1656	395	1369	88	1479	107
63	-	4.7	700	167	1444	93	1669	120
65	741300-4P-4P	3.2	1619	386	1519	98	1344	97
	Tunisian Local Check	5.0	419	100	1556	100	1388	100
Mean		5.3	701		1380		1503	
C.V. %		11.7	26.5		24.5		16.5	
S.E.		0.31	92.7		169.0		124.2	
d.f.		69	67		66		67	

TABLE B9 SEED YIELD OF ENTRIES IN AN IYT-L AT THREE LOCATIONS AND FUSARIUM RATINGS (FR) AT BEJA IN 1982/83.

Entry	B			K	
	F.R.	Kg/Ha	%Lc	Kg/Ha	%Lc
ILC 35	6.0	406	103	1138	95
76	4.5	288	73	1106	93
83	4.5	500	127	1044	87
112	5.0	325	82	1363	114
116	4.5	413	105	1163	97
132	4.0	388	98	950	80
134	3.5	481	122	1075	90
135	4.0	356	90	838	70
136	2.0	1000	254	1194	100
165	4.0	606	154	1050	88
171	4.5	494	125	1000	84
254	6.0	131	33	1363	114
451	4.5	650	165	1088	91
464	5.5	313	79	1125	94
496	6.0	181	46	1038	87
613	5.5	386	98	1100	92
620	5.5	313	79	1163	97
629	5.5	156	40	1163	97
2587	4.0	694	176	1106	93
Tunisian Local Check	5.0	394	100	1194	100
Mean	4.7	424		1113	
C.V. %	14.3	53.3		19.2	
S.E.	0.58	113.0		106.7	
d.f.	56	56		57	

TABLE B10 SEED YIELD AND FUSARIUM RATING (FR) OF ENTRIES IN AN FYT N° 1 AT TWO LOCATIONS IN 1982/83.

Entry	F.R.	B Kg/Ha	K Kg/Ha
ILC 29	7.3	166	920
ILC 2208	2.3	1234	743
FLIP 80-14	2.7	1171	887
-35	3.3	1116	800
-54	4.7	740	1000
-62	6.7	228	757
-65	5.0	900	880
ILC 480	8.7	27	1067
PL.Se.Be. 81-25	5.4	677	890
-27	2.3	1343	877
-28	2.0	1384	767
-40	1.3	1620	900
-41	1.7	1390	733
Tunisian Local Check	8.7	16	900
Mean	4.4	859	866
C.V. %		23.6	25.2
S.E.		117.2	126.1
d.f.		26	26

TABLE B11 SEED YIELD, FUSARIUM RATING (FR) AND 100 SEED WEIGHT OF ENTRIES IN AN PYT N°2 AT BEJA AND SEED YIELD AT EL-KEF IN 1982/83.

Entry	B			K
	F.R.	Kg/Ha	100 Seed Weight (g.)	Kg/Ha
PL.Se.Be. 81-48	1.0	1680	54.4	970
-78	1.0	1550	49.5	1250
-86	1.0	1440	51.7	1050
-87	1.0	1360	51.0	1200
-103	1.0	1490	52.1	950
-108	1.5	1220	53.9	1065
-116	1.0	1480	52.6	820
-120	1.5	1420	53.8	1580
-126	1.5	1360	51.5	1000
-128	2.0	1200	50.7	1300
-144	1.5	1560	49.3	1120
-146	1.0	1580	53.4	1015
-149	1.5	1610	52.0	965
Tunisian Local Check	8.5	49	43.8	1015
FLIP 80-51	5.0	390	24.1	900
FLIP 80-30	5.0	130	23.1	1090
Mean	2.2	1120		1080
C.V. %	24.9	14.4		30.2
S.E.	0.40	123.9		230.7
d.f.	30	30		14

TABLE B12 SEED YIELD AND FUSARIUM RATING (FR) OF ENTRIES IN AN AYT N°1 AT BEJA AND SEED YIELD AT EL-KEF IN 1982/83.

Entry	B		K
	F.R.	Kg/Ha	Kg/ha
PL.Se.Be. 4	1.7	638	1423
5	1.3	1221	1290
6	1.0	1193	1370
7	1.3	1171	1723
9	1.3	1260	1490
10	1.3	1110	1057
11	1.0	1243	1413
12	5.0	716	1460
15	4.7	766	1490
22	1.0	1410	1250
P.L. 82 Cap Negro	7.0	77	1377
FAO 12071-10013	6.0	116	1357
-10014	7.0	71	1110
-10025	9.0	0	1177
-10037	7.7	49	997
Tunisian Local Check	8.0	49	1500
Mean		694	1343
C.V. %		22.9	21.6
S.E.		91.5	167.0
d.f.		30	31

TABLE B13 SEED YIELD OF ENTRIES IN AN AYT N°2 AT TWO LOCATIONS IN 1982/83.

Entry		B		K	
		Kg/Ha	%Lc	Kg/Ha	%Lc
ILC 35		1399	90	860	99
83		1112	71	823	95
116		1612	103	890	103
132		1025	66	835	97
134		1388	89	810	94
136		1571	101	1093	126
237		1404	90	955	110
262		1372	88	678	78
451		1414	91	985	114
493		1604	103	893	103
1102		1688	108	1065	123
PL 82 Q. Meliz	Checks	1595	100	758	100
PL 82 Sfax		1658		933	
PL 82 M. Desi		1672		805	
PL 82 M. Lisse		1381		753	
PL Amdoun Béja		1635		1183	
PL Se Béja 3		1430		760	
Mean		1478		887	
C.V. %		24.3		27.1	
S.E.		179.8		120.4	
d.f.		48		48	

TABLE B14 SEED YIELD OF ENTRIES IN AN F_4 POPULATION TRIAL AT BEJA IN 1982/83.

Entry	Kg/Ha	%Lc
80 TH 63	1630	95
116	1970	115
136	1810	106
137	1917	112
207	1787	104
Tunisian Local Check 1	1810	100
Tunisian Local Check 2	1620	
Mean	1792	
C.V. %	9.1	
S.E.	94.0	
d.f.	10	

TABLE B15 SEED YIELD OF ENTRIES IN A TALL TYPES TRIAL AT BEJA IN 1982/83.

Entry	Kg/Ha	%Lc
ILC 72	550	46
197	175	15
198	328	27
202	375	31
2956	233	19
3279	575	48
FLIP 82-73	512	43
78	367	31
79	637	53
80	1133	95
82	617	52
83	867	72
84	975	82
85	1342	112
86	1317	110
91	675	56
92	1133	95
93	1000	84
Check 1 (ILC 482)	1342	100
2	1275	
3	1033	
4	1133	
Mean	800	
C.V. %	55.9	
S.E.	258.1	
d.f.	42	

TABLE B16 SEED YIELD OF ENTRIES IN A STUNT NURSERY AT BEJA IN 1982/83.

Entry	Kg/Ha
ICC 6433	112
6934	75
591	650
2385	37
3127	1200
685	1350
10495	150
3718	143
4949	37
403	1275
10596	87
CHECK GENOTYPE ICC 11322	750
	825
	1225
	1193
	1500
	1325
	875

TABLE B17 SEED YIELD OF ENTRIES IN TWO SETS OF AN ISN AT TWO LOCATIONS IN 1982/83.

Entry	Pedigree	B Kg/Ha Set 1	B Kg/Ha Set 2	K Kg/Ha Set 1	K Kg/Ha Set 2
FLIP 81 -33	NEC 1605 x Ceylon 2	550	1350	ND	950
34	" 1540 x E 100	350	900	1425	700
35	" 1540 x E 100	375	650	1350	1300
36	" 1646 x P 4307	350	500	1400	1000
37	" 1487 x P 4307	150	400	1475	1000
38	" 14 x NEC 1218	400	450	1425	725
39	" 14 x " 1415	300	550	1275	650
41	" 14 x " 132	400	250	975	900
42	" 14 x " 139	550	500	1275	1800
43	" 30 x " 139	150	250	3350	650
44	IC 75 1269-12	750	1550	1300	650
47	NEC 10 x P 4307	500	700	1500	1600
48	" 2398 x P 4307	300	500	1150	650
49	" 1614 x NEC 316	1550	1100	1275	1575
50	" 1605 x L 534	1050	1500	1200	1475
51	" 2814 x NEC 317	1075	1200	1400	1050
53	" 1540 x P 4307	1300	2100	1300	1650
55	" 1605 x CP 66	1600	2200	1650	1175
56	" 1487 x P 4307	1050	1600	1200	1450
57	" 293 x NEC 139	1700	2000	1450	1275
58	" 1646 x L 2	975	2050	1300	1475
59	" 1487 x P 4307	1300	1950	1350	1000
60	" 293 x NEC 139	1050	1850	1575	1000
61	" 2614 x " 317	1350	2400	1450	1650
62	(NEC 143xL 550) x (V4xP472)	1200	1950	1200	900
64	NEC 14 x NEC 132	2025	2200	1500	950
14W	ILC 1929 x ILC 200	1350	1500	1450	950
23W	630 x 200	1650	1600	1350	600
27W	262 x 183	1500	1800	1375	850
63W	51 x 200	1400	2200	1650	950
67	1920 x 195	950	1100	700	1000
75	202 x 893	1375	1600	975	1250
93	625 x 74TA1629	2450	2250	1625	400
95	625 x 74TA1629	1950	2350	1375	1700
96	625 x 74TA1629	1900	1850	1350	ND
97	896 x 74TA2162	1825	2050	1800	1225
119	7347-6-4-B-BHxICCC3	1150	1850	1150	1000
130	x 75TA53 x 74TA3278	1900	2200	1200	650
131	x 75TA53 x 74TA3278	1650	2000	1450	850
146	x 75TA16991 x 74TA3278	1300	1900	1100	1000
149	x 75TA169 x 74TA2972	1600	1900	1250	1050
156	x 75TA33 x (74TA3278) (75TA16988)	1300	2050	1750	575
158	"	1875	1950	1600	1175
166	"	875	2250	1025	1450

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TABLE B17 (continued)

Entry		Pedigree	B Kg/Ha		K Kg/Ha	
			Set 1	Set 2	Set 1	Set 2
FLIP-81	176	ILC 896 x 74 TA 2162	1650	1800	1400	1150
	177	"	1125	1700	1400	1525
	178	ILC 23 x 74 TA 1629	1500	2000	1200	1050
	179	NEC 2380 x (NEC 1540xP 4307)	1450	2250	1150	1400
	180	GL 629 x B - 110	1800	2200	1650	1600
	181	NEC 2332 x (NEC 1646 x L 2)	1625	2200	1550	1200
	183	ILC 896 x 74 TA 2162	1600	1600	1250	1650
	187	ILC 196 x ILC 19	1950	1750	1250	1050
	198	NEC 2380 x (NEC 1540 x P 4307)	1850	1650	1450	1750
	204	P 9800 x JM 842	755	900	550	1500
	208	7347-6-4-B-BH x ICCC 3	2075	2250	1600	675
	218	x 75 TA 44 x 74 TA 22	2000	2200	1450	1100
	225	x 75 TA 55 x NEC 108	1450	2250	1800	1600
	229	x 74 TA 3272 x 74 TA 2972	1850	1850	1650	1650
	230	x 74 TA 3272 x 74 TA 2972	1275	1750	1200	900
	251	x 75 TA 16029 x Giza 1	2100	1950	1500	875
	252	"	1850	2050	1525	900
	253	"	2275	2300	1325	700
	254	"	2075	2450	1400	850
	269	ILC 72 x ILC 1922		2000	1550	1050
	293	ILC 191 x ILC 496	1525	2050	700	1000
	343	ILC 72 x ILC 897	1950	1400	1250	875
	391	NEC 1540 x H 223	1925	2250	1250	650
	392	NEC 14 x NEC 139	2125	1900	1300	850
	395	IC 751819-1P-5P	1125	1600	1150	550
CHECK GENOTYPES						
ILC	480		650	750	1100	1200
			1200	1800	1175	1475
			1775	1700	1150	800
			1450	2350	1000	1250
Mean			1269	1650	1106	1181
C.V. %			37.4	40.3	7.0	23.8
ILC	1929		825	700	1625	800
			2100	2250	1700	1525
			1800	2150	1150	900
Mean			1575	1700	1492	1072
C.V. %			42.3	51.1	20.0	36.6

TABLE 17 (continued)

Entry	Pedigree	B Kg/Ha Set 1	B Kg/Ha Set 2	K Kg/Ha Set 1	K Kg/Ha Set 2
CHECK GENOTYPE					
Tunisian Local		700	800	1700	1400
		1800	1850	1475	750
		1650	1550	3100	850
		1675	2050	1300	800
Mean		1456	1563	1894	950
C.V. %		34.9	35.1	43.3	31.9

TABLE B18 SEED YIELD OF ENTRIES IN AN ICRISAT INTERNATIONAL ROOT ROTS/WILT NURSERY AT BEJA IN 1982/83.

Entry	Kg/Ha	Entry	Kg/Ha
ICC-537	560	ICC-6440	880
858	1200	6488	1440
1338	1440	6501	960
1376	880	6668	1160
2664	1120	6687	440
2883	1280	6772	580
3354	160	6815	1040
3415	640	6817	1520
3428	1160	7489	1400
3528	1160	8166	1160
3782	880	8170	1280
4485	1040	8933	1560
4843	840	8999	1200
5727	1680	9039	1160
6384	1480	9041	1240
9103	680	ICCL-80001	1080
9112	960	80002	760
9127	720	80004	1120
10382	1360	80031	640
10384	1560	80035	1040
10399	720	81001	800
10466	840	81002	640
10539	920	81004	1320
10630	1080	81005	1000
10809	1360	81006	1000
11088	1800	81007	920
11224	80	81008	1840
12266	960	81009	680
ICCL-81010	1220	81249	1200
81011	1080	81250	1320
81012	1200	81251	1200
81013	760	81253	1280
81014	1800	81254	1280
81015	1640	81255	520
81016	960	81256	1280
81017	600	81257	1040
81201	880	81258	1080
Mean of check ICC 4951, repeated 38 times			935
C.V. %			21.1

5. LENTIL IMPROVEMENT PROGRAM.

Last season there was a severe attack of Sclerotinia spp. on trials at Béja and a light attack of rust (Uromyces spp.) on trials at El-Kef. This season no pathogens were observed on the trials and again it appeared that the area sown to lentils by the farmers was very small.

The full seed yield results from all trials and nurseries are given in appendix C with a summary of the results contained in the following crop report. The local checks used in the experiments were local cultivars from different regions, and are referred to as either the local check(s) or simply the check .

5.1 Results and Discussions.

5.1.1 International Yield Trials (IYT), ex-ICARDA.

In a large seed IYT grown at Béja, El-Kef and Mateur, the entries differed significantly for seed yield only at Béja ($P < 0.001$) and at Mateur ($P < 0.05$), where the number of entries significantly exceeding the local check was 20 (all entries) and 14 respectively (app. C, table C1). Across all three locations the five

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heaviest yielding entries gave a mean increase of 98% over the check (table 5.1), and interestingly two of these entries, namely, ILL 8 and ILL 193 (78S 26066), each showed a similar yield advantage last season at Béja.

More disappointing were the results from an international F_3 trial at Béja (app. C, table C2), in which the populations, selected for early flowering, did not differ significantly for seed yield. It was encouraging, however, to note that the majority of populations exceeded the local check and many did so by a considerable margin.

5.1.2 Advanced (AYT) and Preliminary (PYT) Yield Trials.

In an AYT grown at Béja, El-Kef and Mateur the entries differed significantly for seed yield at all three locations (app. C, table C3). However, only Jordanian Local at Béja and Syrian Local Large at El-Kef significantly outyielded the mean of the four local checks, but not the heaviest yielding check, namely, PL 83 Oueslatia.

A PYT was grown at Béja and El-Kef and at both locations the entry differences for seed yield were significant ($P < 0.01$), with seven and five entries significantly exceeding the mean of the four local .../

TABLE 5.1 SEED YIELD (Kg/ha) OF SUPERIOR ENTRIES IN AN IYT-L AT BEJA (B), EL-KEF (K) AND MATEUR (Ma) IN 1982/83.

Entry		Location				
Designation	Pedigree	B	K	Ma	Mean	%Lc
ILL 8	78S 26002	1449	1363	2917	1910	197
20		1625	1388	2883	1965	202
193	78S 26066	1449	1280	3000	1910	197
4523		1400	1483	2917	1933	199
4606	Nablus	1500	1671	2525	1899	196
Tunisian Local Check		754	1133	1025	971	100
S.E.		65.5	138.1	357.8		
d.f.		39	40	37		

checks respectively (app. C, table C4). Four of these entries were common to both locations and their performance is shown in table 5.2. However, only one entry, namely, ILL 346 at Béja, significantly outyielded the heaviest yielding check, which was again PL 83 Oueslatia.

5.1.3 International (ISN- ex ICARDA) and National (NSN) Screening Nurseries (non-replicated).

The problem of assessing seed yield in these ISNs has been mentioned in the two previous crop reports, although in the three ISNs reported here the CVs for the repeated checks were generally reasonable. Nevertheless there were encouraging seed yield results from a large seeded ISN (ISN-L) grown at Béja and El-Kef (app. C, table C5), an ISN containing early flowering types (ISN-E) grown at Béja, El-Kef and Mateur (app. C, table C6), and an ISN comprised of tall types (ISN-Ta) grown at Béja and Mateur (app. C, table C7). In table 5.3 is given for each ISN the total number of entries that exceeded the mean of the repeated checks at the individual locations (E) and the number that did so at all test locations (EL). In five out of seven cases more than 50% of the entries exceeded the mean of the repeated local check at a location (E), but more encouraging was the number that did so at all test locations for an individual ISN (EL).

TABLE 5.2 SEED YIELD (kg/ha) OF SUPERIOR ENTRIES IN A PYT AT BEJA(B) AND EL-KEF (K) IN 1982/83.

Entry	Location B	Location K	Mean	%Lc
ILL 241	2311	1249	1780	138
346	2400	1371	1886	146
857	2166	1443	1805	140
7	2211	1455	1833	142
Tunisian Local checks:				
PL 83 M1	1467	1149		
83 M2	1581	1066		
83 Oues-latia	1933	1366	1288	100
82 Béja	967	771		
S.E.	140.5	103.4		
d.f.	29	28		

Table 5.3 Number of entries outyielding the mean of the repeated local check in 3 ISN's.

Experiment	Total N° entries	Locations			All Locations (EL)
		Béja (E)	El-Kef (E)	Mateur (E)	
ISN-L	40	30	40	-	30
ISN-E	62	12	36	25	10
ISN-Ta	60	34	-	42	26

The seed yield results from an NSN, which contained entries from the Pullman Institute (Washington, U.S.A.) and was grown at Béja and El-Kef, are given in appendix C, table C8. The CVs for the repeated local check were again reasonable, and at Béja and El-Kef three and six entries respectively exceeded the mean of the local check, and of these, the two entries 254554 and 299124 did so at both locations.

5.2 General Discussion.

Last season a number of entries in the international yield trials from ICARDA grown at Béja significantly outyielded, and by a considerable margin, the check which was a local cultivar from the Béja region. Encouragingly this season these entries maintained a similar yield advantage over this check in the IYT and

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AYT, and the results from the two years of testing are given in table 5.4. However, the inclusion of other local cultivars in the AYT and PYT (app. C, tables C3 and C4 respectively) showed that the Béja check was consistently the lightest yielding of such cultivars. Hence it's use in other trials as the sole check has perhaps overestimated the potential yield improvements that can be obtained over the local cultivar(s). Clearly further sampling of the local populations should be undertaken.

In hindsight it was unfortunate that only the Béja check was used in the F_3 population trial (app. C, table C2). Nevertheless the seed yield of some of the populations suggests that they could equal the heavier yielding checks in the AYT and PYT and that reselection may produce further yield improvements. The Béja check was also used in the ISNs, and the use of other cultivars as the check could well have reduced the number of entries exceeding the check shown in table 5.3.

TABLE 5.4 SEED YIELD (kg/ha) OF FIVE ENTRIES OVER TWO YEARS AT BEJA (B) AND EL-KEF (K).

Entry		1981 - 82		1982 - 83	
		B	K	B	K
ILL 4354	Jordanian Local	1634	1716	1904	1253
ILL 4400	Syrian Local Large	1774	1334	1796	1350
Tunisian Local Check 1		1061	595	1225	633
" " " 2		1056	655		
S.E.		227.1	139.5	141.5	74.3
d.f.		44	45	27	27
ILL 15		1452		1467	1463
28		1685		1583	1363
262		1683		1562	1304
Tunisian Local Check 1		702		754	1133
" " " 2		628			
S.E.		219.3		65.5	138.1
d.f.		30		39	40

APPENDIX C. RESULTS OF THE LENTIL BREEDING TRIALS AND NURSERIES IN 1982/83.

Abbreviations used in tables.

1. Locations : B - Béja
   K - El-Kef
   Ma- Mateur
   Mo- Moghrane

2. Data : Kg/ha - seed yield of entries in these units.
   %Lc - seed yield of entries expressed as a percentage of the Tunisian Local Check.
   Data values - those underlined were significantly ($P \leq 0.05$) superior to the Tunisian Local Check.
   ND - data not available.

3. Statistics : C.V. % - coefficient of variation expressed as a percentage.
   S.E. - standard error of entry mean.
   d.f. - degrees of freedom associated with the standard error.

TABLE C1 SEED YIELD OF ENTRIES IN AN IYT-L AT THREE LOCATIONS IN 1982/83.

Entry		Pedigree	B		K		Ma	
			Kg/Ha	% L c	Kg/Ha	% L c	Kg/Ha	% L c
ILL	8	78S 26002	1449	192	1363	120	2917	285
	15	74TA 9	1467	195	1463	129	2088	204
	20	-	1625	216	1388	123	2883	281
	28	74TA 19	1583	210	1363	120	2325	227
	30	74TA 20	1445	192	1275	113	1850	180
	193	78S 26064	1504	199	1278	113	2117	207
	193	78S 26066	1449	192	1280	113	3000	293
	254	74TA 264	1412	187	1246	110	1767	172
	262	74TA 276	1562	207	1304	115	2312	226
	323	76TA 66136	1129	150	1225	108	1433	140
	707	-	1433	190	1600	141	1808	176
	841	78S 26181	1341	178	1104	97	2163	211
	842	-	1600	212	1483	131	2583	252
	851	-	1516	201	1754	155	2225	217
	857	-	1479	196	1375	121	1925	188
	947	-	1100	146	1317	116	1892	185
	4400	Syrian local	1400	186	1446	128	2167	211
	4523	-	1400	186	1483	131	2917	285
	4605	Precoz	1320	175	1463	129	2100	205
	4606	Nablus	1500	199	1671	147	2525	246
	-	Tunisian local Check	754	100	1133	100	1025	100
Mean			1407		1382		2192	
C.V. %			8.1		17.3		28.1	
S.E.			65.5		138.1		357.7	
d.f.			39		40		37	

TABLE C2 SEED YIELD OF ENTRIES IN A F_3 POPULATION (EARLY FLOWERING) TRIAL AT BEJA IN 1982/83.

Entry	Pedigree	Kg/Ha	% Lc
81 S 5	ILL 2501 x 74TA441	1363	182
11	2526 x 74TA138	963	128
12	2526 x 74TA260	1250	167
18	2526 x ILL4400	925	123
19	4353 x 74TA66054	1400	187
20	4353 x 74TA 138	713	95
21	4353 x 74TA260	763	102
22	4353 x 74TA276	1150	153
23	4353 x 74TA441	1050	140
24	4353 x Giza 9	800	107
26	4353 x ILL4354	763	102
27	4353 x ILL4400	1100	147
29	4380 x 74TA138	988	132
56	4404 x 74TA138	675	90
63	4404 x ILL4400	1200	160
65	4405 x 74TA138	1125	150
67	4405 x 74TA276	1300	173
68	4405 x 74TA441	1192	159
69	4405 x Giza 9	1343	179
71	4405 x ILL4354	1140	152
72	4405 x ILL4400	713	95
74	4406 x 74TA138	1350	180
75	4406 x 74TA260	1150	153
76	4406 x 74TA276	1300	173
77	4406 x 74TA441	1388	185
83	4407 x 76TA66054	1150	153
86	4407 x 74TA441	838	112
89	4407 x ILL4354	1038	138
118	2672 x ILL 4400	1075	143
	Tunisian Local Check	750	100
Mean		1065	
C.V. %		27.8	
S.E.		209.3	
d.f.		26	

TABLE C3 SEED YIELD OF ENTRIES IN AN AYT AT FOUR LOCATIONS IN 1982/83.

Entry	B		K		Mo	
	Kg/Ha	%Lc	Kg/Ha	%Lc	Kg/Ha	%Lc
x 74TA138	1609	105	1116	100	667	122
x 74TA264	1542	101	1270	114	575	106
Jordanian local	1904	124	1253	112	621	114
Lebanese local	1696	111	937	84	450	83
Chilean 78	586	38	762	68	392	72
Syrian local large	1796	117	1350	121	475	87
P.L. 83 M1 Check 1	1571		1133		492	
P.L. 83 M2 Check 2	1479	100	1358	100	563	100
P.L. 83 Oueslattia Check3	1850		1337		783	
P.L. 82 Beja Check 4	1225		633		342	
Mean	1555		1115		536	
C.V. %	18.2		13.3		27.1	
S.E.	141.5		74.3		72.5	
d.f.	27		27		25	

TABLE C4 SEED YIELD OF ENTRIES IN AN PYT AT TWO LOCATIONS IN 1982/83.

Entry	Pedigree	B		K	
		Kg/Ha	% Lc	Kg/Ha	% Lc
ILL 837	78S26177	1706	115	1282	118
-	79Ter3495	1672	112	1310	120
ILL 241	-	2311	155	1249	115
ILL 346	-	2400	161	1371	126
x 74TA50	78S13572-2	1805	121	1304	120
ILL 642	78S26127	1322	89	1095	101
x75TA49	79Sh4890	2128	143	1304	120
ILL 857	-	2166	146	1443	133
ILL 842	-	1900	128	1377	127
ILL 7	-	2211	149	1455	134
ILL 780	-	1695	114	1554	149
ILL 6	76TA66012	1883	127	1188	109
Tunisian Local Check	P.L. 83 M1	1467	100	1149	100
	P.L. 83 M2	1581		1066	
	P.L. 83 Oueslatia	1933		1366	
	P.L. 82 Béja	967		771	
Mean		1822		1268	
C.V. %		13.4		14.2	
S.E.		140.5		103.4	
d.f.		29		28	

Table C5 SEED YIELD OF ENTRIES IN AN ISN-L AT THREE LOCATIONS IN 1982/83.

Entry	Pedigree	B Kg/Ha	K Kg/Ha	Ma Kg/Ha
- ILL	39	1475	1750	1600
-	45	1300	2050	1450
74TA265	254	1450	1500	1150
78S26127	642	1050	1350	ND
-	780	ND	1875	ND
-	920	1800	1550	ND
-	2149	1600	1500	1300
Laird	4349	1050	1100	450
Cyprus Local	4368	1250	1550	ND
79Ter 794	4400	1500	1850	ND
80S50507	4400	2300	1500	ND
80Ter52385	4400	2100	1650	ND
80Ter52390	4400	1700	1900	ND
80Ter52424	4400	2325	1300	2200
80Ter52428	4400	1700	1700	ND
-	4507	1350	1450	ND
-	4515	1575	1400	ND
-	4524	1725	1675	ND
Precoz	4605	1350	1200	ND
Chilean 78	4711	1325	1250	450
80Ter 32004	-	1500	1500	ND
79Ter 1774	x75TA44	1875	1500	1550
79Sh 4806	49	1300	1850	1150
79Sh 4809	49	1675	1500	ND
79S 53247	49	1675	1550	ND
79S 59741	49	1500	1650	ND
78S 13621-1	x75TA53	1400	1825	ND
79Ter 3032	x75TA74	2550	1575	1100
80 S 42059	x76TA11	725	1500	ND
80S 42221	26	1600	1800	1850
80S 42434	66	925	1550	ND
80S 42541	70	1675	1750	ND
80S 41671	71	1800	1900	1500
80S 32768	77	175	1850	1900
80S 41560	250	1875	1750	ND
80S 41620	259	1675	1700	1800
80S 41667	271	1950	1625	ND
80S 41139	x77TA66	1600	1825	1450
80S 34047	x77TA78	2000	1550	ND
80S 34056	x77TA103	1475	1450	ND
CHECK GENOTYPES				
ILL	101	1400	1250	ND
		1350	1550	ND
		1600	1500	1400
		1475	1275	1100
Mean		1456	1394	ND
C.V. %		7.5	11.0	

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(Table C5 continued).

CHECK GENOTYPES	B Kg/Ha	K Kg/Ha	Ma Kg/Ha
ILL 4400	1725	1650	ND
	1800	1625	ND
	1900	1500	1200
	1675	1750	ND
Mean	1775	1631	ND
C.V. %	5.5	6.3	ND
Tunisian Local Check	1365	975	ND
	1350	700	ND
	1300	1100	800
	1450	775	ND
	1200		950
Mean	1333	888	ND
C.V. %	6.9	20.6	ND

TABLE C6 SEED YIELD OF ENTRIES IN AN ISN-E AT THREE LOCATIONS IN 1982/83.

Entry	Pedigree	B Kg/Ha	K Kg/Ha	Ma Kg/Ha
76TA66005	ILL 1	1875	1925	2500
78S 26066	193	550	1950	2100
-	203	1650	1850	1350
PI 250155	228	1025	750	700
Giza 9	784	1275	1500	1750
F 130	813	1425	1325	1500
EL 19	1690	1450	1500	1200
EL 31	1701	1200	1350	1300
EL 43	1713	600	1150	1500
EL 70	1735	850	975	1050
EL 76	1741	1500	1150	1800
Silaim	1861	1750	2450	1550
-	1866	1600	1800	1450
L 528 (75)	1983	750	700	1250
80S 44174	X76TA 143	2500	2625	2200
L 1057	ILL 2022	1175	975	1400
L 1327	2069	750	950	700
-	2149	1650	1900	1900
EL 39	2431	1300	1150	1150
EL 53	2434	1300	975	900
EL 65	ILL 2455	1150	1175	1300
EL 74	2437	1700	1225	1250
EL 83	2439	1475	1525	1600
Pant. L. 538	2500	450	400	450
Pant. L. 406	2501	450	900	400
T-31	2525	950	1200	400
T-36	2526	800	950	450
Pant. L. 639	2573	850	600	750
L-830	2578	850	900	350
L-1278	2580	900	650	150
L-1282	2581	900	925	650
LL-1	2582	1725	700	500
LWS-3	2590	1850	1875	1950
P 257	2768	775	825	650
P 943	3278	945	1200	350
EL 61	3402	1250	1200	1200
EP 3	3416	1350	1550	2000
B-77	3493	800	1000	750
LG 41	3516	800	1025	300
LG 46	3517	800	850	200
LL 37	3601	750	800	350
LL 38	3602	700	725	450
LL 57	ILL 3614	1575	1650	ND
Pant. L-286	4377	825	750	350
S.L.L.	4400	2200	1975	1850
12	4402	500	850	500
162	4403	875	975	259
18-10	4406	425	925	300
Precoz	4605	1750	1800	1050
EL 142	5071	1050	1250	1200
R 186	5425	1050	1350	1100
79 Sh 4867	X75 TA 30	1275	1750	1100
79 Sh 4806	X75 TA 49	1400	1925	ND
80 S 38650	X75 TA 46	1375	1750	1800
41515	X76 TA 249	850	775	1500
41648	271	1350	2150	2600
41649	271	2200	1850	2300

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(Table C6 continued). 2.-

Entry	Pedigree	B Kg/Ha	K Kg/Ha	Ma Kg/Ha
41664	271	1250	1925	ND
41672	271	1950	2300	3150
42431	66	1150	1750	1200
42612	71	1900	1625	2050
CHECK GENOTYPE				
ILL	1744	1350	1450	1250
		550	1075	1100
		1350	1700	1550
		1500	1450	1300
		1450	1550	1050
		1150	1450	1000
Mean		1233	1446	1208
C.V. %		29.2	14.3	16.9
ILL	4354	2225	1900	2350
		2200	2100	1600
		1850	2350	1850
		2150	2800	1650
		1950	1900	2050
		2475	2075	2050
Mean		2158	2188	1925
C.V. %		10.4	15.7	14.7
Tunisian Local	Check	775	850	1300
		2000	1000	900
		1600	1000	1450
		1750	1350	1050
		1725	900	1200
		1225	1325	1250
		1950	1150	1750
Mean		1575	1082	1271
C.V.%		27.7	18.3	21.7

TABLE C7 SEED YIELD OF ENTRIES IN AN ISN-Ta AT TWO LOCATIONS IN 1982/83.

Entry	Pedigree	B Kg/Ha	Ma Kg/Ha
78S 26002	ILL 6	2150	1600
78S 26003	" 8	1700	1800
78S 26004	" 9	2175	1750
74TA 138	" 101	1500	1250
Giza 9	" 784	1350	750
78S 26194	" 922	1300	450
Laird	" 4349	1275	1250
Chilean 78	" 4711	1275	700
-	" 1918	1400	1350
78S 26152	" 793	1300	1150
-	" 468	1700	1100
-	" 986	1200	600
-	" 20	2300	850
-	" 23	1850	1400
-	" 813	875	600
78S 26052	" 112	1600	1150
78S 26024	" 23	1900	1150
S.L.L.	" 4400	1550	1300
-	" 1939	1825	1350
80S 37764	X75TA 25	1550	1150
37768	X75TA 25	1050	750
37614	X75TA 45	1400	550
38651	X75TA 46	1950	950
39928	X75TA 85	1875	750
41793	X76TA 3	1800	1100
41815	X76TA 3	1250	ND
42188	X76TA 25	1150	700
42671	X75TA 72	1100	1000
42830	X76TA 75	1750	1550
32376	X76TA 9	1350	ND
28124	X76TA 156	1425	950
41139	X76TA 66	1825	1100
34047	X77TA 78	1750	1000
34056	X77TA 103	1050	1150
38004	X75TA 29	1800	1250
41120	X76TA 32	1625	1400
34057	X77TA 103	1550	1000
35146	X77TA 80	750	1150
27597	X75TA 78	1175	95
27603	X75TA 88	800	600
78S 13159-1	X75TA 14	700	650
80S 41727	X76TA 1	1500	550
39750	X76TA 81	925	1350
41784	X76TA 3	1250	1000
42431	X76TA 66	1350	400
44174	X76TA 143	2150	1500
44540	X76TA 186	1000	900
32725	X76TA 76	1250	650
33357	X75TA 179	1500	400
34103	X77TA 33	1375	900
34927	X77TA 67	1050	950
35172	X77TA 80	900	650
35183	X77TA 80	1375	800

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(Table C7 continued).

Entry	Pedigree	B Kg/Ha	K Kg/Ha	Ma Kg/Ha
80S 35184	X77TA 80	1100		1200
32623	X76TA 66	1275		550
34273	X77TA 36	1050		1900
34826	X77TA 58	1200		1250
35187	X77TA 80	1450		600
35188	X77TA 80	1650		650
35190	X77TA 80	600		850
CHECK GENOTYPES				
ILL 500		1650		1000
		1800		1000
		1650		1250
		1350		800
		1325		600
		1700		1650
Mean		1580		1050
C.V. %		12.4		34.9
ILL 4401		1300		1350
		1125		750
		1125		850
		1175		1050
		825		750
		1100		850
Mean		1108		933
C.V. %		14.10		24.83
Tunisian Local Check		1325		700
		1400		650
		1475		600
		1250		750
		1300		500
		1200		600
		1475		900
Mean		1346		671
C.V. %		8.0		19.2

TABLE C8 SEED YIELD OF ENTRIES IN A NATIONAL SCREENING NURSERY GROWN AT TWO LOCATIONS IN 1982/83.

Entry	Béja Kg/Ha	El-Kef Kg/Ha
172938	1450	1400
178947	1600	2000
185035	1200	1750
193548	1100	1450
207492	1200	1200
209447	2700	1600
209858	2800	1950
211602	1200	1850
212609	350	1300
217949	650	1300
229611	2400	2800
250156	1650	1250
251029	2300	2450
251030	3000	2350
251248	3300	2450
251784	1200	1650
251785	1400	1550
251786	1300	1600
254554	3100	2800
283604	2150	2050
297285	2100	1600
297740	2500	2050
297741	2200	2700
297742	2150	2250
297744	2600	2200
297749	2900	2000
297760	1300	2250
297763	1700	1800
297770	2100	1800
297797	2200	1800
297743	1620	2900
297798	1300	1400
298019	1300	2850
298121	ND	200
298122	1550	2400
298357	1100	1650
298644	1400	2350
298922	2500	2250
299116	2600	2300
299117	2900	2300
299144	1600	2100
299150	1400	1150
299252	1350	2150
299343	1100	1850
299369	2500	2100
299124	3500	2600
PL 82-1	2000	1750
PL 82-2	1700	2200
PL 82-3	2100	2500
PL 82-4	2250	2450
Mean of Tunisian Local Check (repeated 10 times)	3035	2590
C.V. %	8.8	11.8

6. PERFORMANCE ACROSS LOCATIONS.

In the data presented for the three crops a number of entries did not show a consistant yield performance across locations in relation to the local check. To investigate this further a combined analysis of variance across locations was undertaken on the seed yield of all entries in a number of trials of each crop. The results of these analyses are set out in a simplified form in table 6.1, in which the individual trials analysed are classified by the level of probability (P) attained by the interaction mean square (entry x location).

The results must be treated with some caution as in some cases the error variances did differ significantly between locations. However, on the assumption that an interaction has some practical significance at $P < 0.01$, the analyses suggest that of the three crops the genotypes of faba beans and lentils are more likely to exhibit a varied seed yield performance across locations than those of chickpeas. Although more such analyses are required in the future the results reinforce the need to ensure adequate multilocation testing of breeding material.

TABLE 6.1 CLASSIFICATION OF TRIALS ACCORDING TO THE PROBABILITY LEVEL OF THE INTERACTION MEAN SQUARE IN AN ANALYSIS OF VARIANCE FOR SEED YIELD ACROSS LOCATIONS.

Probability Level	Faba beans (1)	Chickpeas (2)	Lentils (1)
> 0.10	IYT-L IYT-F_3(E) PYT-L-1	IYT-W AYT-W IYT-F_3-W IYT-S	
≤ 0.10- > 0.05	IYT-F_3 AYT-L		IYT-L
≤ 0.05- > 0.01			
≤ 0.01- > 0.001	PYT-L-2		PYT
≤ 0.001	IYT-S PYT-S-1		AYT

(1) L/S : Large/small seeded trials, E : early flowering.

(2) W/S : Winter/spring sowing.
For IYT-S Béja location excluded from analysis.

7. AGRONOMY TRIALS.

Agronomy trials were conducted to study the response of small and large seeded faba beans, lentils and chickpeas to the following factors:

a) Date of sowing and
b) Nitrogen, phosphorus and potassium fertilizer application
c) Use of different weed control treatments
d) Fungicidal seed treatment for chickpeas

A brief summary of the results is presented below.

7.1. Date of Planting and Plant Population Trials.

The treatments were highly significant for all crops (Table 7.2 & 7.3).

1. Faba beans

The best dates of sowing appear to be between beginning of November (D_1) and mid-December (D_3). Yield are highly decreased when planting occured after mid-December (upto 50%). The highest plant population level (P_1) have doubled the yield (Table 7.1).

2. Lentils

Similar remarks can be made for lentils. Reducing the plant population levels have decreased the yield much more at Beja than at El-Kef and confirm last year results.

Table 7.1. Plant population levels (number of plants/m^2) used in the DPPT.

Plant population levels	Faba bean large	Faba bean small	Lentils	Chickpeas
P_1	12.5	50.0	165.0	31.2
P_2	8.3	25.0	82.5	20.8
P_3	6.2	16.6	54.9	15.62
P_4	5.0	12.5	41.2	12.5

Table 7.2. Mean yields (kg/ha) of the Date of planting in the DPPT.

Dates	Faba bean large		Faba bean small		Lentils		Chickpeas	
	Beja	El-Kef	Beja	El-Kef	Beja	El-Kef	Beja	El-Kef
D_1	1319	2278	1072	2562	1599	1476	1434	761
D_2	1243	1794	1096	2416	1478	1338	1087	836
D_3	1275	1679	1030	2060	1517	1380	818	783
D_4	881	1309	821	1434	994	1139	-	486
D_5	182	1065	469	1272	904	1049		
CV	16.0	21.9	16.2	25.8	18.8	20.8	22.0	20.3
SE	44.9	103.0	41.9	145.4	69.9	76.8	70.5	23.8

Table 7.3. Mean yield (kg/ha) of the plant population trials in the DPPT.

Plant Population levels	*Faba bean* large		Faba bean small		Lentils		Chickpeas	
	Beja	El-Kef	Beja	El-Kef	Beja	El-Kef	Beja	El-Kef
P_1	1360	2718	1331	2942	2138	1507	1366	785
P_2	1051	1700	879	2129	1305	1217	1038	687
P_3	757	1381	716	1553	973	1343	902	677
P_4	702	1200	664	1174	847	1079		
CV (%)	16.7	17.9	23.7	18.7	17.4	17.6	23.7	18.3
SE	41.9	75.3	76.2	18.5	57.9	58.1	76.2	18.5

Table 7.4.Weed Control Trial on Faba bean small yield (kg/ha)

Treatments	Beja		El-Kef		Mean yield of the 2 stations	
	Yield	% of T_2	Yield	% of T_2	Yield	% of T_2
T_2 Weedy (check)	13.92	74.95	5.09	35.00	9.50	57.40
T_2 Weed Free	18.57	100	14.54	100	16.55	100
T_3 Hand weeding twice	16.97	91.38	14.09	96.90	15.33	93.83
T_4 Maloran	13.68	73.66	10.79	74.25	12.23	73.89
T_5 Tribunil	15.10	81.31	10.49	72.14	12.79	77.28
T_6 Igran	16.01	86.21	10.86	74.69	13.43	81.14
T_7 Bladex	14.84	79.91	9.24	63.54	12.04	72.74
T_8 Bladex	13.52	72.80	10.04	69.05	11.78	71.17
T_9 Maloran + Kerb	15.45	83.19	10.51	72.28	12.98	78.42
T_{10} Tribunil + Kerb	13.46	72.46	10.71	73.65	12.08	72.99
T_{11} Igran + Kerb	13.50	72.69	11.06	76.06	12.28	74.79
T_{12} Bladex + Kerb	13.59	73.18	10.81	74.34	12.20	73.71
CV (%)	17.0		16.2			
SE	145.7		87.2			

3. Chickpeas

The earliest dates of planting (D_1, D_2) seem to be the best for Beja while at the El-Kef no difference in yield was observed between D_1 and D_3. Plant population treatments had no significant effect on yield at El-Kef. Highest density at Beja seem, however, to result in an average increase of around 450 kg/ha in the yield.

7.2. Weed Control Trials.

In general the average yield loss due to weeds is estimated at 50% for all species.

1. Faba beans

Yield decrease due to weeds was 43%. Hand weeding twice at 45 days intervals improved substantially the yield (Table 7.4). Igran and Maloran + Kerb were the most efficient in controlling weeds.

2. Lentils

Yield loss to weeds was about 42% on an average (Table 7.5). Treatments including Kerb gave satisfactory results but Tribunil seems to be phytotoxic

3. Chickpeas

Yield decrease due to weeds was around 47%. Treatments had a highly significant effect at El-Kef but their effect was nonsignificant at Beja (Table 7.6). Bladex and Igran are phytotoxic and Tribunil appears to be efficient against the existing weed species.

Table 7.5.Weed Control Trial on lentils yield (qx/ha)

Treatments	Beja		El-Kef		Mean yield of the 2 locations	
	Yield	% of T_2	Yield	% of T_2	Yield	% of T_2
T_1 Weedy (check)	7.83	74.14	4.57	41.51	6.2	58.21
T_2 Weed free	10.56	100	10.75	100	10.65	100
T_3 Hand weeding twice	10.00	94.69	10.25	95.34	10.12	94.13
T_4 Maloran	8.90	84.28	6.74	62.69	7.82	73.42
T_5 Tribunil	8.00	57.75	5.07	47.16	6.53	61.31
T_6 Gesagard	8.17	77.36	6.63	61.67	7.4	69.48
T_7 Bladex	7.17	67.89	7.75	72.09	7.46	70.04
T_8 Bladex	3.30	31.25	7.45	69.30	5.37	69.20
T_9 Maloran + Kerb	9.03	85.51	8.13	75.62	8.58	80.56
T_{10} Gesagard +Kerb	8.87	83.99	6.53	60.74	7.7	72.30
T_{11} Maloran + Kerb	9.93	94.03	7.34	68.27	8.63	81.03
T_{12} Bladex + Kerb	8.93	84.56	8.04	74.79	8.48	79.62
CV (%)	14.0		22.0			
SE	61.2		81.8			

Table 7.6.Weed Control Trial on chickpeas yield (qx/ha)

Treatments	Beja		El-Kef		Mean yield of the 2 stations	
	Yield	% of T_2	Yield	% of T_2	Yield	% of T_2
T_1 Weedy (check)	8.89	69.88	3.69	33.66	6.29	53.12
T_2 Weed free	12.72	100	10.96	100	11.84	100
T_3 Hand weeding twice	11.65	91.58	9.35	85.31	10.5	88.68
T_4 Maloran	8.73	68.63	6.72	61.31	7.72	65.20
T_5 Tribunil	10.59	83.25	7.32	66.78	8.95	75.59
T_6 Igran	8.36	65.72	5.72	52.18	7.04	59.45
T_7 Bladex	9.76	76.72	4.72	43.06	7.24	61.14
T_8 Bladex	9.82	77.20	5.22	47.62	7.52	63.51
T_9 Maloran + Kerb	10.19	80.11	5.92	54.01	7.70	67.98
T_{10} Tribunil+ Kerb	9.76	76.72	7.16	65.32	8.41	71.45
T_{11} Igran + Kerb	9.66	75.94	7.45	67.97	8.55	71.21
T_{12} Bladex + Kerb	9.52	74.84	5.96	54.37	7.74	65.37
CV (%)	22.0		22.5			
SE	109.6		75.3			

Table 7.7.Fertilization and inoculation trial No.1 on chickpea , mean yield (qx/ha)

Treatments	Beja	El-Kef
O check	12.96	7.80
N	11.69	7.46
K.	13.20	10.28
I	13.29	9.85
I + K	12.18	9.71
I + N	13.03	9.24
I + N + K	12.99	10.17
N + K	12.75	10.18
CV (%)	12.2	31.0
SE	38.5	72.1

7.3. Fertilization and Inoculation Trials.

Chickpea was the only crop concerned with this type of trial. It was condacted at Beja and El-Kef. No significant effect of the treatments used was observed, although the application of Potassium improved slightly the yield at both stations (Table 7.7). Local Rhizobia strains appear to be effective as introduced strains in fixing nitrogen in chickpeas.

7.4. Fungicide Seed Dressings.

A chickpea seed dressing trial was conducted in the field (Beja) and in the laboratory (Tunis). No significant effect on yield was observed for the different treatments used (Table 7.8). In the field

Table 7.7.Weed Control Trial on Peas at Beja, yield (qx/ha)

Treatments		Yield	% of T_2
T_1	Weedy (check)	23.02	90.41
T_2	Weed free	25.46	100
T_3	Hand weeding twice	24.96	98.03
T_4	Maloran	20.16	76.18
T_5	Tribunil	17.42	68.42
T_6	Igran	23.72	93.16
T_7	Bladex	18.42	72.34
T_8	Bladex	21.21	83.30
T_9	Maloran + Kerb	21.16	83.11
T_{10}	Tribunil + Kerb	23.09	90.69
T_{11}	Igran + Kerb	22.46	88.21
T_{12}	Bladex + Kerb	19.71	77.41
CV (%)		18.7	
SE		205.6	

Table 7.8. Fungicide seed dressing trial on chickpeas
% of germination and yield (qx/ha)

Products	Rate/ kg	% of germination	Yield (qx/ha)
Maneb	1g	78.51	12.82
"	3g	80.95	13.16
"	6g	78.56	11.90
Benlate	1g	77.38	14.49
"	3g	74.00	13.32
"	6g	73.80	11.90
Peltact	1g	74.99	14.82
"	3g	77.37	13.57
"	6g	74.99	12.66
Maneb + Peltact	1.5g+ 1.5g	79.76	14.10
Maneb + Benlate	1.5g+ 1.5g	74.99	11.82
Benlate + Peltact	1.5g+ 1.5g	73.80	13.49
Calixin M	1g	73.80	11.99
"	3g	76.19	14.57
"	6g	77.12	13.82
Temoin		77.38	12.16
SV (%)			18.0
SE			118.7

Calixin M (3g/kg) and Peltact (1g/kg) gave the highest yields. In controlled laboratory conditions the mixture Maneb + Peltact (1.5 + 1.5g/kg) slightly improved the germination percentage and speed (unpublished data).

Table 7.9. Winter/Spring sowing comparison trial-chickpeas. Mean yield (kg/ha) - % over spring sowing

Varieties	Beja		El-Kef		Mateur		Moghrane	
	Winter	Spring	Winter	Spring	Winter	Spring	Winter	Spring
ILC 482	1719	1334	1715	1027	1285	830	1150	314
Local	2229	1099	1933	1025	0	672	1074	360
ILC 484	1901	1184	2008	930	1262	845	1040	324
Average increase %	61		89		92		227	
CV (dates)	21.3		14.4		26.2		21.9	
SE	96.8		89.4		61.8		44.8	

7.5. Chickpea Spring/Winter Comparison Trial

A set of three chickpea varieties, ILC 482, ILC 484 and a local was used in a spring by winter comparison trial. Results are presented in Table 7.9. Yield increase due to winter sowing varied from 61% at Beja to 227% at Moghrane. The latter site is much drier than Beja and winter planting in this site has resulted in a very high yield increase. It is interesting to note the yield potential of the local variety when it is sown in winter and not hit by Ascochyta blight (Beja, El-Kef, Moghrane). No yield, however, was obtained when the local is attacked by Ascochyta blight at Mateur site. ILC 482 and ILC 484 were also hit but to a lesser extent and have produced similar yields to those obtained in Beja spring planting.