NORTH AFRICAN REGIONAL PROJECT ON FOOD LEGUME IMPROVEMENT

TUNESIA SCARDA COOPERATIVE PROGRAM

Progress Report 1983/94

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NORTH AFRICAN REGIONAL PROJECT ON FOOD LEGUME IMPROVEMENT

TUNISIA - ICARDA

COOPERATIVE PROGRAM

ON

FOOD LEGUME IMPROVEMENT

PROGRESS REPORT 1983-84

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PREFACE

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)

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With the technical help of:

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1. INTRODUCTION

This report gives the results from the third year of a cooperative project on food legume improvement between INRAT (Institut National de la Recherche Agronomique de Tunisie) and ICARDA.

Within this project a food legume breeder from ICARDA and Tunisian legume scientists work together to identify superior genotypes and production techniques for faba beans, chickpeas and lentils, that together can ensure the farmer a more stable and improved economic return from the cultivation of these legume crops.

Data from "La Direction de la Production Vegetale" 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. 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 thereafter were steady at around 1000 hectares and 1000 metric tonnes. Yield levels for all three crops, however, showed no discernible trend. Data from "La Direction de la Planification" of the Ministry of Agriculture for faba beans and chickpeas for 1981-82 is also included in table 1.1. These data indicate a considerable increase in area of these two crops whilst the production showed no similar increase and the yields are thus lighter than before. For faba beans lighter yields no doubt reflect the heavy attack of chocolate spot which devastated many farmers' crops, but the reason for the chickpea yield depression is not clear.

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TABLE 1.1 AREA, PRODUCTION AND SEED YIELD OF FABA BEANS (F), CHICKPEAS (C) AND LENTILS (L) IN TUNISIA FROM 1971-72 TO 1981-82.

	Area	Area (1000 hectares)			Production (1000 metric tonnes)			Seed Yield (kg/ha)		
Season	F	С	L	F	С	L	F	С	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	
1981-82	65.8	53.3	2.8	39.0	30.5		593	572		
Mean	52.9	28.9	2.8	42.0	23.0	2.0	787	8 15	727	

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

As a mean over the period 1971 to 1981 faba beans accounted respectively for 64% and 71% of the total area and production, whilst the corresponding figures for chickpeas are 33% and 31% and for lentils are 4% and 7%. Also during this period these three crops accounted for 80-90% of the total legume production and area in the country.

2. THE RESEARCH PROGRAMME

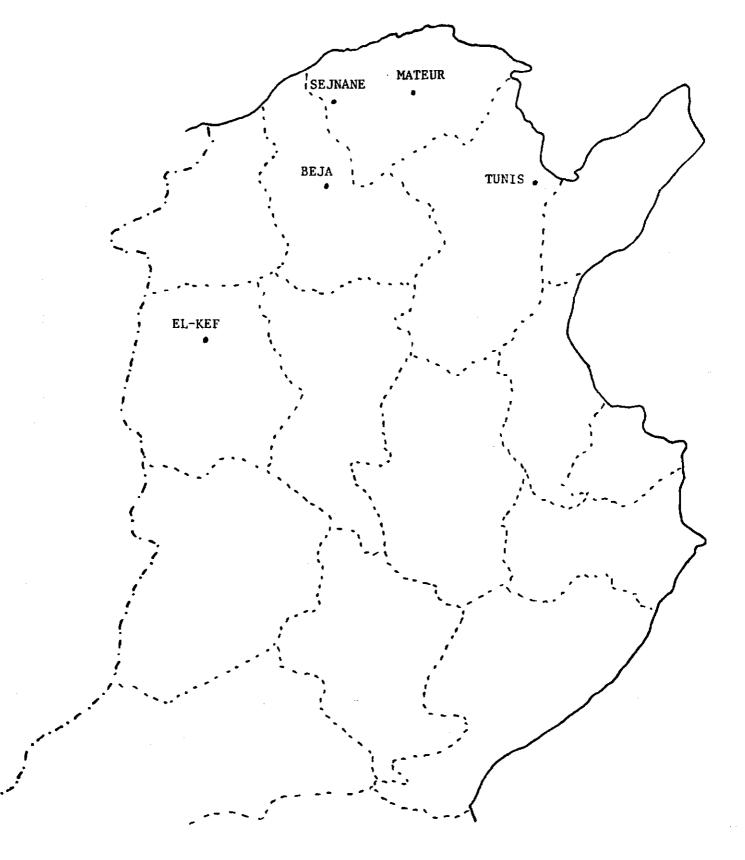
2.1 Experiments and locations

The breeding trials and nurseries and agronomic experiments were grown at one or more of five locations at Tunis, Beja, El-Kef, Mateur and Sejnane; the last four locations are situated in the principal crop growing areas in the North and West of the country (figure 2.1). Details of the experiments sown at each of the locations are given in tables 2.1, 2.2 and 2.3 respectively for faba beans, chickpeas and lentils. Unfortunately seed yield and other data could not be recorded on some trials and nurseries at Tunis, Mateur and Sejnane owing to adverse weather conditions and/or animal predators.

In the breeding programme the experiments labelled "international" came from ICARDA and contained breeding lines and segregating populations for evaluation in replicated trials and non-replicated screening and disease nurseries. Four advanced lentils trials were additionally received from ICARDA and contained breeding lines not yet at the stage of international testing; these trials are listed as preliminary yield trials 3,4,5 and 6 in table 2.3

The advanced and preliminary yield trials contained lines selected for a superior performance last season. Generally lines in an AYT have already been tested for one or more seasons in a replicated trial whilst those in a PYT have been previously evaluated only in a non-replicated screening nursery.

FIGURE 2.1. LOCATION OF EXPERIMENTAL TRIALS AND NURSERIES
IN TUNISIA, 1983-84



	Numb	er of			Locati	ons	
Experiments	Replicates	Entries/Treatments	Beja	Kef	Mateur	Tunis	Sejnane
· · ·		·					
Breeding trials							
International Yield Trial (S) (2)	4	24	x(1)	x ⁽¹⁾			
Preliminary Yield Trial 1 (S)	4	17	X	X			
" 2 (S)	4	17	X	X			
" " 3 (S)	2	17	X				
Advanced Yield Trial 1 (S)	4	. 18	X	X	x		
2 (S)	3	10					
International Yield trial (L)	4	24	$\frac{2}{x}(1)$	$\frac{X}{X}(1)$			
Preliminary Yield Trial (L)	2	21	X	X			
Advanced Yield Trial (L)	4	16	X	X	Х		х
Breeding Nurseries						•	•
International Screening Nursery	(S) 1	48	Х	х	X		
	(L) 1	37	X	X	X		
" F ₀ "	1	86	X ·	X			
F3 " ear!	Ly 1	38	X	X			
National Screening Nursery	1	25	x				
	•					•	- "
Diseases Nurseries							
International Orobance Nursery	3	21	х				*,
" Rust "	2	15	X				
International Ascochyta Nursery	2	41	X				,
" Chocolate sport "	2	25	X				
Botrytis Resistant Lines Nursery		45	X				•
Ascochyta " " "	1	45	- X				
Rust/Botrytis " " "	1	26	X				
Agronomy Trials							
Date of Sowing/Population Trial	(S) 4	20	х	X			
Fertilizer Trial (S)	4	8	X	X			
Weed Control Trial (S)	4	12	X	X			
Date sowing/Population Trial (L)	4	20	x	X			

⁽¹⁾ One replicate kept to grow in isolation(2) S = small seeded , L = large seeded

	Nu	mber of			Locat	ion	-
Experiments	Replicates	Entries/Treatments	Beja	Kef	Mateur	Tunis	Sejnane
A. WINTER PLANTING							
Breeding Trials	•						
International Yield Trial - MR " STR	4 4	24 24	$X^{(1)}$	x	x		
" F ₃ Trial STR	3 3	24 24	x x	x x			
Preliminary Yield Trial - 1	3 3	15 14	X X	X X			
" " " - 3 Advanced " "	3 4	14 18	X X	X X	x		x
Breeding/ Nursery							
International Screening Nursery Disease Nurseries	7 1	63	X	x		X	
International Ascochyta Nursery	y 2	72	X	x	x		
Agronomy Trials			·	•		•	
Date of sowing/Population Trial Weed Control Trial Winter/Spring Comparison Trial	4	20 12 5	X X X	X X X	x		
B. SPRING PLANTING		·					
International Yield Trial (L)	4 4	20 24	X X	X X	X	X	
Adaptation Trial Preliminary Yield Trial	4 3	16 22	X X	X		. X	
Advanced Yield Trial 1 " " 2 " " 3	4 4 4	18 18 18	X X X	X X			
" " " 4	4 .	18	X				

⁽¹⁾ One replicate used for fusarium wilt screening.

8

⁽¹⁾ L = large Seeded

In the following crop reports, however, the entries in the international, advanced and preliminary trials and screening nurseries are referred to simply as lines. The plot size in the majority of trials was 8m² and in the screening nurseries 2m² with 4m² and 2m² respectively harvested for yield evaluation.

The agronomic programme continued to evaluate crop responses to different dates of sowing and differing levels of plant population, phosphate and nitrogen and the effectiveness of a range of herbicides on natural weed populations.

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 been noted in the text. Also, only if the analysis of variance produced a significant (P< 0.05) 'F' value has a least significant difference value been calculated, in order to assess whether the lines or populations had values that were significantly different from that of the check.

The following individual crop reports are a summary of the complete research results which are given at the end of each report in appendices A,B and C for faba beans, chickpeas and lentils respectively. Tables in the appendices that are referred to in a report are always prefixed by one of the three letters, whereas summary tables pertaining to a report have no such prefix. All the values given both in the appendices and in the summary tables are the mean of the relevant number of replicates, and the values underlined significantly exceeded the local check in that trial.

2.3 Meteorological data

Data on temperature and rainfall at the four locations from which experimental data is given in the following report are given in figure 2.2.

The E1-Kef location stands out as being much drier than the other locations and having the lowest mean minimum and maximum temparatures. The other locations experienced a similar rainfall at between 532 to 562 mm and had more equitable temperature regimes. At all four locations the rainfall was well distributed between September and February but then fell off rapidly producing a dry spring, which will have contributed to the general lack of natural disease development.

Fig. 2.2. Rainfall distribution (mm) and temperature at four locations TOTAL in Tunisia in 1983/84 SEASONAL Rainfall RAINFALL (mm) (mm) BEJA 100r Temp. (°C) 30r _372 EL-KEF TUNIS O MATEUR S J J D \mathbf{F} A M N - 12 -

3. FABA BEAN IMPROVEMENT

3.1 Introduction

The programme encompasses the improvement of large and small seeded types through the testing and selection of superior yielding genotypes and the identification of genetic sources of disease resistance. There was little natural disease development or pest attack this season aside from localised occurences of Orobanche spp, nematode (Ditylenchus dipsaci) and the stem borer (Lixus algirus) and a very high level of orobanche infestation at Beja resulted in large coefficients of variation for the yield data.

During the last two seasons (1981-82 and 1982-83) there were locally severe infections of the above three pests as well as alternaria leaf spot (Alternaria tenuis), rhizoctonia root rot (Rhizoctonia spp.), ascochyta blight (Ascochyta fabae), downy mildew (Peronospora spp.), and rust (Uromyces fabae).

Also in 1981-82 an attack of chocolate spot (Botrytis fabae) devastated the crop in Tunisia, and although no such similar attack has since occurred the disease is always a potential danger. Each season genetic material selected for resistance to chocolate spot by ICARDA is screened for resistance in Tunisia and increased emphasis is being put on artificial inoculation to

try and ensure adequate infection levels. Also available from ICARDA and grown each season are nurseries containing genetic material selected for resistance to ascochyta blight, rust and nematodes.

With the low level of natural disease development this season the results in this crop report concentrate mainly on seed yield, and the report provides a summary of the complete results from all trials and nurseries given in appendix A. Any table in this appendix that is referred to in the report is prefixed by the letter A, whereas summary tables have no such prefix. The local check used in all the trials and nurseries was a local Tunisian cultivar and is referred to as the Tunisian local check or the local check.

3.2 Yield trials and nurseries

3.2.1 Results

In the large seeded programme seed yield results are available from testing 57 lines in replicated yield trials and 36 lines in non-replicated screening nurseries, and the corresponding figures in the small seeded programme were 95 and 48 respectively (table 3.1). The trials and nurseries were conducted at two or three locations, and additionally 120 F₃ populations were evaluated in two nurseries at two locations (table 3.1).

Table 3.1 A summary of the yield results for faba bean lines and populations tested in replicated yield trials (YT) and screening nurseries (SN) at Beja (B), E1-Kef (K) and Mateur (M) locations in 1983-84.

				Numbe	r of	lines	/popul	ations	:	· · · · · · · · · · · · · · · · · · ·				
Tri	ial designation	1	local check at: exc loc		exceed	Significantly (1) exceeding the local check at:			efficie variat		Table No. and abbreviation in appendix A			
				В	K	M	A11 ⁽²⁾	В	K	M	В	K	M	
1.	Large Seeded											-		
	International Advanced Preliminary	YT YT YT	23 14 20	10 13	0 7 12	-(3) 14 - 9	7	0 0 0	0	1 -	46.1 39.6	14.0 20.2 29.2	_ 19.2	1 (IYT-L) 2 (AYT-L) 3 (PYT-L)
	International		36	5 5	1	9	3	U	U	-	77.2	47.2		4 (ISN-L)
2.	Small Seeded													·
	International Advanced	YT YT-1 -2	23 17 8	16 7 2	21 6 1	- 11 -	14 0 0	0	0	1	45.8 47.7 35.7		- 16.7	5 (IYT-S) 6 (AYT-S-1) 7 (2)
	Preliminary	YT-1 2 3	15 16 16	7 2 0 2 5	0 16 4	_	0 0 0 2 1	0 0	0	- - -	63.5 50.0 50.7	23.6 22.4		8 (PYT-S-1) 9 (2) 10 (3)
	International	SN ⁽⁴⁾	48	17	37	18	6	•0	U	-	50.7	11.5		11 (ISN-S)
3.	F ₃ Populations	S												
	International	SN(early) SN	36 84	8. 15	3 9	- -	1	4	1					12 (IF ₃ SN-E) 13 (IF ₃ SN)

⁽¹⁾ If more than one check then exceeding the larger value.

⁽²⁾ Number of lines or populations exceeding the check at all test locations.

⁽³⁾ Trial or nursery not grown at this location

⁽⁴⁾ Results from screening nurseries (SN) not analysed statistically.

A summary of the yield data for each trial and nursery is also given in table 3.1, together with the number of the relevant table of complete results in appendix A.

Although a number of lines in the trials outyielded the local check at the locations, significant
increases were only evident for one large and one small
seeded line at the Mateur location. Clearly the large
coefficients of variation at Beja, owing to high levels
of orobanche infestation, markedly affected the accuracy
of the trials grown at this location. Within the screening
nurseries a relatively large number of lines and F₃ populations exceeded the local check at the three locations,
but further testing in replicated trials is needed to confirm
such yield advantages.

Despite the lack of consistent and significant acrosslocation improvements there were ten large seeded and seventeen
small seeded lines in the trials that outyielded the local check
at all test locations. Amongst the former lines the largest yield
advantages were evident for three and two lines in the advanced
(AYT) and preliminary (PYT) yield trials respectively (table 3.2),
with ILB 398 (74 TA 56246) the most consistent with an average
mean increase 31% over the local check. The corresponding lines
amongst the small seed types were two in the PYT 2 and three in
the international yield trial (IYT) (table 3.2), although for

Table 3.2 Seed yield (SY) (1) in kg/ha, and as a percentage (2) of the local check of superior yielding large (L) and small (S) faba lines at three locations in 1983-84

Trial (2)	Line	Location							
	ILB/Cross Selection/	Be -	ia Ke		ef	Mate	Mateur		a
	Number Cultivar	SY	%	SY	7	SY	7.	SY	Z
	ILB 10 77TA 88311	981	133	2700	107	3291	165	2324	133
AYT-L	398 74TA 56246	1075	146	3306	131	2497	125	2293	131
AII L	1217 Reina Blanca	1100	150	2575	102	2787	139	2154	123
	Tunisian Local Check	735	100	2519	100	1998	100	1751	100
PYT-L	ILB 2488	1163	133	3175	109			2169	115
	ILB 1814 Syrian Local	950	109	3150	109			2050	109
	Tunisian Local Check	875	100	2900	100			1888	100
	ILB 1816 78S 48561	1263	110	2225	147			1744	131
PYT-2-S	33 74TA 95	1213	105	2213	146			1713	129
	Tunisian Local Check	1150	100	1513	100			1332	100
	ILB 112 78S 49288	925	159	2050	117			1488	127
Tym c	X77Sd 13 80S 45727	800	137	2150	122			1475	126
IYT-S	ILB 1813 Giza 3	1142	196	1792	102			1467	125
	Tunisian Local Check	583	100	1758	100			1171	100

⁽¹⁾ Values underlined significantly (P<0.05) exceeded the local check

⁽²⁾ Advanced (AYT), preliminary (PYT) and international (IYT) trials.

Table 3.3 Seed yield (1) as a percentage of the local check of five large and five small seeded lines at three locations over two seasons.

Location	Season		Large	Seeded Lines		
		ILB 10	ILB 398	ILB 1266	ILB 1217	ILB 1269
	i.	(77TA88311)	(74TA56246)	(Aquadulce)	(Reina Blanca)	(New Mammouth)
Beja	82-83 83-84	110 133	138 146	120 201	152 150	124 162
Kef	82-83 83-84	93 107	101 131	82 96	135 102	94 95
Mateur	82-83 83-84	139 165	_ 125	90 137	103 139	- 139
	Mean	125	128	121	130	123
Location	Season		Smal]	. Seeded Line	es	
		%77 Sd11 (80S45676)	ILB 9 (74TA 22)	ILB 269 (74TA 367)	ILB 269 (78S 48821)	ILB 407 (78S 49395)
Beja	82-83 83-84	144 110	- 63	131 89	- 124	156 91
Kef	82-83 83-84	117 100	111 100	123 102	118 99	129 92
Mateur	82-83 83-84	70 122	101 129	64 118	86 110	42 118
	Mean	111	101	105	107	105

⁽¹⁾ Values underlined significantly (P<0.05) exceded the local check.

all these lines the increased yield advantage tended to reflect a large increase at one of the two locations.

3.2.2. Discussion

Yield data is now available on a number of lines
from two seasons of testing at more than one location.
Table 3.3 gives such yield data, expressed as a percentage of the local check, for the best five large and small seeded lines at three locations; unfortunately this table includes only three of the lines listed in table
3.2 as the rest had undergone only one season of testing.
For most lines there was a marked within and between season variation at a location for the percentage increase or decrease although in certain instances this will partly reflect high coefficients of variation. In spite of this ILB 398
(74 TA 56246) and ILB 1217 (Reina Blanca) consistently outyielded the check, and ILB 10 (77TA 88311) and x 77 Sd11(80S
45676) did so in all but one instance, although only two of the increases for these four lines were significant.

Although such data gives an indication of a sustained and superior yield improvement over the local check, the lack of any consistency in significant increases does not permit any definite conclusions to be drawn about this apparent superiority. And over three seasons of testing the figures for the number of lines that significantly outyielded the local check

cultivar, out of the total number of lines tested, are none out of 46 in 1981-82, 8 out of 128 (6%) in 1982-83 and 2 out of 152 (1%) in this season (1983-84), and all these yield increases were evident at only a single test location.

The value of statistical significance can be overestimated, but the above low percentage and lack in consistency of significant increases does indicate the poor progress so far achieved in identifying superior yielding genotypes. The previous two annual reports also noted lack of progress, and observed that the large majority of the material tested had been imported after previous selection for improved seed yield in other environments. From these two points it was inferred that such selection pressure appeared to be relatively ineffective for conditions in Tunisia, and thus that faba bean genotypes/cultivars possessed a relatively narrow adaptation. This season's data has done little to change this view, and to overcome the problem it would seem necessary to place much greater emphasis on testing and selecting under local environmental conditions segregating populations and early generation breeding lines. In the longer term this could also be extended to material contained in ICARDA's germplasm collection. In the meantime selfing and selection is being

undertaken within a number of local populations to examine existing variation, and see if such a procedure can ultimately improve yield levels.

3.3 Disease Nurseries

The three international disease nurseries grown at Beja this season comprised 11 lines in a rust nursery, 29 lines in an ascochyta blight nursery and 18 lines in an orobanche nursery. With little or no natural infection of rust or ascochyta this season only the yield results from the first two nurseries above are presented in tables A 14 and A 15 respectively. As mentioned previously the soil at Beja is highly infested with Orobanche and table A16 gives for each line a visual score for the level of orobanche infestation (OBI) on a 1 to 5 scale (1= little or no infestation and 5= heavy infestation), an adaptation score (AS) on a 1 to 5 scale (1= good growth and adaptation and 5= poor growth and adaptation) and a seed yield (SY) value.

The correlation between these three characters are shown in table 3.4. As might be expected the adaptation score, which was a simple assessment of general growth during pod set, was significantly and negatively correlated with seed yield. The significant

Table 3.4 Correlations (df = 18) between

three characters in the international orobanche nursery.

			_
Character	A 6	SY	
OBI	-0.61**	0.53**	
AS		- 0.73***	

Correlation of the level of orobanche infestation infection with both the adaptation score and seed yield indicates in this experiment that lines with low infestation levels were poorly adapted and light yielders. Thus the apparent resistance of a line may reflect more it's inability to support more than a few parasitic plants due to an overall poor growth rather than genuine resistance. If this is correct then the detection and selection of resistance in field experiments could prove difficult.

Although no line was significantly superior to the local check for any of the three characters, it is noteworthy that compared to the check the three lines BPL-54,1009 and -1474 combined similar seed yields with a lower level of orobanche infection. These lines and others such as BPL-1772, BPL-2270 and F 402, that also showed lower than average levels of

orobanche infections combined with moderate seed yields, are worthy of further evaluation.

A number of lines were also screened against the nematode, <u>Ditylenchus dipsaci</u>, in infested land at El-Krib, and although visual scores of the symptoms indicated some differences between the lines further detailed evaluation is required.

In spite of the general lack of diseases this season, the earlier devastation of farmers' crops by chocolate spot and the always present problem of orobanche infestation, indicates that the transfer of disease resistance, initially into the local cultivar, must have a high priority. Such a programme 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 some return even in epidemic years.

3.4 Appendix A. Results of the faba bean breeding trials and Nurseries, 1983-84

Abbreviations used in the tables

1. Locations : B - Beja

K - El Kef

M - Mateur

T - INRAT, Tunis

- 2. Data:
- a) Seed yield data is expressed in kg/ha
- b) % local or % check seed yield of entries expressed as a percentage of the Tunisian local check
- c) Data values those underlined were significantly (p< 0.05) superior to the Tunisian local check
- d) N D (or -) data not available
- 3. Statistics: CV% 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 TWO LOCATIONS IN 1983-84

ENTRY	SELECTION	S E E D	YIELD
		В	K
ILB 1814	Syrian Local Large	742	1517
1269	New Mammoth	1025	2358
1266	Aquadulce	833	1925
1933	Sevilla giant	1173	1917
. 1813	S.L.L long Pod	942	1792
1817	76 TA 56809	517	1867
1815	Lattaka local	758	1983
444	79 S 97513	500	2042
34	78 S 49841	758	1800
1814	79 S 4	1125	1775
398	76 TA 56246	533	1792
1817	Lebanese local large	1083	1242
1805	Elegant S M C I	692	2108
1799	39 MB	1075	1683
605	78 S 49694	817	1800
1821	Turkish local	783	2092
x75TA 43	FLIP 83 - 8 FB	692	1433
ILB 1280	Reina Blanca	933	2267
282	79 SL 48590	1075	2083
371	74 TA 516	842	1992
31	74 TA 87	683	2167
9	74 TA 22	367	2008
4	-	700	1575
-	Tunisian local check	792	2542
Mean		812	1907
c.v. %		46.1	14.0
S.E.		216.2	154.1
d.f.		46	46

Table A2. SEED YIELD OF ENTRIES IN AN AYT-L AT THREE LOCATIONS IN 1983-84

The state of the s

E N T R Y	S E	E E D Y I E L D		
	В	K	М	
Aqua Claudia	1425	2463	2159	
ILB 1814	1056	2538	2229	
1269	1194	2388	2787	
1814 B	1056	263I	2676	
1799	1225	2244	2664	
1805	II75	1919	2807	
398	IO7 5	3306	2497	
1817	925	258I	2628	
1266	I48I	2425	2728	
10	981	2700	<u>3291</u>	
29	763	2494	2643	
1217	1100	2575	2787	
1812	1144	223I	2797	
268	956	2713	2245	
Tunisian local Beja	825	2713	2120	
" " Kef	644	2325	1876	
Mean	1064	2515	2558	
C.V.%	39.6	20.2	19.	
S.E.	210.5	253.9	245.	
d.f.	45	45	.45	

: Table A3. SEED YIELD OF ENTRIES IN A PYT-L AT TWO LOCATIONS IN 1983-84

ENTRY	SELECTION	SEED	YIELI
		В	K
<u> </u>		e e	
ILB 1270	-	1025	2650
1814	- .	838	2865
x 79L I53	80 S 81054	813	2525
x 75TA II6	79 S 79180	713	2350
ILB 1812	- .	525	2850
BPL 472		713	4625
ILB 1814	Syrian Local Large	950	3150
BPL IIO7		538	2525
F 17		325	3325
ILB 435		713	3550
ILB 2488		1163	3175
ILB 26563		863	3150
BPL 373		988	3025
520		725	3025
542		388	3350
552		813	3700
557		900	2825
661		688	2950
x 77 TA 48	•	600	2800
x 77 Sd 70	**	575	3425
	Tunisian Local Kef	875	2900
Mean		749	3057
C.V. %		44.2	29.2
S.E.		234.3	630.I
d.f.		20	20

Table A4 . SEED YIELD OF ENTRIES IN AN ISN-L AT THREEE LOCATIONS IN 1983-84

ENTRY	SELECTION	SEE	D Y	I E L D
	· · · · · · · · · · · · · · · · · · ·	В	K	М
x79 S 70	80 S 80026	1450	2150	2950
ILB 12	FLIP 83 - 4 FB	800	2750	2250
ILB 1933	Seville giant	1700	2500	1750
ILB 263	77 TA 88311	350	2400	2050
x79 S 101 B	FLIP 82 - 26 FB	900	2050	2500
77 TA 72	80 S 44178	1000	2350	1750
x75 TA 116	97 S 79180	2400	2250	2200
x79 L 25	FLIP 82-29 FB	1400	2300	2200
x79 S 74	FLIP 82-25 FB	1500	2600	2850
x79 S 72	80 S 80028	1600	1900	2700
ILB 1814	79 S 653	1300	1950	2550
ILB 41	75 TA 56297	.1.550	2500	2900
x79 \$131	FLIP 28-27 FB	1050	1850	3000
x79 S 178	FLIP 82-28 FB	1150	2250	2750
x79 S 12	FLIP 83-3 FB	1300	2300	2200
x75 TA115	78 S 33200	1600	2450	2600
ILB 1817	FLIP 82-45 FB	1100	2000	2100
ILB 23	FLIP 82-53 FB	800	1850	1650
ILB 29	FLIP 83 -6 FB	950	2300	2450
ILB 1817	FLIP 82-46 FB	450	1900	1750
x79 S 103	80 S 80064	1900	2700	3050
ILB 41	FLIP 82-54 FB	1700	1850	2475
x79 S 155	80 S 80123	600	1550	2100
x75 TA 209	FLIP 82-39 FB	850	2400	3600
ILB 1817	FLIP 82-47 FB	1000	2850	3900
x77 TA 31	80 S 43587	700	2700	2600
x79 L 130	FLIP 82-30 FB	800	2550	2150
x79 K 153	80 S 81954	850	2550	3750
ILB 282	76 TA 5636	1200	2350	3950
x79 S 171	80 S 80135	1750	1800	2150
ILB 1814	79 S 546	1100	2100	3600
x79 5160	80 S 80128	1350	1750	3000
ILB 22	FLIP 83-5- FB	1200	2250	1850
ILB 10	78 S 49907	950	ND	2900
x77 TA 64	80 S 44027	500	1800	2950
ILB 1817	FLIP 82-48 FB	950	2100	3300

Table A4. (continued)

ENTRY		SEED YIELD		
ENIKI		В	к м	
CHECK GENOTYPES				
ILB 1814	Syrian local large	1050 2 1100 3	750 2750 850 2100 450 2250	
	Mean CV%		017 2367 12.5 14.4	
ILB 1270	Reina Blanco	1350 20	150 3200 600 3800	
	Mean		000 2550 583 3183	
	CV. %	41.1	16.5 19.6	
		4050	400 2250	
	Tunisian local check	1600 3	150 2250 100 4150 550 2300	
	Mean C.V%		300 2900 20.1 37.3	

Table A5. SEED YIELD OF ENTRIES IN AN IYT-S AT TWO LOCATIONS IN 1983-84

ENTRY	SELECTION	S E E D	SEED YIELD		
	· · · · · · · · · · · · · · · · · · ·	B	K		
ILB 1813	Syrian local large	925	2042		
1819	Giza 3	1142	1792		
1816	78 S 48561	442	1800		
5	FLIP 83-1 FB	733	1842		
277	-	733	1858		
360	74 TA 498	933	1708		
269	74 TA 367	592	1842		
33	74 TA 95	392	2067		
287	77 MS 88323	875	1925		
x77 TA 148	80 S 45 579	708	1775		
x77 Sd 92	80 S 46593	375	1892		
x77 Sd 13	80 S 45727	800	2150		
ILB 29	FLIP 83 - 7 FB	442	2108		
295	75 TA 26467	992	1683		
112	78 S 49288	925	2050		
. 22	FLIP 83 - 2 FB	883	1825		
18	77 TA 80023	567	1867		
1266	78 S 49171	467	1833		
x77 TA 82	80 S 44371	883	1933		
x77 SD 70	80 S 46341	383	2008		
ILB 32	74 TA 91	642	1858		
x77 TA 88	80 S 44539	875	1892		
ILB 285	78 S 48476	650	1800		
-	Tunisian local check	583	1758		
Mean		704	1888		
C.V. %		45.8	16.0		
S.E.		186.2	174.2		
d.f.		46	46		

Table A6. SEED YIELD OF ENTRIES IN AN AYT-S NO.1 AT THREE LOCATIONS IN 1983-84

and the second s

ENTRY	SELECTION	SEED YIELD		
		В	K	М
ILB 1820	Giza 4	888	1856	2396
277	-	625	2013	3110
269	78 S 4882I	994	1931	3175
x 75 TA 146	79 S 78978	713	1981	2896
LB 49	74 TA 133	838	1906	3015
5	74 TA 12	650	1813	2679
407	78 S 49395	725	1806	342I
269	74 TA 367	713	2000	342I
360	74 TA 498	713	1969	2340
1816	78 S 4856I	900	2056	2877
905	78 S 35513	188	1900	2702
9	74 TA 22	500	19 63	3727
¥ 77 Sd II.	80 S 45676	188	I95 0	3546
LB 287	77 MS 88323	506	1525	33II
32	74 TA 9I	656	193 1	3125
24	74 TA 63	850	1594	3258
_	Talot	613	1600	3273
-	Tunisian local			
	check	800	1956	2896
lean		747	1875	3065
c. v.%		47.7	26.7	16.
5. E.		178.2	240.9	256.
l.f.		51	51	5I

TABLE A7. SEED YIELD OF ENTRIES IN AN AYT-S No.2 AT TWO LOCATIONS 1983-84

ENTRY	SELECTION	S E E D Y	I E L D
		В	ĸ
ILB 336	78 S 48437	317	1650
339	78 S 48504	683	I625
3I	74 TA 87	625	1792
285	77 TA 88118	658	I3I7
317	77 MS 88338	725	1383
INAM IOO6	-	658	1683
INAM 709	-	933	I4I7
INAM IO26	-	892	1542
-	Tunisian Local Kef	783	1550
-	Tunisian Local Beja	792	1702
Mean		707	I 566
C.V. %		35.7	17.6
S.E.		I45.6	159.4
d.f.		18	18

TABLE A8. SEED YIELD OF ENTRIES IN A PYT-S No.1 AT TWO LOCATIONS IN 1983-84

ENTRY	PEDIGREE	SEED	YIELD
		В	K
ILB 356	<u>-</u>	450	1738
x77 TA 60	80 S 43971	675	1488
-	PBI Cambridge 63	475	1925
	PBI Cambridge 73 II	350	1688
•	81 S 26775	563	1650
x75 TA 150	80 S 50088	375	1313
x77 TA 82	80 S 44367	425	1788
x77 TA 101	80 S 44812	350	1838
x77 TA 101	80 S 44815	475	1763
x77 TA 117	80 S 45050	525	1350
x77 Sd 13	80 S 45727	250	1588
x77 Sd 92	80 S 46593	300	1900
BPL 471	-	363	1918
BPL 666		450	1963
-	80 Latt. 15035 - 1	325	1963
-	Tunisian local check (Beja)	638	1788
-	Tunisian local check (Kef)	713	2063
Mean		453	1748
C.V. %		63.5	23.6
S.E.		143.8	206.5
d.f.		48	47

TABLE A9. SEED YIELD OF ENTRIES IN A PYT-S No.2 AT TWO LOCATIONS IN 1983-84

ENTRY	SELECTION	SEED	YIELD
		В	K
ILB 1816	78 S 4856I	1263	2225
33	74 TA 95	1213	2213
x 75 TA 33 x 77 TA 70	80 S 4365I 80 S 44150	738 788	2050
X // IA //	80 S 44150 203154 (USA)	1138	1775 1838
_	Maris Bread	913	1700
-	Blaze	900	1688
_	Relon	563	1938
BPL 460	Keton	850	1688
x 75 TA 3	80 S 43064	588	2000
x 77 TA 48	80 S 43856	775	2250
BPL 262	-	938	1763
x 77 Sd 60	80 S 4612I	800	2225
ILB 1555	Rusttat	988	1938
x 77 TA 88	80 S 44539	725	1938
x 77 Sd 70	80 S 4634I	944	1863
-	Tunisian Local Kef	1150	1513
Mean		898	1918
c.v. %		50.0	22.4
S.E.		224.6	215.0
d.f.		48	48

TABLE A10. SEED YIELD OF ENTRIES IN A PYT-S No.3 AT TWO LOCATIONS IN 1983-84

ENTRY	S E E D	YIELD
	В	K
ILB 22 328	650 650	1500 2075
x 77 TA 8I	525	1525
x 77 TA 86	775	1675
251233 (USA)	1050	1750
253806 (USA)	525	1675
254001 (USA)	375	1825
BPL II6I	I300	1875 2025
ILB 382	IIOO 875	2500 2500
470	700	2400
8I S 26575 8I S 26586	600	2625
BPL 505	675	2400
BPL 6020	350	2125
25I232 (USA)	575	I 650
25I33I (USA)	550	1675
Tunisian Local Kef	725	2200
Mean	706	1971
c.v. %	50.7	11.9
S.E.	253.3	165.6
d.f.	16	16

TABLE A11. SEED YIELD OF ENTRIES IN AN ISN-S AT THREE LOCATIONS IN 1983-84.

ENTRY	SELECTION	SI	EED YII	D YIELD	
		В	K	M	
x 77 TA 118	80 S 45057	2100	2450	2750	
x 75 TA 33	80 S 43651	1500	2150	3 350	
x 77 TA 48	80 S 43859	1400	1800	2900	
х 77 TA 85	FLIP 82 - 21 FB	1250	1850	2700	
ILB 905	78 S 35513	700	2250	2600	
x 76 TA 34	FLIP 82 - 16 FB	1150	1850	2200	
x 77 Sd 60	80 S 46121	1500	2250	2500	
ILB 1105	79 S 97330	2050	1650	2500	
ILB 320	78 S 48434	1250	2500	2750	
x 77 Sd 48	FLIP 82 - 13 FB	1450	1750	1950	
x 75 TA 10	80 S 43238	900	2250	3 850	
x 75 TA 7	78 S 33011	1550	2250	2000	
x 77 TA 70	80 S 44150	1400	2000	3125	
x 75 TA 16	FLIP 82 - 15 FB	1500	1750	2000	
x 77 TA 48	80 S 43856	1700	2750	3250	
ILB 407	78 S 49395	1550	2100	3475	
x 75 TA 14	FLIP 82 - 35 FB	1550	2750	3400	
x 75 TA 16	80 S 43341	800	1900	2550	
x 77 TA 33	FLIP 82 - 9 FB	900	2500	2150	
x 77 TA 72	80 S 44203	1050	2200	1850	
x 77 TA 81	80 S 44358	2950	2700	2000	
x 77 TA 81	FLIP 82 - 20 FB	2250	2800	2750	
x 75 TA 20	FLIP 82 - 36 FB	1450	2250	2850	
x 77 TA 72	FLIP 82 - 17 FB	1450	2300	2750	
x 75 TA 150	80 s 50088	1150	1750	2700	
x 77 TA 60	80 S 43977	900	2650	3950	
x 77 Sd 100	FLIP 82 - 24 FB	2050	2650	1950	
x 75 TA 3	80 S 43064	1400	1900	2950	
x 77 TA 88	FLIP 82-22 FB	1550	2900	3250	
x 75 TA 193	80 S 50106	1100	2350	1600	
ILB 1817	76 TA 56267	2200	2550	3850	
x 77 TA 60	80 S 43971	1225	2400	3000	
x 75 TA 8	FLIP 82 - 33 FB	1225	2400	2950	
ILB 352	77 MS 88158	750	2650	3000	
ILB 336	78 S 48437	1250	2250	2600	
x 75 TA 14	FLIP 82 - 1 FB	1400	2200	2175	
x 75 TA 14	FLIP 82 - 34 FB	800	2850	2350	
x 77 TA 81	FLIP 82 - 19 FB	600	3050	2925	
x 77 TA 117	80 S 45050	500	2000	1925	
x 77 Sd 11	80 S 45676	1300	2200	3250	

TABLE A11. (continued)

ENTRY	SELECTION		SEED YIEL	D
ENIKI	SELECTION	В	K	M
ILB 308	FLIP 82 - 2 FB	850	2710	2250
ILB 49	74 TA 133	700	ND	1500
ILB 1816	FLIP 82 - 38 FB	850	2700	2550
x 75 TA 105	FLIP 82 - 12 FB	1350	2650	1950
x 75 TA 43	FLIP 83 = 9 FB	500	2300	4000
x 77 TA 51	FLIP 82-11 FB	250	1850	3150
x 77 TA 66 x 77 TA 86	80 S 44056	650	1950	2350
x 77 TA 86	80 S 44474	600	2250	2050
CHECK GENOTYPES				
ILB 1820	Giza 4	1450	2600	2350
1010		1000	2050	2050
		1050	2750	2500
		1500	2050	2000
	Mean	1250	2363	2225
	CV. %	20.9	15.5	10.8
ILB 1278	F 402	1950	2400	2200
		1500	2550	2050
		1450	2500	2700
		1100	1950	1250
	Mean	1500	2350	2050
	Cy, %	23.3	11.6	29.3
Tunisian local check		1750	2200	3250
		2200	2300	2650
		1000	1400	2500
		700	1850	3150
	Mean	1413	1938	2888
	CV %	48.6	21.0	12.8

TABLE A12. SEED YIELD OF ENTRIES IN AN IF₃SN-E AT TWO LOCATIONS IN 1983-84

ENTRY	S E E D	Y I E L D
anan a	В	K
S 82004	1300	2200
S 82008	1325	1925
S 82009	425	2450
S 82013	800	1650
S 82015	1525	2375
S 82017	1375	1925
S 82023	250	2250
S 82018	1275	1700
S 82076	1200	2175
S 82027	1425	1650
S 82029	1100	1950
S 82037	375	2250
S 82054	400	1975
S 82064	575	2175
S 82068	725	1750
S 82069	800	1825
S 82077	825	2175
S 82085	950	1850
S 82088	675	2125
S 82091	825	1875
S 82095	825	1975
S 82096	275	1600
S 82099	400	2125
S 82103	775	1700
S 82107.	250	1350
S 82110	150	1950
S 82112	225	2075
S 82129	700	2250
S 82146	500	2150
S 82151	825	2100
S 82154	375	1875
S 82169	800	1675
S 82179	200	1725
S 82425	400	2300
S 82426	675	1950
S 82399	475	2375

TABLE A12. (continued)

	·- <u></u> -	SEED Y	IELD	
ENTRY	В		K	
CHECK GENOTYPES				
Syrian local large		300 475 425	1950 1650 2000	
Mean		400	1867	
C.V.Z		22.5	10.1	
Reina Blanca		550 275 375	2300 2050 2175	
Mean		400	2175	
CX%		34.8	5.7	
Tunisian local large		1725 1000 400	2275 2450 2275	
Mean CVZ		1042 63.7	2333	
Tunisian local small		1250	1750	
		1025	1850	
Mean		150 808	1850 1817	
C.V.%		71.9	3.2	

TABLE A13. SEED YIELD OF ENTRIES IN AN IF₃SN AT TWO LOCATIONS IN 1983-84

ENTRY	SEED	YIELI
	В	К
S 82 368	800	2250
028	400	2000
098	625	1700
144	700	2075
083	775	1950
106	1000	2225
390	500	1725
012	775	1675
124	675	2025
121	1050	2025
134	1000	2050
435	575	1875
165	900	1450
052	675	1900
143	1075	1325
407	250	2275
120	750	1325
170	1075	2075
081	800	2075
113	825	1775
084	840	2 100
176	600	1875
051	425	1775
117	600	2350
030	625	2375
415	725	1875
478	875	2900
166	625	1575
375	1225	2075
171	675	2175
463	1050	1750
131	275	1675
158	200	1600
132	7 50	1800
408	1250	1850
115	425	1875
155	950	2450
005	575	2125
021	650	1300
434	550	2250
149	825	2400
102	550	1875
104	675	1875

			SEED	YIELD
E	NTRY		В	K
S 82	388		125	1575
	357		500	1700
	057	· ·	425	2250
	153		600	2425
	128		675	2050
	097		850	2 100
	14 1		100	2275
	474		525	2225
	175		375	2000
	409		275	1925
	049		600	2050
	136		775	1550
	167		1375	1900
	020		525	1975
	163		275	1850
	417		350	1675
	010		550	2275
	139		375	1500
	087		225	1950
	164		700	2250
	025		550	1625
	142		375	1700
	061		700	1925
	133		1800	2250
	034		875	2175
	130	-	875	1875
	161		700	1725
	079	,	725	1300
	145		100	1700
	147	•	1200	1975
	178		1000	1950
	484		875	2350
	105		975	1400
	101	····	475	2450
	082		1225	1700
	156		625	1800
	413		775	1725
	014		425	1500
	418		375	1975
	411		175	2350
	416		1475	1825
СНЕСК	GENOTYP	ES		
Svria	n local	large	625	1975
<i>y</i> =344	=	o -	975	2300
			275	2050
			450	1500
			625	1750
			350	1525
		Mean	800 800	1450
		C.V. %	42.4	18.1

TABLEA13 (continued)

	SEED	YIELI
ENTRY	В	K
Reina Blanca	900	2325
	700	2025
	525	2225
	425	2250
	875	1175
	850	2100
	800	1950
Mean	725	2007
c.v. %	25.5	19.4
Tunisian local large	950	2250
-	725	2325
	975	2575
	475	2875
	575	1800
	950	2425
	500	1875
Mean	736	2304
C.V. %	30.3	16.4
Tunisian local small	850	2400
	1225	1700
	825	2050
	475	1700
	1025	1375
	1550	1450
	600	1700
Mean	936	1768
C.V. %	39.3	20.0

TABLE A14. SEED YIELD OF ENTRIES IN AN INTERNATIONAL RUST NURSERY
AT BEJA IN 1983-84

NTRY	SELECTION	SEED YIELD
A contraction of the second of		
•		
<u>~</u>	82 - 15563 - 3 - A	900
-	82 - I5563 - 3 - B	900
В 2760	82 - 7002 (F6)	4100
LB 2764	82 - 7004 (FI7)	1100
PL 1179 PL 1179	8I - 24948 - I 8I - 24948 - 2	1200 700
PL 710	8I - 24857 - I	1000
PL 26I	8I - 24694 - I	800
PL 8	83 - 30010	1300
PL 150	83 - 30094	1000
B 1814	Syrian Local Large	800
-	Tunisian Local Check	1375
ean		1087
V. %		30.6
E. for entries		235.4
E. for Tunisian L	ocal Check	117.7
f.		18

TABLE A15. SEED YIELD OF ENTRIES IN AN INTERNATIONAL ASCOCHYTA NURSERY AT BEJA IN 1983-84.

ENTRY	PEDIGREE	SEED YIELD
BPL 230	80 - 14200 - 1	1100
365	80 - 14336	1100
435	80 - 14398	900 .
460	80 - 14422 - 1	1100
- .	.	1200
460	80 - 14422 - 3	1300
460	80 - 14422 - 4	800
471	80 - 14434 - 1	800
471	80 - 14434 - 2	1300
471	80 - 14434 - 3	1000
472	80 - 14435 - 1	1000
472	80 - 14435 - 2	800
472	80 - 14435 - 3	1400
472	80 - 14435 - 4	1100
472	80 - 14435 - 5	1000
472	80 - 14435 - 7	1000
ILB 382	80 - 14998 - 1	800
382	80 - 14998 - 2	900
549	80 - 15035 - 2	800
161	80 - 14986 - 1	1000
161	80 - 14986 - 2	700
161	80 - 14986 - 3	1100
x75 TA 46	82 - A2	700
BPL 2485	83 - 10026	1300
74	79 - 70015 - 1	900
74 .	79 - 70015 - 3	900
74	79 - 70015 - 4	900
ILB 1820	Giza 4	700
ILB 1814	Syrian local large	1000
-	Tunisian local check	1300
	Mean	1071
	CY.Z	44.5
	S.E. for the entries	336.9
	S.E. for Tunisian local	101.6
	df	51

TABLE A16. LEVELS OF INFECTION BY OROBANCHE (OBI), ADAPTATION SCORES (AS), AND SEED YIELD (SY) OF ENTRIES IN THE INTERNATIONAL OROBANCHE NURSERY AT BEJA IN 1982-83

ENTRY	OBI ⁽¹⁾	AS (2)	SY
BPL 4	2.8	2.7	1600
54	3.7	1.7	2200
375	3.5	2.7	1233
472	3.0	2.3	1933
553	1.8	3.3	1400
561	1.0	5.0	733
733	1.5	3.7	1100
799	1.8	3.7	367
1009	1.8	1.7	1833
1474	1.8	2.3	2100
1636	1.3	3.3	1400
1656	1.2	4.7	767
1722	1.5	4.0	1367
2062	1.5	3.3	1067
2210	1.5	3.7	1300
2270	1.8	2.7	1667
402	1.5	2.7	1633
331	2.0	1.3	1233
ınisian Local	2.8	2.3	2067
misian Local	2.2	1.7	1867
ean	2.1	2.8	1443
. V. %	41.0	19.9	40.9
. E	0.48	0.33	340.9
.f.	38	38	38

^{(1) 1=} Very little or no infestation, 5 = heavy infestation

^{(2) 1=} Good growth, 5 = very poor growth

4. CHICKPEA IMPROVEMENT

4.1 Introduction

The sowing date trials of this season again confirmed the yield advantage that can accrue from winter versus spring sowing, and it is intended that these two practicies will be extensively compared next season in a network of trials in farmers' fields. At present, however, the chickpea crop is largely spring planted and the breeding programme thus has both a winter and spring component.

Ascochyta blight resistant genotypes are a pre-requisite for winter planting, and although little blight occurred naturally this season it is always a potential danger. All the genetic material, aside from the large seeded lines, received in ICARDA trials has been previously screened for resistance to ascochyta blight and this season, in cooperation with INAT (Institut National d'Agronomie de Tunisie), a number of the winter sown trials at Beja were artificially inoculated with a locally occurring isolate of the pathogen. Also part of the M.Sc. thesis of a student at INAT is to assess the variation in pathenogenicity within and between naturally occurring populations of ascochyta blight in Tunisia.

Last season's annual report indicated that <u>Fusarium</u> spp. was the causal organism of the wilt symptoms observed in experiment stations and farmers' fields, and that this disease was as big a constraint to production as ascochyta blight. More detailed work this season both from field surveys and in the laboratory has further confirmed

the importance of wilt, and both <u>Fusarium</u> spp. and <u>Verticillium</u> spp. have been isolated from wilt infected plants.

To date the programme has evaluated a considerable amount of imported and locally selected genetic material for seed yield and for resistance to ascochyta blight and fusarium wilt. Also crosses have been undertaken to meet the first essential need of developing a range of genotypes that combine resistance to both diseases with a yield potential and adaptation at least equivalent to the local cultivar. This work will continue with increased emphasis on selecting a plant type adapted to mechanical harvesting and an improvement in seed yield per se

This crop report provides a summary of the complete results from all trials and nurseries given in appendix B. Any table in this appendix that is referred to in the report is prefixed by the letter B, whereas summary tables have no such prefix. The local check in all trials and nurseries was the local Tunisian cultivar 'Amdoun' and is referred to as the Tunisian local check or local check.

4.2 Results and discussion of winter planted yield trials and nurseries.

Seed yield results are available from the testing of 99 lines and 42 F₃ populations at two locations in replicated yield trials and from evaluating 60 lines in a non-replicated screening nursery at three locations (table 4.1). A summary of the yield data for each trial and nursery is also given in table 4.1, together with the number of the relevant table of complete results in appendix B.

												
Trial designati	on	tested	exc loc	exceeding the (1) local check at		the ⁽¹⁾ ck at	\$ignificantly (1) exceeding the local check at		Coefficients of variation		Table No. and abbreviation in appendix B	
			В	K	T	A11 ⁽²⁾	В	К	A11	В	K	
International	YT (MR) (3)	23	2	4	_(4	·) ₀	0	0	0	79.5	5.3	1 (IYT-MR)
ii	YT(STR) (3)	23	5	•	-	-	0	-	0	57.5	-	2 (IYT-STR)
Advanced	YT	16	3	2	-	1	0	0	0	33.0	28.5	3 (AYT)
Preliminary	YT 1	13	2	10	-	1	0	0	0	50.5	24.6	4 (PYT 1)
11	YT 2	12	5	10	-	4	0	2	0	24.8	18.5	5 (PYT 2)
11	YT 3	12	8	11	-	7	1	0	0	23.7	31.0	6 (PYT 3)
International	F ₃ YT	21	21	, 4	-	4	0	0	0	64.1	17.7	7 (IF ₃ T)
ti	F_YT(STR)	21	1	20	-	1	0	0	0	69.1	21.0	8 (IF ₃ T-STR)
International	3(5) SN	60	10	2	1	0						9 (ISN)

⁽¹⁾ If more than one local check then exceeding the larger value.

⁽²⁾ Number of lines or populations exceeding the check at all test locations.

⁽³⁾ MR= Mediterannean region, STR= Sub-tropical region.

⁽⁴⁾ Trial not grown at this location.

⁽⁵⁾ Results from screening nurseries (SN) not analysed statistically.

A considerable number of lines and F3 populations in the trials exceeded the check at individual locations, and 13 of the former and 5 of the latter did so at both locations (table 4.1). Relatively few of the lines in the nurseries exceeded the check and none did so across the three test locations. However, the results from Beja for all trials, except the preliminary yield trials 2 and 3 (PYT 2and PYT 3), must be treated with caution as the coefficients of variation (CVs) were large mainly due to an unidentified soil problem that caused very poor growth in half the plots in each replicate. A heavy infestation of Orobanche spp. was also noted at this location in the advanced and preliminary yield trials suggesting that this parasite could pose a problem for winter planted chickpeas grown in heavily infested land (as at Beja). It was, however, encouraging that a few lines showed a very low level of infection and/or complete absence in all replicates. In spite of these problems, seed yield data, expressed as a percentage of the local check, on the top five lines and the five F_3 populations in the trials are given in table 4.2

The advanced lines listed in table 4.2 were in trials with relatively low CVs and the two lines FLIP 81-218 and FLIP 81-156 significantly outyielded the check at one of the two locations. Neither of these lines showed a good level of resistance to ascochyta blight or fusarium wilt, but could prove useful as parents in a crossing programme after further yield evaluation. Although no F₃ population proved to be significantly heavier yielding than the check, single plant selections from the best populations will be advanced for disease screening.

Table 4.2 Seed yield, expressed as a % of the local check, of superior yielding chickpea lines and F₃ populations at two locations in 1983-84

Advanc	ed lines	Loc	ation	
Trial	1) line	Beja	Kef	Mean
PYT 3	FLIP 81-218	141 (2)	102	125
2	176	113	132	123
2	156	103	141	122
3	229	127	111	121
3	391	108	131	117
3 popula	tions			
rial ⁽¹⁾	Population			
F ₃ T	x 82 TH 82	207	100	130
ű	80	164	107	122
" -S	TR 77	106	145	121
11	168	136	103	112
11	88	105	100	102

⁽¹⁾ PYT = preliminary yield trial IF_3 T= international F_3 trial, STR = sub-tropical region

⁽²⁾ Underlined values significantly (P≤0.05) exceeded the check.

Unfortunately only one year's data is available for the superior yielding lines listed in table 4.2, but yield data from two years of multi-location testing is available for a number of lines grown in the international yield trial (IYT) and the advanced yield trial (AYT); the seed yield, expressed as a percentage of the local check for the top five lines is given in table 4.3. The yield of the check which is susceptible to ascochyta blight, was not adversely affected by this disease as little or none occurred in either season. In no instance did any of the five lines significantly exceed the check, and the heaviest yielding line, FLIP 81-56W, had the most stable performance exceeding the check three out of four times. However, it is clear that the percentage increases or decreases relative to the check varied considerably, both within and between seasons at a location. This illustrates one of the difficulties in selecting for improved seed yield and emphasises the need for multi-location testing over a period of time.

4.3 Results and discussion of spring planted yield trials and nurseries

Seed yield results are available from the testing of 120 lines and 30 F₄ populations in replicated trials at one or more locations (table 4.4). A summary of the yield data for each trial is also given in table 4.4, together with the number of the relevant table of complete results in appendix B.

Conthe lines tested at more than one location 34 at Beja and 6 at Kef significantly outyielded the local check, and two lines, namely, ILC 493 in the AYT 1 (tables 4.4. and B12) and PL-Se-Be (81) 27 in the AYT 2(tables 4.4. and B13) did so at both locations.

Table 4.3 Seed yield, expressed as a % of the local check, of the five heaviest yielding chickpea lines tested in 1982-83 and 1983-84 at Beja and El-Kef locations.

Line		1983	-1984	1982-	Mean	
		Beja	Kef	Beja	Kef	
FLIP	81-56W	61	112	129	159	113
	4 1W	85	67	132	131	104
	57W	94	65	108	122	97
ILC	484	94	112	90	85	95
ILC	3279	79	69	101	128	94

Table 4.4 A summary of the yield results of spring planted chickpea lines and F, populations tested in replicated yield trials (YT) at Beja (B), El-Kef (K) and Mateur (M) locations in 1983-84

		•	Numb	er	of 1	ines/pop	oulat	ions	.					
		tested	exceedi local c		ing chec	the (1) k at:	significantly (exceeding the local check at			the		Coefficients of variation		Table No. and abbreviation in appendix B
	·	•	В	K	М	A11 ⁽²⁾	В	K	М	A11 ⁽²⁾	В	K	M	•
International	YT	23	1	 1	_(3	·) 0	0	0		0	37.7	20.0		10 (IYT (S)
	YT(L) (4)		10	2	0	Ō	Ŏ	-	0	0	-	19.4		11 (IYT (S)L
Advanced	YT 1	32	28	28	-	25	12	5	-	1	35.5	34.9	-	12 (AYT (S)1
11	YT 2	25	23	18	-	17	22	1	-	1	22.6	20.5	-	13 (AYT (S)2
11	FAYT 1	15	5	-	-		0	-	-		52.0	-	-	14 (AYT (S)3
11	F ₄ YT 2	15	2	-	-		0	-	-		130.9	-	-	14 (AYT (S)4
Preliminary	YT	21	21	_	-		19	-	-		26.4	_	-	15 (PYT (S)

⁽¹⁾ If more than one local check then exceeding the larger value

⁽²⁾ Number of lines exceeding the check at all test locations

⁽³⁾ Trial not grown at this location

⁽⁴⁾ Large seeded international YT.

A further 19 lines in the PYT at Beja also showed significant and large increases over the local check (table 4.4. and B.16), whereas no such increases were evident amongst the \mathbf{F}_4 populations.

The three previous trials were grown in the wilt sick plot (WSP) at Beja, and the 46 lines tested in the AYT 2 and PYT stemmed from single plant selections for resistance to fusarium wilt made in the local cultivar 'Amdoun'. The wilt rating (where 1=no symptoms and 9 = complete kill) for the majority of these lines was much lower than that for the local check 'Amdoun', which as the unselected population used in the trials is susceptible to the disease (tables B 13 and B 16), and this was also evident for a number of lines in the AYT 1(table B12). In all three trials the wilt ratings and seed yield were significantly and negatively correlated at P4 0.01, indicating that the significant yield increases partly stemmed from greater level of wilt resistance rather than improved yield per se; this was amplified by the considerable reduction in the number of lines that significantly exceeded the check at Kef where wilt is not a problem.

The wilt resistance of the lines in the AYT 2 and PYT has now been confirmed for three seasons, and the wilt ratings and seed yield of the five heaviest yielding lines over two seasons from the AYT 2, grown in the WSP at Beja and at Kef, are given in table 4.5. The superiority of these Lines over the local

Table 4.5 Fusarium wilt ratings (FR) and seed yield in kg/ha of five superior yielding chickpea (Amdoun derived) lines at Beja (B) and E1-Kef (K) in 1982-83 and 1983-84

					1	983-84		Mean	% check
Line		FR Seed y		yield	FR	Seed	yield		
		В	В	K	В	В	K		
PL-Se-Be-81-8	37	1.04)	1360	1200	1.5	1875	1819	1564	213
4	8	1.0	1680	970	1.8	1737	1725	1528	208
12	20	1.5	1420	1580	1.8	1653	1363	1504	205
14	44	1.5	1560	1120	2.0	1475	1856	1503	205
7	78	1.0	1550	1250	1.5	1400	1644	1461	199
Tunisian local	check	8.5	49	1015	6.0	460	1413	734	100
SE		0.40	123.9	230.7		155.1	161.8		
df		30	30	14		75	72		

⁽a) Underlined values were significantly (P<0.05) better than the check

in wilt infested land (at Beja) is very clear, whilst being equivalent in disease free conditions (at Kef).

A number of these lines have been crossed with ascochyta resistant genotypes in an attempt to combine the wilt resistance, large seed size and local adaptation of these Amdoun derived lines with ascochyta resistance.

4.4 International ascochyta blight nursery, fusarium wilt screening and segregating material

The importance of ascochyta blight and fusarium wilt has already been noted and clearly the immediate aim must be to breed a cultivar combining resistance to both diseases. The artificial inoculation of breeding trials at Beja has been mentioned, and in addition the international ascochyta blight nursery from ICARDA was grown at Beja and Kef and inoculated at the former location. Data on blight ratings at Beja and seed yield at both locations of the test lines are given in table B16. The local check had a mean blight rating of 6.9 from being repeated 72 times as a spreader row, and all of the 70 test entries, except FLIP 82-59C, had lower ratings with 42 entries showing a resistant reaction at <3.

Since none of the genetic material entering the programme has been previously tested for resistance to fusarium wilt, all such 'new' material was screened in the wilt sick plot (WSP) at Beja. Most of material proved to be highly susceptible but a few lines exhibited moderate to good levels of resistance (less than 5 on 1 to 9 scale where 1= no symptons and 9= complete kill). For example in the winter planted experiments 1 out of the 46 lines in the international yiels trials (IYT) and 6 out of the 63 lines in the international screening nursery (ISN) showed such levels (table 4.6) and these lines can be expected to have a good level of blight resistance. Furthermore in the international ascochyta blight nursery 18 out of the 70 test entries combined acceptable levels of resistance to both blight and wilt (table 4.6), and the four entries ILC-182,-196-,200, and 201 have also shown a good level of resistance to blight in Morocco and Syria. All the above lines that showed or potentially have dual resistance will be further evaluated for seed yield and disease resistance, and some will be crossed with wilt resistant selections from the local cultivar, Amdoun.

Other work on dual resistance concerns firstly the cross ILC 237 x ILC 191 which was an entry in a 1982-83 F_3 population trial from ICARDA. Last season it was noted that ILC 237 was resistant to wilt (and the resistance was confirmed this season, table B12) and ILC 191 is known to have acceptable blight

4.6 Fusarium wilt ratings (FR) for selected chickpea lines in the international yield trials (IYT) and screening nursery (ISN) and FR and ascochyta blight ratings (ABR) for selected entries in the international ascochyta blight nursery (IABN) at Beja in 1983-84

FR	 Ent				IABN								
FR	Ent			IYT/ISN IABN									
		ry	ABR	FR	Entr	7			ABR	FR			
3	ILC	182	2	2	FLIP	81		71	. 3	3			
3		196	2	4				75	4	3			
3		200	2	4		82	-	1C	4	1			
4		201	2	3				26C	4	3			
4	•	215	4	4	÷			61C	2	1			
		3856	4	4				74C	4	3			
		4421	4	2				91C	4	4			
	ICC	6304	4	3				99C	4	3			
		6306	2	3			1	100C	4	3			
	3 3 4	3 3 4 4	3 196 3 200 4 201 4 215 3856 4421 ICC 6304	3 196 2 3 200 2 4 201 2 4 215 4 3856 4 4421 4 ICC 6304 4	3 196 2 4 3 200 2 4 4 201 2 3 4 215 4 4 3856 4 4 4421 4 2 ICC 6304 4 3	3 196 2 4 3 200 2 4 4 201 2 3 4 215 4 4 3856 4 4 4421 4 2 ICC 6304 4 3	3 196 2 4 3 200 2 4 82 4 201 2 3 4 215 4 4 3856 4 4 4421 4 2 ICC 6304 4 3	3 196 2 4 3 200 2 4 82 - 4 201 2 3 4 215 4 4 3856 4 4 4421 4 2 ICC 6304 4 3	3 196 2 4 75 3 200 2 4 82 - 1C 4 201 2 3 26C 4 215 4 4 61C 3856 4 4 74C 4421 4 2 91C ICC 6304 4 3 99C	3 196 2 4 75 4 3 200 2 4 82 - 1C 4 4 201 2 3 26C 4 4 215 4 4 61C 2 3856 4 4 74C 4 4421 4 2 91C 4 1CC 6304 4 3 99C 4			

resistance. Accordingly F_3 single plants were selected and the resulting F_4 progenies screened this season in the WSP. A large number exhibited good wilt resistance and of these 133 had acceptable seed quality and will be screened for wilt and blight resistance next season.

Secondly F_3 single plant selection was also practiced in a number of other entries in the F_3 population trial, (each population having one blight resistant parent) and the resulting F_4 progenies were grown at Beja this season. Unfortunately the blight inoculation of these progenies was unsuccessful, but the F_4 parental populations were grown in the WSP, and F_4 progenies from the populations that had a rating of less than five were retained. After selection for seed quality 65 progenies from 13 crosses were chosen for screening against wilt and blight next season.

4.5 Appendix B. Results of the chickpea breeding trials and Nurseries, 1983-84

Abbreviations used in the tables

1. Locations : B - Beja

K - El Kef

M - Mateur

T - INRAT, Tunis

- 2. Data:
- a) Seed yield data is expressed in kg/ha
- b) % local or % check seed yield of entries expressed as a percentage of the Tunisian local check
- c) Data values those underlined were significantly (p< 0.05) superior to the Tunisian local check
- d) N D (or -) data not available

3. Statistics:

CVZ - coefficient of variation expressed as a percentage

S.E. - standard error of entry mean

d.f - degrees of freedom associated with
 standard error

Table B1. SEED YIELD OF ENTRIES IN IYT-MR AT TWO LOCATIONS IN 1983-84

ENTRY	5	SELEC	TION	SEED	YIELD
				В	K
			_		
FLIP 81-26	x 79	TH	23	292	1675
-29			25	917	1738
−34 W			29	1358	1525
-40 W			50	858	1381
-41 W			50	700	1381
-56 W			151	367	1713
−57 W			151	858	1950
−59 W			158	408	1606
- 269			221	1200	1663
- 293			8	1050	1975
FLIP82- 5 C			220	400	1638
- 13 C			168	742	1406
- 40 C			8	1513	1413
- 43 C	x 80	TH	199	1467	1500
- 64 C			264	1217	1444
- 65 C	x 79	TH	221	733	1431
- 72 C			151	992	1538
- 73 C	x 80	TH	67	1208	1619
- 79 C	x 79	TH	220	758	1431
- 91 C			158	1100	1694
- 93 C			158	908	1606
ILC 482				1033	1944
1929				433	1888
Tunisian local check	:			1408	1744
Mean				892	1621
C.V.%				79.5	5.3
S.E.				409.0	106.5
d.f.				46	66

TABLE B2. SEED YIELD OF ENTRIES IN THE IYT-STR AT BEJA IN 1983-84

E N T R Y	SEED YIELD
FLIP 81 - 10	1467
- 74	558
-312	1167
-335	367
FLIP 82 - 3C	842
- 8C	983
-10C	717
-17C	475
-28C	692
−36C −38C	408 358
-52C	375
-53C	383
-56C	692
-59C	1225
-61C	1092
-63C	1150
-66C	1408
-68C	1467
-69C	1008
-71C	1442
ILC 482	758
ILC 3279	858
Tunisian local check	1200
Mean	876
C.V%	57.5
S.E.	290.9
d.f,	46 ^a)

⁽a) only 3reps sown

TABLE B3. SEED YIELD OF ENTRIES IN THE AYT AT TWO LOCATIONS IN 1983-84

E N T R Y	SEED	YIELD
	В	K
ILC 195	1344	1294
FLIP 81 - 56 W	1825	1100
FLIP - 26 W	1175	1544
ILC 484	1263	1788
ILC 482	1100	1394
FLIP 82 - 86	1200	1294
FLIP 81 - 59 W	913	956
FLIP 81 - 41 W	1144	1063
FLIP 82 - 80	1319	1225
FLIP 82 - 92	1250	1113
FLIP 81 - 57 W	1275	1031
FLIP 81004	1413	1731
ILC 3279	1063	1100
FLIP 81078	1070	1075
FLIP 82 - 85	1608	1306
FLIP 81079	1745	1075
Tunisian local check 1	1350	1594
Tunisian local check 2	1213	1194
Mean	1293	1271
C.V. %	33.0	28.5
S.E.	213.3	180.8
d.f.	51	51

Table B4. SEED YIELD OF ENTRIES IN THE PYT 1 AT TWO LOCATIONS IN 1983-84

E N T R Y	SEED	YIELD
	В	K
ILC 2506	744	967
ILC 183	445	1533
FLIP 81 - 67 - 75	1289 489	1178 1744
- 73 269	469 778	1447
- 55	578	1555
- 57	567	1600
- 23 W	555	1555
- 27 W	422	1478
- 63 W	356	1422
- 93	622	1755
- 95	533	1233
- 96	989	1656
Tunisian local check 1	889	1144
Tunisian local check 2	900	1389
Mean	677	1445
C.V. %	50.5	24.6
S.E.	197.4	205.5
d.f.	28	28

Table B5. SEED YIELD OF ENTRIES IN THE PYT 2 AT TWO LOCATIONS IN 1983-84

E N T	R Y	SEED	YIELI
		В	K
			4400
FLIP 81	- 130	1300	1422
	- 131 - 149	1411 1567	<u>2367</u> 1822
	- 149 - 156	1478	20 <u>67</u>
	- 158	1300	1956
	- 176	1622	1933
	- 178	1333	1544
	- 180	1378	1833
	- 181	1167	1922
	- 183	1589	1367
	- 187	1478	1878
	- 198	1022	1400
Tunisian	local check 1	1433	1244
Tunisian	local check 2	1344	1467
	Mean	1387	1730
	C.V. %	24.8	18.5
	S.E.	198.9	184.5
	d.f.	26	26

Table B6. SEED YIELD OF ENTRIES IN THE PYT 3 AT TWO LOCATIONS IN 1983-84

ENTRY	SEED	YIELD
	В	K
FLIP 81 - 208	1155	1322
- 218	1833	911
- 229	1655	989
- 251	1788	879
- 252	1322	1122
- 253	1356	956
- 254	1000	1311
- 269	1267	1089
- 293	1333	900
- 343	1211	1167
~ 391	1400	1167
- 392	1311	1022
Tunisian local 1	1300	867
Tunisian local 2	689	889
Mean	1330	1042
c.v. %	23.7	31.0
S.E.	182.2	186.7
d.f.	26	24 (ه)

(a) 2 missing values calculated

Table B7 SEED YIELD OF ENTRIES IN THE IF3T AT TWO LOCATIONS IN 1983-84

E N T R Y	S E E D	YIELI
	В	К
x 82 TH 67	1028	1325
68	1258	1550
70	825	1542
76	818	1208
80	1025	1749
82	1293	1650
87	883	1567
88	658	1650
102	768	1599
105	975	1475
110	750	1525
111	800	1517
121	943	1550
125	575	1592
127	668	1433
128	525	1450
134	893	1558
136	1500	1567
164	743	1550
168 x 82 TH 169 ILC 482 ILC 3279 Tunisian local check	850 1218 1243 508 625	1691 967 1525 1025 1642
Mean C.V.Z S.E. d.f.	898 64.1 332.0 46	1496 17.7 152.9 42

TABLE: B8. SEED YIELD OF ENTRIES IN THE IF3 T-STR AT TWO LOCATIONS IN 1983-84

LOCATIONS IN 19	83-84	
ENTRY	SEED	YIELD
	В	K
ж 82 TH 2	1025	1183
13	425	1158
61	708	1292
65	700	1133
77	1775 ^	1525
78	1083	1200
81	1558	1158
86	908	1300
91	1200	1317
92	358	1400
98	1175	1000
99	283	1442
100	600	1075
137	692	1175
146	683	1367
149	583	1358
152	450	1575
156	1033	1608
158	783	1442
160	783	1333
ं । e 165	908	1167
ILC 482	425	950
ILC 3279	1183	967
Tunisian local check	1667	1050
Mean	875	1257
c.v%	69.1	21.0
S.E.	139.5	152.8
d.f.	46	44

TABLE B9 SEED YIELD OF ENTRIES IN THE ISN AT THREE LOCATIONS IN 1983-84

E N T	R Y	SELECTION	SE	ED YI	ELD
			В	K	Т
x 79 TH	221	FLIP 82 - 96 C	800	1700	100
	23	- 97 C	1750	1700	800
	82	- 98 C	1350	1800	175
	151	-100 C	1500	1700	725
	151	-101 C	1500	1500	600
	101	-104 C	2300	1400	800
	151	-112 C	1400	1500	75
	151	−113 C	1650	1400	50
x 80 TH	199	−115 C	1250	1650	100
x 79 TH	220	-117 C	2200	1400	40
	159	-118 C	1250	1250	32.
	159	−119 C	2150	1650	75
	220	-121 C	850	1100	72
	168	−126 C	1050	1100	85
	8	−127 C	1800	1750	70
	8	−128 C	1900	1600	125
	23	-130 C	1300	1450	77
	24	-133 C	900	1650	42.
	151	−138 C	700	1800	95
	101	-144 C	1400	1200	87
	101	−150 C	1800	950	65
	101	−152 C	1700	950	75
	158	-154 C	850	1300	550
	216	-160 C	1750	650	600
	216	-161 C	1000	1250	850
	216	-164 C	1400	1250	850
	220	-167 C	1300	1500	47.
	221	-169 C	1100	1450	450
	123	−175 C	1300	1450	90
	220	-180 C	1400	1600	750
	220	-181 C	2000	1600	92.
	159	-182 C	650	1750	150
	215	-186 C	1300	1000	550
	220	-188 C	1200	1700	950
	220	-189 C	950	1150	400
	82	-193 C	1600	800	800
	123	-194 C	1400	ND	325
	151	−195 C	1300	1900	675
	16	-196 C	1000	1350	425

TABLE B.9 (cont.)

*					
x 79 TH	123	FLIP 82 -197C	1900	1550	800
x // In	151	-199C	1450	1250	300
	158	-203C	1350	1000	475
٠	151	-205C	1600	1700	ND
	49	-208C	1250	1450	300
	151	-219C	1400	1100	950
	220	-225C	1700	1450	825
	49	-228C	1150	1500	475
	151	-232C	1400	800	775
	151	-234C	1200	1550	425
	151	-236C	1700	1200	175
	101	-239C	700	1200	575
x 80 TH	60	-241C	1200	1100	175
x 79 TH	50	-245C	1050	1550	400
A 1 7 111	46	-246X	1400	1600	275
	151	-251C	1400	1450	450
	151	-254C	1300	1650	200
	151	-255C	800	1400	350
	151	-258C	1450	1500	175
	151	-259C	1100	1300	175
	151	-261C	1450	1850	150
CHECK GEN	OTYPES				
ILC 482			1000	1800	100
			1750	1750	900
		•	1400	1350	625
			1900	1550	750
			850	1800	700
Mean			1380	1650	615
C.V. %			33.1	11.9	49.6
			700	1550	75
					, ,
ILC 3279					
110 3279			1550	1500	375
ILC 3279			1550 1750	1500 1200	375 400
110 3279			1550 ¹ 1750 1100	1500 1200 600	375 400 200
			1550 1750 1100 1000	1500 1200 600 1350	375 400 200 100
Mean			1550 1750 1100 1000 1220	1500 1200 600 1350 1240	375 400 200 100 230
Mean			1550 1750 1100 1000	1500 1200 600 1350	375 400 200 100 230
Mean		Tunisian local check	1550 1750 1100 1000 1220	1500 1200 600 1350 1240	375 400 200 100 230
Mean		Tunisian local check	1550 1750 1100 1000 1220 34.8	1500 1200 600 1350 1240 30.9	375 400 200 100 230 65.8
Mean		Tunisian local check	1550 1750 1100 1000 1220 34.8	1500 1200 600 1350 1240 30.9	375 400 200 100 230 65.8
Mean		Tunisian local check	1550 1750 1100 1000 1220 34.8 1150 1400	1500 1200 600 1350 1240 30.9 1800 ND	375 400 200 100 230 65.8 800 775
Mean		Tunisian local check	1550 1750 1100 1000 1220 34.8 1150 1400 1700	1500 1200 600 1350 1240 30.9 1800 ND 1250	375 400 200 100 230 65.8 800 775 975
Mean C.V%		Tunisian local check	1550 1750 1100 1000 1220 34.8 1150 1400 1700 1650	1500 1200 600 1350 1240 30.9 1800 ND 1250 1500	375 400 200 100 230 65.8 800 775 975 675

Table B10 SEED YIELD OF ENTRIES IN THE IYT(S) AT TWO LOCATIONS IN 1983-84

ENTRY	PEDIGREE	S E E D	YIELD
		В	K
FLIP 81- 3	x 79 TH 23 'ILC 262x ILC 183'	1250	706
- 24	x 79 TH 16 'ILC 630x ILC 200'	1850	488
- 25	x 79 TH 16 'ILC 630x ILC 200'	1338	606
- 68 W	x 79 TH 123 'ILC 1929xILC 200'	1244	650
- 69	x 79 TH 4 'ILC 1929xILC 200'	1156	431
- 70	x 79 TH 151 'ILC 72 xILC 897'	1406	513
- 71	x 79 TH 151 'ILC 72 xILC 897'	1523	663
- 75	x 79 TH 158 'ILC 200 xILC 893'	1481	419
FLIP 82- 1C	x 79 TH 216 'ILC 202 xILC 577'	1050	488
- 2C	x 79 TH 216 'ILC 202 xILC 577'	1525	688
- 4C	x 79 TH 220 'ILC 72 xILC 480'	1150	694
- 9C	x 79 TH 168 'ILC 72 xILC 573'	1138	706
-16C	x 79 TH 168 'ILC 72 xILC 573'	1338	650
-20C	x 79 TH 25 'ILC 262 xILC 194'	1156	556
-22C	x 79 TH 123 'ILC1929 xILC 200'	1394	500
-25C	x 79 TH 123 'ILC1929 xILC 200'	1225	781
-26C	x 79 TH 123 'ILC1929 xILC 200'	1531	631
-39C	x 79 TH 158 'ILC 200 xILC 893'	1063	431
−75C	x 79 TH 203 'ILC 953 xILC 201'	1119	594
-77C	x 79 TH 219 'ILC 201 xILC3279'	1275	513
-87C	x 79 TH 101 'ILC 523 xILC 183'	1169	594
ILC 482		1481	619
ILC 3279	<u> </u>	1450	425
	Tunisian local check	1819	756
	Mean	1339	588
	C.V. %	37.7	20.0
	S.E.	253.9	58.8
	d.f.	68	69

Table B11. SEED YIELD OF ENTRIES IN THE IYT (S)-L AT TWO LOCATIONS IN 1983-84

	В	K	
			M
ILC 35	1450	813	1241
76	817	756	1035
83	1375	769	844
112	1542	800	966
116	1108	781	1025
132	1117	719	938
134	1492	788	804
135	783	775	988
136	1717	781	1235
165	1692	781	1019
171	958	719	1100
254	1442	813	910
451	1417	925	1160
464	1733	675	1088
496	875	706	1053
613	1225	813	1219
620	1142	769	1019
629	1100	831	1153
2587	1825	825	932
Tunisian local check	1317	825	1272
			4050
Mean	1306	783	1050
C.V%	39.2	19.4	18.5
S.E.	295.4	76.1	97.
d.f	38 ^(a)	79	79

⁽a) only 3 reps

Table B12 SEED YIELD OF ENTRIES IN THE AYT (S) 1 AT TWO LOCATIONS IN 1983-84

ENTRY	FUS RATING	SEED	YIELD
	В	В	К
ILC 4	5.50	221	1213
116	7.00	109	1013
134	7.25	63	1219
136	2.50	<u>8</u> 75	1181
165	6.50	129	915
237	2.00	<u>866</u>	1125
262	8.25	38	1031
451	5.25	175	<u>1363</u>
493	4.25	<u>475</u>	1269
1102	6.75	71	856
FA010014	6.50	41	506
ILC 2208	2.00	<u> 1046</u>	1013
2587	4.75	466	831
F 80-14	3.00	<u>846</u>	644
35	5.50	<u>34 1</u>	700
F 81-31	5.25	138	1069
-40	7.50	91	1050
- 52	3.00	<u>438</u>	550
- 54	2.00	488	1225
-63	7.00	250	<u>1438</u>
- 65	3.75	<u>591</u>	1094
80TH 63	5.50	263	819
116	7.25	150	1075
136	6.50	113	1006
137	5.00	484	969
207	8.00	91	856
PL82 O.Mellez	5.75	59	825
PL Sfax	6.25	241	<u>1675</u>
M. Desi	6.75	263	<u>1406</u>
M. Lisse	6.50	79	906
PL Se Beja 3	3.50	975	963
FAO 10025	8.00	116	813
PL Amdoun (local check)	6.75	63	763
Mean		323	1012
C.V. %		35.5	34.
SE.		82.6	176.
df.		63	94

Table B13. SEED YIELD OF ENTRIES IN THE AYT (S) 2 AT TWO LOCATIONS IN 1983-84

ENTRY	THE DAMEN	CPTN	YIELD
	FUS. RATING	В	K
PL-Se-Be-81-5	1.50	1391	1281
6	2.25	<u>1731</u>	1656
7 `	2.00	<u>1478</u>	1725
9	1.50	1500	1381
10	1.75	1562	1681
11	1.50	<u>1635</u>	1713
22	1.50	1522	1781
27	1.50	<u>1116</u>	2188
28	1.75	1428	1625
40	2.00	<u>1543</u>	1575
41	1.50	1506	1631
48	1.75	<u>1737</u>	1725
78	1.50	1400	1644
87	1.50	1875	1819
103	1.00	1793	1600
116	1.50	1553	1669
120	1.75	1653	1363
126	1.50	1487	1538
128	1.75	1468	1169
144	2.00	1475	1856
146	2.00	1250	1388
149	1.25	<u>1553</u>	1488
FAO 10025	6.25	460	1269
28 III Fretissa	5.00	780	1325
30 II Fretissa	6.25	435	1575
P.L Amdoun local check	6.00	460	1413
CHECK			
Mean		1250	1580
C.V. X		22.6	20.
S.E.		155.1	161.
d.f.		75	7 <i>2</i> [a]

⁽a) 3 missing values calculated

TABLE B14 FUSARIUM WILT RATINGS (FR) AND SEED YIELD OF ENTRIES IN THE AYT (S) 3 AND AYT (S) 4
AT BEJA IN 1983-84

AY	(s)	3	AYT	(S) 4	
ENTRY	FR	SEED YIELD	ENTRY	FR	SEED YIELD
x 81 TH 29	7	994	x 81 TH 53	6	538
41	3	525	56	2	669
48	4	469	84	6	619
49	3	563	85	4	1663
55	7	350	101	5	794
108	5	588	104	6	506
109	5	988	105	3	413
116	6	588	111	6	988
117	6	450	112	2	413
123	5	506	113	4	631
130	5	894	120	4	338
171	5	713	125	5	181
190	6	663	126	3	856
203	5	488	146	4	1519
FAO 10025	8	344	FAO 10025	9	188
L Amdoun	2	656	PL Amdoun	5	1444
lean		611	Mean		735
. V %		52.0	C. V %		130.9
5.E.		158.7	SE.		120.3
l.f.		45	d.f.		45

TABLE B 15. PERCENTAGE FUSARIUM INFECTION AND SEED YIELD OF ENTRIES IN THE PYT (S) AT BEJA IN 1983-84

	% FUSARIUM	SEED	NUMBER OF
ENTRY	INFECTED PLANTS	YIELD	REPLICATIONS
FTA (82) 2	25	475	2
5	5	<u>1000</u>	1
9	3	<u>1163</u>	2
- 10	3	<u>1013</u>	2
12	0	<u>1188</u>	2
13	3	<u>1375</u>	2
15	43	<u>925</u>	2
16	8	<u>1025</u>	2
21	3	1088	2
23	2	1038	4
29	4	988	4
33	4	1175	4
34	3	988	2 4
37 38	10 0	919 969	4
36 39	5	1375	2
40	5 5	950	2
41	5	1263	. 4
46	3	925	2
49	3	1138	2
50	Õ	700	2
Tunisian Local	63	391	6
Mean		951	
C.V%		26.4	
S.E.	one rep. two reps. four reps. six reps.	250.9 177.4 125.4 88.7	

Table B16. SEED YIELD OF ENTRIES IN INTERNATIONAL ASCOCHYTA BLIGHT NURSERY AT TWO LOCATIONS AND BLIGHT RATINGS (ABR) AT BEJA IN 1983-84

ENTRY	PEDIGREE	SEED	YIEL	D
		В	K	ABR
ILC 72	Lot No. 4	700	775	, 2
182	Teninakanskij	350	1150	2
187	-	700	1475	4
195	-	400	1325	2
196	-	675	775	2
200	STEPNOJ 1	300	1350	2
201	VYR 32	450	1175	2
202	VYR 32	825	1625	2
215	PI 222770	305	1075	4
482	Acc No. 26780-68	450	1975	2
2380	P 9655	200	1450	2
2506	_	200	1275	2
2956	-	400	1300	2
3274	-	300	600	3
3279	_	800	1350	3 2 2
3346	-	525	1400	2
3856	_	675	2000	4
3864	Borisovo 1	325	1100	3
3866	Hemus	475	1100	4
3868	Plovdiv 8	650	1300	4
3870	Sinapovo 3	325	1375	4
4421	-	400	1725	4
FLIP 81 - 41	x 75 TA 131	600	1175	2
59	x 75 TA 206	200	1750	6
70	x 79 TH 151	325	1725	3
71	x 79 TH 151	650	2050	3
- 75	x 79 TH 158	200	1675	4
-293	x 79 TH 8	550	1550	3
FLIP 82 - 1C	x 79 TH 216	1200	2275	4
2 C	x 79 TH 216	550	1425	3
3C	x 79 TH 216	325	1350	4
26C	x 79 TH 123	625	1550	4
40C	x 79 TH 8	300	2075	5 7
59C	x 79 TH 151	175	1700	
61C	x 79 TH 216	400	1350	2
64C	× 80 TH 264	925	1125	4
65C	x 79 TH 221	550	1400	3
68C	x 79 TH 221	450	1325	3
74C	x 80 TH 213	375	1475	4
91C	× 79 TH 158	375	1300	4
99C	x 79 TH 151	275	1625	4
100C	x 79 TH 151	275	1900	4

Table B.16 (cont.)

ENT	RY	PEDIGREE	SEED B	YIELD K	AB
FLIP 82	129C	х 79 ТН 8	400	2000	2
	178C	× 80 TH 60	250	1125	5
	191C	x 79 TH 8	700	1850	4
	222C	x 79 TH 219	325	2050	4
	239C	× 79 TH 101	400	2225	4
	246C	x 79 TH 76	425	1450	
	259C	x 79 TH 151	450	1675	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
ICC	641	_	625	975	2
	2160	· ·	350	475	2
	3932	**	625	500	2
	4256	-	650	850	2
	5035	-	175	1525	2
	5124	_	350	1300	3
	5127	-	375	1825	2
	5566	-	400	1725	2
	6304	-	500	1300	4
	6306	-	425	1125	
	6336	-	600	1250	3
	6373	-	725	1225	2 3 2 2
	6945	-	650	450	2
	6981	_	175	650	_
	6988	-	500	675	2
	6989		500	550	2
÷	7028	<u> </u>	250	1325	2 2 2
NEC	138.2		300	1675	6
Pch	15	-	350	675	5
	70	-	725	1425	5 2 2
	124	_	450	1050	2

CHECK GENOTYPE

Tunisian local check (repeated 72 times)

Mean	598	1558	6.9
C.V. %	51.1	29.3	2.4

5. LENTIL IMPROVEMENT

5.1 Introduction

In the previous two seasons the number of lines that significantly outyielded the local check suggested that meaningful yield advances could be achieved. Last season, however, after four local cultivars were tested in two trials it was evident that the local cultivar from Beja, which had been used as the check in the previous two seasons, was considerably lighter yielding than the other three. Accordingly it seems possible that the potential for achieving advances over the local cultivar(s) could have been over estimated, and clearly further evaluation of different local cultivars is required and is being undertaken. Meanwhile the heaviest yielding of the local cultivars, namely, the one from Oueslatia is currently being used as the local check in all trials.

Two seasons ago there was a severe attack of Scelerotinia spp. on the trials at Beja and a light attack of rust (Uromyces spp.) on the trials at Kef, but no pests or diseases were observed during this or the last season. This crop report provides a summary of the complete results from all trials and nurseries contained in appendix C, and any table in this appendix that is referred to in the report is prefixed by the letter C, whereas summary tables have no such prefix.

5.2 Results and discussion of yield trials and nurseries

Seed yield results are available from testing 153 lines and 78 F₃ populations in replicated trials at one or two locations, and 151 lines in non-replicated screening nurseries at two locations (table 5.1). For each experiment table 5.1 also gives a summary of the yield data and the relevant table number in appendix C for the complete results.

A considerable number of the lines in the trials exceeded the local check at individual locations, and of 84 tested at two locations 22 did so at both locations (table 5.1). However, only 12 of these latter lines showed a significant increase over the local check and this was confined to the Beja location (table 5.1). Seed yield data on the five heaviest yielding lines are given in table 5.3, and interestingly the line ILL 8 is a tall type that can be harvested with a cutter bar.

All of the 69 lines tested in trials at the INRAT station in Tunis outyielded the local check, and 6 and 9 lines in the preliminary yield trials (PYT) 3 and 5 respectively did so significantly (table 5.1). Yield data on the top five lines in each trial are included in table 5.3. These 69 lines had previously been rejected on the basis of seed yield in ICARDA's base programme in Syria, and the contrasting performance of these lines in the two countries may

Table 5.1 A summary of the yield results of lentil lines tested in replicated yield trials (YT) at Beja (B), E1-Kef (K) and Tunis-INRAT (T) locations in 1983-84

				Nui	nber	of lines:								
Trial designation tested		tested	ested exceeding the local check at:		significantly (1) exceeding the local check at:		Coefficients of variation			Table No. and abbreviation in appendix C				
			в к т	A11 ⁽²⁾	В	K	T	A11	В	K	T			
Internationa	1 YT(L) (3)	23	22	2	-(4)) 2	10	0		0	16.5	24.7	_	1 (IYT-L)
Advanced	ΥT	19	12	19	-	12	0	0	~	0	28.0	31.0	-	2 (AYT)
Preliminary	YT-Ta (3)	13	9	4	-	3	2	0	~	0	21.6	23.3	_	3 (PYT-Ta)
II	YT 1	15	10	4	_	4	0	0	~	0	39.4	25.5	-	4 (PYT 1)
11	YT 2	14	1	3	-	1	0	0	-	0	28.7	22.1	-	5 (PYT 2)
•	YT 3	23	-	-	23		-		6		-	-	47.7	7 6 (PYT 3)
tt	YT 4	23	-	-	23		_	-	0		-	-	45.9	9 7 (PYT 4)
11	YT 5	23	_	_	23		_	_	9		-	_	59.5	5 8 (PYT 5)

⁽¹⁾ If more than one local check than exceeding the larger value

⁽²⁾ Number of lines exceeding the check at all test locations.

⁽³⁾ L = large seeded, Ta = tall

⁽⁴⁾ Trial not grown at this location

Table 5.2 A summary of the yield results of lentil populations tested in replicated yield trials (YT) and of preliminary lines tested in screening nurseries (SN) at Beja (B), El-Kef (K) in 1983-84

		Nun	ber o	f popu	lations/	lines					
Trial designation		tested exceeding the local check at		local check at				Table No. and abbreviation in appendix C			
	·		В	K	A11 ⁽³⁾	В	К	A11	В	K	
International F ₃	YT	40	27	7	5	0	0	0	40.2	33.0	9 (IF ₂ T)
" F ₃	YT (E) (4)	38	23	7	5	8	0	0	34.2	38.1	10 (IF ₃ T-E)
ti .	SN(L)	46	12	13	6						11 (ISN-L)
tt	SN(T-E)	46	8	16	3						12 (ISN-T-E)
n	SN(E)	59	1	- (5)	1						13 (ISN-E)

⁽¹⁾ If more than one local check then exceeding the larger value.

⁽²⁾ Results from screening nurseries (SN) not analysed statistically

⁽³⁾ Number of populations exceeding the check at all test locations.

⁽⁴⁾ E= early, L= large, T= tall.

⁽⁵⁾ Screenig nursery not grown at this location

Table 5.3 Seed yield (SY) in kg/ha, and as a percentage (%) of the local check, of superior lentil lines at Beja and E1-Kef locations (A) and at the INRAT station, Tunis (B) in 1983-84

		Bej	a .	Ke	f			
Line	Selection	sy ⁽¹⁾	7.	SY	%	Mean	7.	Trial
ILL 8	-	1806	143	1038	106	1422	127	PYT-T
19	78\$ 26018	1692	153	1442	104	1566	126	IYT~L
842	-	1617	146	1400	101	1509	121	***
20	-	2167	196	767	55	1467	118	"
28	74 TA 19	1558	141	1275	92	1417	114	11
Line	PYT 3 Cross	SY		Line	PYT 5 Cro	oss	SY	
81S 33045	X 76 TA 2	497		81 \$ 33	726 X 7	75 TA 81	<u>311</u>	
	X 75 TA 73	390		28	082 X 7	75 TA 11	292	
33488		=		34	744	38	258	
33488 32430	23	346						
	23 X 76 TA 9	348 336		35	786	169	256	
32430	•				786 777	169 169	256 202	

⁽¹⁾ Underlined values significantly (P<0.05) exceeded the local check

reflect either differences in the yield potential of the local cultivars used as checks, and /or the effect of differing environmental conditions. However, this season in the trials testing these lines the mean yields were low and the coefficients of variation large, and thus further and more accurate yield evaluation is required before any definitive conclusion can be reached.

Of the 78 F₃ populations 9 outyielded the local check at both locations and 8 populations in the 'early' trial did so significantly at the Beja location (table 5.1). In comparison to the material in the yield trials relatively few of the lines in the screening nurseries exceeded the check at individual locations and only 9 out of 92 did so at both locations. However, as experience has shown that little weight can be attached to the yield levels recorded in these non-replicated nurseries, a large number will be evaluated in replicated trials next season.

In spite of the exclusive use of the local cultivar from Oueslatia in all the trials this season's results still indicate that there is material superior to the local cultivar(s). The yield data presented in table 5.4 for four lines over three years at two locations confirms this view, although it should be remembered that in the first two years of testing the local check was the lighter yielding local cultivar from Beja.

Table 5.4: Seed yield in kg/ha of four lentil lines over three seasons at Beja (B) El Kef (K) in Tunisia.

			Seas	son				
	1981-	82	1982-		1983-8	34		
Entry	В	K	В	K	В	K	Mean	% local
ILL 4354	1634	1716 ^(a)	1904	1253	1358	792	1443	154
ILL 4400	1774	I 334	1796	<u>1350</u>	2000	1167	1570	168
Tunisian Local	1059	625	1225	633	1592	475	935	100
SE ±	227.1	139.5	141.5	74.3	232.8	138.1		:
đf	44	45	27	27	57	57		
ILL 28	1685		1583	1363	1558	1275	1493	149
ILL 262	1683	•	1562	1304	1692	1050	1458	145
Tunisian local	665		754	1113	1108	1383	1005	100
SE +	219.3		65.5	5 138.1	140.7	152.9		
df ~	30		30	40	46	46		

⁽a) Underlined values significantly (P \leqslant 0.05) exceeded the Tunisian Local Check

5.3 Appendix C. Results of the lentil breeding trials and Nurseries, 1983-84

Abbreviations used in the tables

1. Locations : B - Beja

K - El Kef

M - Mateur

T - INRAT, Tunis

- 2. Data :
- a) Seed yield data is expressed in kg/ha
- b) % local check seed yield of entries expressed as a percentage of the Tunisian local check
- c) Data values those underlined were significantly (p< 0.05) superior to the Tunisian local check
- d) N D (or -) data not available
- 3. Statistics: CV% 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 TWO LOCATIONS IN 1983-84

ENTRY	SELECTION	SEED	YIELD
		В	K
ILL 8	78 S 26002	1475	1075
19	78 S 26018	1692	1442
20	_	2167	767
26	78 S 26032	1242	1250
26	78 S 26033	<u>1625</u>	875
28	74 TA 19	<u>1558</u>	1275
43	78 S 26038	1083	1100
5441	Araucana - INIA	1350	800
54	74 TA 72	1358	1175
193	78 S 26066	1242	1333
254	74 TA 264	1408	958
262	74 TA 276	<u> 1692</u>	1050
323	76 TA 66136	1167	833
465	-	1317	567
707	-	1417	1175
841	78 S 26181	1375	1242
842	-	<u> 1617</u>	1400
857	_	1492	1208
4400	Syrian local	<u>1583</u>	975
4523	-	<u>1567</u>	1208
4605	Precoz	1458	883
4606	Nablus	<u> 1850</u>	767
253x210	FLIP 84 - IL	<u>1508</u>	983
	Tunisian local check	1108	1383
Mean		1473	1072
CV%		16.5	24.
SE		140.7	152.
df		46	46

TABLE C2 SEED YIELD OF ENTRIES IN AN AYT AT TWO LOCATIONS IN 1983-84

E N T R Y	SEED	YIELD
	В	К
ILL 837	1742	1192
241	1267	934
346	1708	842
857	2017	1075
842	1425	1125
7	1650	742
780	1433	959
ILL 6	1208	892
79 Sh 4908	2167	900
x 75 TA 50/78 S 13572-2	1842	809
74 TA 138	1674	633
74 TA 264	1333	1075
Jordanian local	2000	1167
Syrian local large	1358	792
ILL 851	1442	817
707	1775	742
28	1725	850
20	1908	775
ILL 4606	2025	950 475
Tunisian local large	1592	475
Mean	1665	887
C.V.%	28.0	31.1
S.E.	232.8	138.1
d.f	57	57
d.f	57	57

TABLE C3 SEED YIELD OF ENTRIES IN A PYT-Ta AT TWO LOCATIONS IN 1983-84

ENTRY	SEED	YIELE
	ъ.	K
76 TA 3	1531	1200
ILL 500	1388	919
75 TA 29	1650	806
76 TA 143	1456	1031
ILL 8	1806	I038 ·
ILL 23	<u>1669</u>	925
75 TA 85	1213	800
77 TA 78	152 5	881
ILL 9	1750	788
ILL 20	1656	938
76 TA 75	1200	1144
77 TA 8I	938	769
77 TA 80	931	63I
Tunisian local check	1263	975
Mean	I427	917
c.v %	21.6	23.3
S.E.	154.2	106.8
d.f	39	39

TABLE C4 SEED YIELD OF ENTRIES IN A PYT 1 AT TWO LOCATIONS IN 1983-84

ENTRY	SEED	YIELD
	В	K
251029	322	556
- '	411	756
ILL 4605	489	856
X 77 TA 77	500	967
X 76 TA 7I	711	I067
ILL 780	311	922
8155	822	811
254554	456	1067
ILL 4400	511	1089
ILL 39	378	1000
ILL 2582	589	IOII
X 77 TA 27I	634	1189
X 76 TA 143	778	911
ILL 4524	511	822
X 76 TA 66	378	956
Tunisian local check	433	1045
Mean	515	939
C.V. %	39.4	25.5
S.E.	117.0	I38.4
d.f	30	30

TABLE C5 SEED YIELD OF ENTRIES IN A PTY 2 AT TWO LOCATIONS IN 1983-84

ENTRY	SEED	YIELD
	В	K
		-0.1-
ILL 2149	1200	I345
X 76 TA 27I	1156	1256
ILL 45	1167 1211	1233 1278
X 77 TA 78 2296II	1211 1155	II33
81574	1067	778
ILL I	1155	1578
X 75 TA 74	1333	1222
297749	922	1589
ILL 4354	1111	878
297743	1089	1233
ILL 193	844	1389
76 TA 271/80541472	1300	1233
76 TA 27I	1555	1478
Tunisian local check	1355	1455
Mean	1175	1265
C. V. %	28.7	22.
S.E. d.f	194.7 28	161. 28

TABLE C6 SEED YIELD OF ENTRIES IN A PYT 3 AT THE INRAT STATION, TUNIS IN 1983-84

ENTRY	SELECTION	SEED YIELD
x 76 TA 182	81 S 31374	230
182	31341	<u>577</u>
182	31359	208
x 75 TA 23	31358	205
x 76 TA 169	30911	263
x 76 TA 9	28055	<u>336</u>
x 75 TA 23	32362	225
ж 76 ТА 182	31384	197
x 75 TA 5	32227	126
x 76 TA 182	31383	252
x 75 TA 23	32361	223
ILL 4400	Syrian local large	183
x 75 TA 81 x 76 TA 2	81 S 33694 33045	241 497
x 75 TA 43	32805	162
59	33132	167
81	33706	269
23	32393	208
73	33463	191
79	33608	260
73	33488	390
43	32771	121
23	32430	348
-	Tunisian local check	75
Mean		248
CV %		47.7
S.E		68.4
d.f	· · · · · · · · · · · · · · · · · · ·	46

TABLE C7 SEED YIELD OF ENTRIES IN A PTY 4 AT THE INRAT STATION TUNIS IN 1983-84

and the second of the second o

ENTRY	SELECTION	SEED YIELD
x 75 TA 59	81 S 33133	156
x 76 TA 11	34393	292
11	34498	323
32	34708	193
12	34541	292
10	34347	300
9	34287	304
9	34265	504
146	35671	262
38	34753	301
143	35629	356
ILL 4400	Syrian Local Large	108
x 76 TA 143	81 S 35641	364
146	35666 35509	331 238
136 75	33309	157
38	34743	214
139	35529	232
136	35495	213
75	34900	266
81	35111	188
143	35656	200
32	34713	203
-	Tunisian local check	86
Mean	to the west of the second	253
CV %		45.9
S.E		67.1
d.f		46

TABLE C8 SEED YIELD OF ENTRIES IN A PYT 5 AT THE INRAT STATION TUNIS IN 1983-84

ENTRY	SELECTION	SEED YIELD
x. 76 TA 139	81 S 35563	164
38	34744	258 888
169 x 75 TA 81	35777 33736	<u>202</u>
Prog. Loc.	33726 38294	<u>311</u> 115
x 75 TA 37	32654	218
x 76 TA 169	35786	$\frac{218}{256}$
66	28515	98
x 75 TA 81	33714	140
x 76 TA 173	35716	34
Prog. loc.	38350	36
ILL 4400	Syrian local large	75
x 76 TA 173	81 S 35836	161
6	34234	67
4	34162	50
x 75 TA 81	33728	64
x 76 TA 139	35553	<u>165</u> .
x 75 TA 77	33567	107
28	32464	74
x 76 TA 11	34412	136
3	34109	73
11	28082	<u>292</u>
x 75 TA 28	32463	147
-	Tunisian local check	21
Mean		136
C.V.%		59.5
S.E.		46.7
d.f		46

TABLE C9 SEED YIELD OF ENTRIES IN AN IF3T AT TWO LOCATIONS IN 1983-84

E N T	R Y		S E E D	YIELD
	4 - 4 %	and the second of the second o	. В	K
· · · · · · · · · · · · · · · · · · ·				
x 82 S	8		850	1213
	14		1075	675
	20		77 5	1050
	30		713	750
	31		1125	975
	32		1063	988
	33		1450	1213
	36		900	975
	40		1663	1675
	41		1400	1013
	45		1088	ND
	49		1313	1488
	55		1475	1100
	17		1063	1163
	60		1063 1475	1125
	61			1463
	63 71		1013 675	888 1150
	71		1438	1063
	73	e la granda de la composición de la co	1413	750
	75		825	1175
	76		1213	1350
	82		1063	1013
	89		1113	1163
	105		875	1613
	106		713	1200
	118		650	1438
	281		1263	750
	286		750	788
	288		1525	775
	289		700	938
	293		1188	1300
	3 01		1388	925
	304		1275	1038
	307		1200	550
	314		750	1050
	315		863	1100
	322		1075	988
	328		1825	825
	332		1163	625

TABLE C9 (continued)

ENTRY	SEED B	YIELD K
Tunisian Local check	1000	1288
Tunisian local check	1288	1075
Tunisian local check	675	1175
Mean	1102	1068
C.V %	40.2	33.0
S.E.	313.4	249.0
d.f	42	40 ^a

a - 2 missing values

TABLE C10 SEED YIELD OF ENTRIES IN AN IF₃T-E AT TWO LOCATIONS IN 1983-84

x 82 S 165 167 168 169 172	SEED	YIELD
167 168 169 172	В	К
167 168 169 172		
168 169 172	1075	338
169 172	9 50	513
172	738	713
	938	650
	813	288
173	900	888
174	413	438
175	363	613
176	850	763
. 177	1038	1075
179	713	675
180	1325	800
181	650	400
186	1450	1213
189	638	725
190	988	525
194	588	1000
199	1250	588
206	688	475
207	1225	550
215	850	625
220	1150	625
225	988	600
226	388 543	263 775
228	513	775
229	863 1125	1138
230	713	1075
231 233	1013	1038 663
	463	688
234 235	763	588
237	763 363	313
237	1313	900
230	1263	550
245	1163	300
245	1288	300

TABLE C10 (continued)

ENTRY	SEED B	YIELD K
349 82 S 355	775 1050	988 913
Tunisian local check	775	963
Tunisian local check	525	950
Tunísian local check	513	550
Mean	864	684
C.V %	34.2	38.1
S.E	208.9	183.8
d.f	40	40

TABLE C11. SEED YIELD OF ENTRIES IN AN ISN-L TWO LOCATIONS IN 1983-84

ENTRY	SELECTION	SEED	YIELD
		В	K
ILL 4400	8I, § 30935	1400	1550
4400	81 \$ 38291	900	950
4400	8I S 38326	1300	900
4400	8I S 38342	900	950
4515	~	900	1050
4605	Precoz	450	700
323 x 199	FLIP 84-68L	1300	1700
253 x 210	-69L	650	900
253 x 210	-70L	350	900
351 × 210	-71L	1050	1250
479 × 212	-72L	1200	1650
883 x 470	-73L	1100	1100
883 x 214	-74L	1150	700
883 x 470	-75L	1350	1100
39 x 984	-76L	I500	1200
20 x ILWL I	5 −77L	1700	1150
(449x226) x (351x212)	-78L	950 7050	1000
(351x173) x (251x199)	-79L	1050	II50
502 x 1719 889 x 588	-80L	I200	1200
20 x ILWL I	-8IL -82L	IO50 IO50	1250 1500
20 x ILWL I	-83L	1050 1450	1000
445 x 35	-84L	900	1250
445 x 470	-85L	1000	550
333 x 199	-86L	700	1100
253 x 35	-87L	1400	850
470 x 470	-88L	1800	1400
253 x 470	-89L	1500	1300
IOI x 262	-90L	1300	1000
262 x 350	-9IL	1250	750
262 x 445	-92L	1500	1250
262 x 470	-93L	1050	1300
262 x 470	-94L	850	900
39 x 32I	-95L	1000	1100
IOI x 32I	-96L	350	1600
39 x 479	-97L	750	950
262 x 35	-98L	1200	800

ENTRY	SELECTION	SEED	YIELI
		В	ĸ
IOI x 25	- 99 L	1100	ND
IOI x 445	-100 L	950	1000
345 x 470	-IOI L	950	900
262 x 35	-102 L	I500	1300
253 x 35	-103 L	1500	1150
253 x 470	-104 L	1450	700
253 x 470	-IO5 L	1400	1000
39 x 479	-106 L	1050	1000
39 x 784	-107 L	850	700
· · · · · · · · · · · · · · · · · · ·	en e		
CHECK GENOTYPES	•		
ILL 4400	Syrian Local Large	950	1550
•		850	900
	•	950	IIOO
	W	950	1000
	Mean	925	1138
	C.V. Z	5.4	25.2
	N. Sq.		
ILL 8	87 S 26002	I250	II 50
		1300	500
		900	1400
		1250	750
	Mean	1175	<i>9</i> 50
•	c.v. %	15.7	42.3°
	Tunisian Local Check	IO50	950
	÷	900	1200
		900	850
	;	I350	900
	Mean	IO50	9 75
	c.v z	20.2	15.9

TABLE C12 . SEED YIELD OF ENTRIES IN AN ISN-T-E AT TWO LOCATIONS IN 1983-84

ENTRY	SELECTION	SEED	YIELD
		В	К
ILL 8	78S 26002	1050	750
8	78S 26003	1000	1000
9	78S 26004	1200	1150
20	-	900	900
99	76 TA 66054	900	950
IOI	74 TA 138	750	1100
II2	78 S 26052	1000	1000
468	-	1300	900
784	Giza 9	750	1400
813	-	750	750
1939	_ _	1000	900
4399	Laird	700	600
4354	Jordanian local	1200	1400
4400	81 S 31368	1150	650
4605	Precoz	500	1300
4711	Chilean 78	550	1400
IOI x 2I2	FLIP 84 - 13	1250	1450
345 x 35	- 42L	1000	750
500 x 1719	- 43L	1650	1750
500 x 1719	- 44L	1200	1150
39 × 784	- 47L	950	700
262 x 35	- 48L	1150	1450
262 x 35	- 49L	1100	800
262 x 784	- 50L	I450	700
883 x 470	- 51L	1600	1300
39 x 479	- 58L	1650	1900
883 x 470	, - 78L	850	1200
449 x 2I2	-I16L	1000	850
(I76x226)x(345x2I7)	-124L	1200	1300
I76 x 555	-125L	1200	1250
345 x 199	-126L	1300	1000
IOI x 350	-128L	1250	950
262 x 445	-129L	1550	850
262 x 445	-I30L	1050	1250
500 x 35	-13IL	1650	1100
500 x 35	-I32L	1300	. 850
883 x 470	-133L	1050	I450
IOI x 199	-134L	1250	1400
500 x 2	-135L	1700	1300

TABLE C 12 (continued)

ENTRY	SELECTION	SEED	YIELD
		В	К
500 x 1719	- 137L	1050	1350
500 x 1719	- I38L	1000	1100
500 x 1719	- I39L	800	1100
345 x 35	- 140L	1100	600
345 x 32I	- 141L	1250	1800
500 x 254	- I42L	900	1650
-	- 143L	1750	1050
CHECK GENOTYPES			
ILL 440I	Syrian local	800	1150
	-	1250	I550
		1000	900
		IIOO	1250
	Mean	I038	1213
	C.V%	18.2	22.2
TLL 2130	Hurani I	950	1400
		1050	1250
		1150	1050
		1050	1250
	Mean	1050	1238
	C. V%	7.8	11.6
	Tunisian local check	1300	1050
		1000	1000
•	•	1150	1100
		1050	1200
	Mean	II25	1088
	C. V%	II.8	. 8.0

TABLE C13 SEED YIELD OF ENTRIES IN AN ISN-E AT BEJA STATION IN 1983-84

ENTRY	SELECTION	SEED YIELD
ILL 1	76 TA 66005	1750
358	-	1500
784	Giza 9	1550
813	F. 130	1100
1693	_	1050
1701	EL - 31	1250
1712		950
1713	EL 43	1050
1861	Selaim	1450
1866	_	1350
1983	L 528 (75)	1000
2022	L 1057	400
2069	L 1327	850
2149	_	1500
2439	_	850
2500	Pant. L- 538	350
2501	Pant-L-406	450
2526	т - 36	850
2532	-	1450
2573	Pant - L-639	350
2578	L 830	550
2580	L 1278	700
2581	L 1282	650
2582	LL 1	450
2590	LWS 3	1100
34 16	E P 3	1200
3493	в 77	550
3516	LG 41	750
3517	LG 46	750
3601	LL 37	450
3614	LL 57	850
4062	-	1300
4236	-	950
4374	-	1400
4377	Pant L 286	850
4401	81 S 38084	1250
4403	162	600
5071	EL - 142	1150
5425	r - 186	1100

Table C13 (continued)

ENTRY	SELECTION	SEED YIELD
39x 983	FLIP 84-108 L	1050
20 xILWL 1	- 67L	1050
0 x ILWL 1	- 29L	1550
83 x 470	-109L	1350
74 x ILWL 1	-110L	1700
53 x 470	-111L	1250
83 x 470	-112L	1600
9 x 35	-113L	1450
9 x 479	-114L	1500
9 x 479	-115L	1250
49 x 212	-116L	1000
00 x 35	-117L	1350
00 x 1719	-118L	1050
00 x 35	-119L	1350
00 x 35	-120L	1050
-	- 56L	1850
33 x 470	-121L	1550
3 x 516	-122L	1300
0 x 866	-123L	1300
3 x 470 ECK GENOTYPES	- 78L	850
nisian local		1750
		1450
		1200
		1150
		1600
an		1430
v%		17.9
rdan local (ILL	4534)	1600
		2050
		1 100
		1700
		1450
an		1580
V%		22.0
ecoz (ILL 4605)		1200
		800
		650
		1250
		700
an		920
٧Z		30.9

6. AGRONOMIC STUDIES

6.1 Introduction

The agronomy trials conducted during 1983/84 season and of which the results are presented below, were the following:

Date of Planting and Plant Population Trials (DPPT)

Fertility Trials (N, P, K)

Weed Control Trial

Iron Chlorosis Trial on chickpea

Details of the treatments for the DPPT are given in Table 6.1.

6.2 Results and Discussion

6.2.1 Date of Planting and Plant Population Trials:

The treatments (Table 6.1) had a significant effect on the yield of all crops. Results of chickpea trial are not reported because of the associated high CV's. All the results are in Tables 6.2 and 6.3. The high CV's observed in Beja trials can be explained by the Orobanche infestation in faba bean and an attack of wilt in lentil plots.

1. Faba beans: Early planting dates (D_1 to D_3) have given the highest yields (Table 6.2). Faba bean large seems to respond to early sowing, better than does faba bean small. The low yields obtained with D_1 at Beja were due to a high Orobanche infestation associated with that particular date. The highest plant population level (P_1) resulted in a substantial yield increase (Table 6.3); it had, in some cases, doubled the yield when compared to the lowest plant population level (P_A).

Table 6.1. Plant Population Levels (number of plants/m²) and dates of sowing used in the DPPT at different locations in Tunisia in the 1983/84 season

Locati	on Factor		a bean rge	Fa	ba bean Small	Peas	Lentils	Chickpeas
A11	Population				Plan	ts/m ²		
	P ₁		12,5		50,0	100,0	165,0	31,2
	P ₂		8,3		25,0	50,0	82,5	20,8
	P ₃		6,2		16,6	33,3	54,9	15,62
	P ₄		5,0		12,5	25,0	41,2	12,5
eja	Date of so	ving	_					
	D ₁	8	Nov	8	Nov	8 Nov	8 Nov	1 Feb
	D ₂	23	Nov	23	Nov	23 Nov	23 Nov	15 Feb
	D ₃	8	Dec	8	Dec	8 Dec	8 Dec	1 March
	D ₄	23	Dec	23	Dec	23 Dec	23 Dec	17 March
	D ₅	9	Jan	9	Jan	9 Jan	9 Jan	3 Apr
l-Kef	Date of so	wing	<u> </u>					
	D ₁	7	Nov	7	Nov	7 Nov	7 Nov	20 Feb
	D ₂	22	Nov	22	Nov	22 Nov	22 Nov	1 March
	D ₃	13	Dec	13	Dec	13 Dec	13 Dec	14 March
	D ₄	23	Dec	23	Dec	23 Dec	23 Dec	29 Apr
	D ₅	19	Jan	19	Jan	19 Jan	19 Jan	-

Table 6.2. Mean Yields (qx/ha) of different food legumes as affected by dates of sowing in the D.P.P.T. at Beja and Kef in 1983/84.

Dates	Faba bea	n Large	Faba bea	n Small	Lenti	ls	Peas	
	Bja	Kef	Beja	Kef	Beja	Kef	Beja	Kef
D ₁	610	2827	691	1904	575	1830	1041	1896
D ₂	1077	2193	1467	2005	506	1605	1651	1906
D ₃	1147	1802	1797	1916	538	1192	1647	1405
D ₄	905	1361	1236	1259	449	916	1102	1248
D 5	642	713	970	1298	221	229	947	911
cv%	45.1	33.9	31.2	98.4	40.3	39.0	20.2	20.0
S E	0.99	1.51	0.95	2.35	0.62	1.00	0.6	5 0.74

Table 6.3. Mean Yields (qx/ha) of different food legumes as affected by the plant population levels in the D.P.P.T. at Beja and Kef in 1983/84.

Dates	Dates Faba bean Large Faba bean Small			Lentils		Peas		
	Beja	Kef	Beja	Kef	Beja	Kef	Beja	Kef
P ₁	1173	2114	1864	2061	645	1432	2195	1942
P ₂	923	1793	1238	1663	424	1359	1123	1574
P ₃	792	1679	955	1467	405	1060	980	1266
P ₄	617	1531	773	1515	357	793	811	1114
C V %	33.7	21.9	25.10	19.0	36.1	26.2	22.5	23.7
S E	0.66	0.87	0.68	0.83	0.52	0.68	0.64	0.95

- 2. Lentils: At El-Kef delaying the seeding till D_3 resulted in an important decrease in yield (35%). At Beja no difference was observed between D_1 and D_4 , the last date D_5 produced 50% of the yield obtained with the first date. Increasing plant populations level $(P_1 \text{ and } P_2)$ resulted in substantial increase in yields (80% at El-Kef and Beja).
- 3. Dry peas: The results obtained this year confirm those of last year. The dates of planting can be more flexible at Beja than at El-Kef where the earliest date of planting appears the best despite the cold weather that prevailed in the beginning of the season and caused some damage to the earlier planted pea crop (D_1) .

6.2.2. Weed Control Trials

On the average yield losses due to weeds varied from 62 to 75% (Table 6.4). Complete loss can sometimes occur (chickpea trial at El-Kef).

- 1. <u>Faba beans:</u> (Table 6.4): Yield decrease due to weeds was around 63%. Hand weeding twice at 45 days intervals was almost comparable to the weed free treatment. Igran, Maloran + Kerb, and Tribunil + Kerb were relatively the most efficient in controlling weeds. However at El-Kef, where weed infestation level was exceptionally high, none of the treatments used outstandingly improved the yield.
- 2. Lentils (Table 6.5): Yield loss due to weeds was around 62%. While last year Tribunil was phytotoxic to lentils, this year, when combined with Kerb, Tribunil gave good control of weeds when infestation level was not very high.

Table 6.4. Weed Control Trial on Faba bean Small. Seed Yield (qx/ha) as affected by the treatments at Beja and Kef.

Treatments		Beja		Cef 	Mean Yields of th Two Stations		
	Yield	%of T ₂	Yield	%of T_2	Yield	χ of \mathtt{T}_2	
T ₁ : Weedy check	9.84	75.7	1.19	8.19	5.51	40.04	
T ₂ : Hand weeding Twice	13.00	100	14.52	100	13.76	100	
T ₃ : Weed Free	13.62	104.76	15.86	109.22	14.74	107.12	
T ₄ : Maloran	8.84	68.0	1.55	10.67	5.195	37.71	
T ₅ : Tribunil	8.74	67.23	1.76	12.12	5.25	38.15	
T ₆ : Igran	9.76	7.5	1.74	11.98	5.75	41.78	
T ₇ : Bladex	8.52	65.53	2.21	15.22	5.36	38.95	
T _g : Bladex	9.58	73.69	1.52	10.46	5.55	40.33	
Tq: Maloran+Kerb	10.78	82.92	2.12	14.60	6.45	48.87	
Tin:Tribunil+Kerb	10.44	80.30	2.52	17.35	6.48	47.09	
T ₁ ;:Igran+Kerb	9.4	72.30	3.14	21.96	6.29	45.71	
T ₁₂ : Bladex+Kerb	10.84	83.38	1.95	13.42	6.39	46.43	
C V %	28.4		43.0				
SE	1.454		0.89				

Table 6.5. Weed Control Trial on lentils. Seed yield (qx/ha) as affected by the treatments at Beja and El-Kef

Treatments	I	BEJA	EL	-KEF		elds of th stations
	Yield	% of T ₂	Yield	% of T ₂	Yield	% of T ₂
T _l Weedy check	7.42	55.78	0.42	5.94	3.92	38.50
T ₂ Hand Weeding Twice	13.3	100	7.06	100	10.18	100
T ₃ Weed Free	12.4	9.32	8.16	115.58	10.28	100.98
T ₄ Maloran	6.99	52.03	0.49	6.94	3.70	36 .3 4
T ₅ Gesagard	9.28	69.77	0.42	5.94	4.85	47.64
T ₆ Tribunil	9.02	67.81	0.42	5.94	4.72	46.36
T ₇ Bladex	8.16	61.35	0.34	4.81	4.25	41.74
T ₈ Bladex	7.24	54.43	0.36	5.09	3.8	37.32
T ₉ Maloran + Kerb	8.48	63.75	0.36	5.09	4.42	43.41
T ₁₀ ^{Gesagard + Kerb}	9.72	73.08	0.48	6.79	5.1	50 .0 9
T ₁₁ Tribunil + Kerb	12.88	96.84	0.52	7.36	6.7	65 .8 1
T ₁₂ Bladex + Kerb	8.12	61.05	0.26	3.68	4.19	41.15
CV (%)	23.1		30.2		, <u></u>	
SE	1.259		0.25			

- 3. Dry Peas (Table 6.6): Yield loss due to weeds was, on the average, 75%. No treatment yielded similar to the "weed free" and the "hand weeding twice" treatments even in relatively low to medium weed infested plots (Beja).
- 4. Chickpea (Table 6.7): Only the results of El-Kef trial are presented. Observations and data obtained were striking. Weed infestation level was so high that the check yielded nothing and none of the treatments used was efficient at all.

6.2.3. Fertility Trials:

- 1. Faba bean (Table 6.8): Not all the treatments used had a significant effect on yield, at both stations. Banding the fertilizers resulted, in general, in decreased yield.
- 2. Dry Peas (Table 6.9): No significant effect due to treatments was observed in Beja and El-Kef stations. Potassium alone caused a slight increase in yield at Beja and El-Kef. Potassium in combination with P and N (NPK) resulted in a slight increase in yield.
- 3. Lentils (Table 6.10): Only the results of Beja trial are reported. Those of E1-Kef were discarded because of mixture between plots during harvest. The effect of the treatments was not significant. The data shows however a depressive effect of Nitrogen, alone and, in combination with P and K. This was observed visually during the growth of the lentil crop as well as in the other food legume crops (pea and faba beans). Nitrogen, when banded during planting, resulted in less vigorous germination than the other treatments. This depressive effect was much clear on lentil than on faba bean or pea. Results of this year trials have shown that conducting fertility trial on research station may not give a real picture of what would be the effect of the major nutrients (N, P, K) on the yield of the food legume crops.

Table 6.6. Weed Control Trial on Peas. Seed Yield (qx/ha) as affected by the treatments at Beja and kef.

Treatments	В	Beja		ef	Mean Yields of the Two Station	
	Yield	% of T ₂	Yield	% of T ₂	Yield	of T
「」: Weedy Check	10.34	40	1.12	10	5.73	31.58
Hand Weeding Twice	25.7	100	10.59	100	18.14	100
3: Weed Free	29.48	114	14.83	140	22.15	122.10
ار : Maloran	13.24	51	2.42	22	7.83	43.16
4 1 ₅ : Gesagard	12.54	48	1.89	17	7.21	39.74
: Tribunil	11.24	43	1.59	15	6.41	35.33
o 7 : Bladex	10.76	41	1.72	16	6.24	35.39
Bladex	15.42	60	1.92	18	8.67	47.79
o 'o : Maloran+Kerb	15.94	62	2.16	20	9.05	49.88
Gesagard+Kerb	13.62	52	1.77	16	7.69	42.39
10	15.00	58	1.69	15	8.34	45.97
11: Bladez+Kerb	14.48	56	2.02	19	8.25	45.47
: V %	18.5		39.0			<u></u>
E	1.448		0.711	•		

Table 6.7. Weed Control Trial on Chickpea at Kef Station. Seed Yields (q_x/ha) as affected by the treatments.

Treatments	Yield	% of T ₃
T ₁ : Weedy Check	0	
T ₂ : Hand Weeded Twice	6.66	94.7
T ₃ : Weed Free	7.03	100
T ₄ : Maloran (2.5 kg)	0.12	1.7
T ₅ : Tribunil (3.0 kg)	0.04	0.6
T ₆ : Igran (3.0 kg)	0.28	4.0
T ₇ : Bladex (0.5 kg)	0.08	1.1
T ₈ : Bladex (1.0 kg)	0.04	0.06
T ₉ : Maloran+Kerb 2.5 kg 0.5 kg	0.24	3.4
T ₁₀ : Tribunil+Kerb 3.0 kg 0.5 kg	0.33	4.7
T ₁₁ : Igran + Kerb 3.0 kg 0.5 kg	0.28	4.0
T ₁₂ : Bladex + Kerb 0.5 kg 0.5 kg	0.08	1.1 .
C.V. %	NA	
SE	NA	

Table 6.8. Fertility Trial on Faba bean Small. Seed Yield (qx/ha) as affected by the treatments at Beja and Kef.

		Beja	K	ef
Treatments	Yield	% of T	Yield	% of T
0 = Check	22.06	100	17.69	100
N	21.09	95.60	15.46	87.39
P	20.46	92.74	13.05	73.77
K	21.62	98.005	16.06	90.78
P + K	25.52	115.68	14.99	84.73
P + N	22.25	100.86	19.62	110.91
N + P + K	16.72	75.79	14.79	83.60
N + K	22.59	102.40	16.89	95.47
CV %	16.2		13.8	
SE	0.65		0.74	

Table 6.9. Fertility Trial on Peas. Seed yield (qx/ha) as affected by the treatments at Beja and El-Kef.

Treatments		Beja	El-Kef		
	Yield	% of T ₁	Yield	Z of T	
0 = check	27.66	100	16.29	100	
N	28.09	100.55	15.19	93.24	
P	28.26	102.16	16.73	102.70	
K	28.45	102.85	16.82	103.25	
P + K	25.49	92.15	11.36	69.73	
P + N	27.39	99.02	14.69	90.17	
N + P + K	29.76	107.59	16.80	103.10	
N + K	27.89	100.03	15.19	93.24	
CV %	7.6	and the second s	21.4		
SE	0.54		0.82		

Table 6.10. Fertility trial on lentil at Beja Station. Seed Yields (qx/ha) as affected by the treatments.

Treatments	Yield	% of the check
Check	12.62	100
N	12.59	99.7
P	13.39	106.1
К	14.62	115.8
P + K	14.39	114.0
P + N	11.36	90.0
N + P + K	11.36	90.0
N + K	11.12	88.1
CV %	27.4	
SE Main Effect	0.86	

Table 6.11. Iron Chlorosis Trial on Chickpea at Kef Station.

Seed Yields (qx/ha) as affected by various treatments.

Treatments	Yield
Local + One spray of water	7.75
Local + Two spray of water	8.60
Local + One spray of Ferrous Sulphate	6.65
Local + Two spray of Ferrous Sulphate	4.55
ILC 191 + One spray of water	3.55
ILC 191 + Two spray of water	4.65
ILC 191 + One spray of Ferrous Sulphate	5.30
ILC 191 + Two spray of Ferrous Sulphate	4.55
cv %	34.8
SE	1.02

The soils of the research station show, usually, no defficiency in these major elements.

6.2.4. Iron Chlorosis Trials

One trial on the control of iron chlorosis was conducted on chickpea at El-Kef station where Iron chlorosis is frequently observed on chickpea grown on a high calcareous soil. Two varieties were used in the trial, ILC 191, highly susceptible one for iron chlorosis in El-Kef conditions and a Local Amdoun which is a tolerant one. The results are presented in Table 6.11. The treatments had a significant effect on yield. The data and the observations in the field indicate a highly toxic effect of the iron, applied as ferrous sulfate, on the local chickpea variety. This depressive effect is more pronounced when two sprays of ferrous sulfate was applied (42% decrease). ILC 191 was less affected by the application of Iron, one spray of ferrous sulfate improved even the yield.

High coefficient of variation (35.8%) associated with the trial imposes some constraint in interpacting the data.