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(I.D.G.C. - CIMMYT)

ALGERIA

1978-1979

ANNUAL REPORT CIMMYT-IDGC ALGERIA 1978-1979

INTRODUCTION

The report year 1978-79 was the third successive unfavorable crop year for Algeria. The drought effect was common to all the North African countries. The Algerian cereal production this year was 14.2 million quintals with an overall average of 5.34 quintals per ha. (Table A.1)

TABLE A.1. Cereal situation Algeria 1978-1979.

	Area harvested Ha	Production Qx	Average Yield Qx/ha	% Area
Bread wheat	619,858	3,347,720	5.40	23.3
Durum Wheat	1,184,090	6,399.405	5.40	44.6
Barley	736,690	3,899,471	5.29	27.7
Oats	116,208	542,840	4.67	4.4
Total	2,656,906	14,189,436	5.34	100.0

Cereal crop research in Algeria is carried out in seven different stations. Of these seven only the Oued Samar Station (Algiers) had good moisture throughout the crop season. Stations of Khroub (Constantine) Setif and Ain El Hadjar (Saida) were extremely dry. Guelma, Tiaret and Sidi Bel Abbes the crop went through some drought stress. The actual yields obtained by the producers in these areas are much lower than what can be attained. Table A.2, a comparison is made between the yields obtained in these seven research stations and the yields obtained in the Wilayate in which these station are located

TABLE A.2. A comparison of Bread Wheat's yields obtained in 7 different Wilayates to the potential yield. Algeria 1978-79.

Wilayate	Potential* Yield Qx/ha	Average Wilayate yield Qx/ha	Wilayate yield as a per cent of the potential
Algiers	46.24	9.21	19.92
Saida	14.82	3.88	26.18
Sidi Bel Abbles	29.04	5.31	18.29
Tiaret	25.02	4.74	18.95
Setif	7.07	3.11	43.99
Constantine	26.78	7.10	26.51
Guelma	30.26	5.86	19.30

* Average yield of 10 top varieties from the two advanced bread wheat yield trials grown in seven experimental stations in seven Wilayates.

BREAD WHEAT

Site Cerros continues to be the predominent bread wheat variety in production. Among the newer varieties Ghriss (Anza) gave the best overall performance in the yield trials.

Advance yield trials (3rd year) were gwon in all the stations to represent most of the agroclimatic conditions of Algeria. Due to the extreme drought the yield levels at the Setif Station were very low and non significant and hence they were not used in the calcualtions. Results of the remaining six stations are reported in Table A.3. Crosses CC-Inia x Cno-7C, Bb-Kal and a Yougoslavian selection NS-14-13 were the best

TABLE A.3. Promising bread wheat lines in the advance yield trials Algeria* 78-79.

Variety No.	Pedigree	Yield Qx/ha	Rank**	% Ghriss ~~Anza~~
AB555	Ghriss'	25.35	9.3	100.00
AB557	CC-Inia x Cno-7C CM-4319-1Y-2M-0Y	26.97	5.3	106.39
AB558	Bb-Kal CM-9160-11M-5Y-4M-1Y-0M	26.04	8.7	102.72
AB559	HD1220-Kal[2] 72L 222	25.77	8.5	101.66
AB563	Bb-Kal CM-9160-11M-5Y-1M-2Y-0M	26.33	7.5	103.87
AB565	7C	24.25	13.5	95.66
AB570	Local checks	21.98	14.2	86.79
BB579	NS 14-13	29.13	5.0	115.46
BB585	Local checks	24.41	9.8	96.75
BB595	Ghriss	25.23	12.2	100.00

* Average of 6 stations 3, very dry, 2, average moisture and and one with no moisture stress.

** Average rank among 25 varities over 6 locations
1 Ghriss=Anza

The first year yield trials were grown in three different station. There were in all 275 lines under test this year. Results of the best 12 lines from these 11 trials ~~were~~ are given in comparison to Ghriss in Table A.4

TABLE A.4. Best bread wheat selections of the first year yield trials*. Algeria 1978-1979.

Variety No.	Pedigree	Yield Qx/ha	Rank	% Ghriss
A-3	Bb-Kal CM-9160-1M-4Y-1M-0Y	27.99	6.3	114.43
A-16	Roussalka (Cno-On x HD832/Bb-Cno) SWM-1555-3S-1S-0S	24.70	6.3	100.98
A-19	Darius	29.99	3.7	122.61
D-82	HD1220-Kal x Jup 73 CM-40055-14AL	28.88	1.3	117.59
E-111	Kal-Bb x Pavon"S" CM-40230-8AL	24.47	6.3	100.16
E-125	Dougga 74	27.86	2.0	114.04
F.143	/Bb(Son64-An64xNad/Jar"S")/Emu"S" CM-40521-5AL	24.80	5.3	113.04
F.148	Kite-Huacamayo"S" CM-40546-11AL	25.41	3.0	115.82
F.186	Cgñ-Zaragoza 75 CM-36706-11AL	25.36	4.0	107.59
J.229	Kvz x Kal-Bb SWM-1698-21-0KE-4AL	22.51	5.3	99.43
K.254	SK-Edch x Mexipak L.101-51L-0L-6Bj-1S-0S-4AL	25.87	2.3	108.24
K.256	Pj-Cal/S.948-Al x Cno"S" Alg-3AL-2AL	25.67	5.6	107.41

* Average of 3 stations. One without moisture stress and two with extreme stress.

DURUM WHEAT

The main durum varieties in cultivation are Oued Zenatei, Bidi-17, Hedba 3, Mohamed Ben Bahcir and Poloniceim x ZB•INRAT 69, Capeiti and Cocorit are also in cultivation but their area is less. The newer varieties Tell, Timgad and Tassili will take many more years to come to production because they are in the early stages of seed production.

Results of the promissing lines in the advanced yield trials are reported in Table A.5. A. Chilean cross Bidi 17^2 x Cfn-Lan dwarf/ Lan was outstanding. The next two best were Erpel"S"-Ruso and Gta"S" x 21563-AA"S".

TABLE A.5. Promissing durum wheat lines in the advanced yield trials*. Algeria 1978-79.

Variety No.	Pedigree	Yield Qx/ha	Rank**	% Cpt***
PAB 627	Gta"S" x 21563-AA"S" CM-10143-6M-3T-1M-2Y-0Y	23.66	8.0	126.39
PAB 630	INRAT 69	17.95	18.8	95.89
PAB 632	Erpel"S"-Ruso CD-10437-7M-1Y-0M	24.89	6.0	132.96
PAB 635	Capeiti	18.72	15.5	100.00
PAB 640	Cocorit 71	17.08	17.5	91.24
PAB 643	Bidi17^2 x Cgn-Lan.dwarf/Lan T.38-47-18T-2V-1P	25.05	4.3	133.81
PAB 644	Tassili 77	19.81	12.5	105.82

* Average of 6 stations. One station no moisture stress, 2 with medium stress and 3 stations with extreme stress.

** Average rank among 25 varieties over 6 locations.

*** Cpt= Capeiti

First year durum trials were also grow in three different stations. There were in all 300 lines under test this year. Among the check varieties Capeite gave the best result. The best 25 lines from these 12 trials are reported in Table A-6. It is worth noting that except one line all others are local selections or reselections.

The Elit durum yield trial from CIMMYT was grow at Oued Samar and Sidi Bel Abbes Stations. The yield levels in this trial was excellent at both stations (Table A.7). The top yielder was Mapache a Triticale. The best durum was Can. 02109 x Jo"S"-AA"S"/S15-Cr"S". It yielded almost 1.3 metric tones more than Cocorit 71. Pavon the bread wheat was the next highest variety.

TABLE A.6. Best durum wheat selections of the first year yield trials* Algeria 1978-79.

Variety No.	Pedigree	Yield Qx/ha	Rank	% Cpt.
P 709	Gr"S"-Fg"S"/21563-Gs"S"xCit-P.66/270 CD-1074-1Y-3Y	29.43	6.50	106.32
Q 743	Gdo.VZ579(Cr"S'/21563x61.130-Lds) CD-7437-3AL	32.79	2.50	109.70
R 757	Cr"S"-Gs"S" x Gerardo VZ469 CD-7507-0G-11AL	26.17	7.00	115.80
R 758	Cr"S"-Gs"S" x Gerardo VZ469 CD 7507-0G-15AL	26.34	8.67	116.55
R 759	D67.2(G11"S"xBY_E^2-Tc^4)Cr"S"/Rabi"S"-Fg"S" CD-8617-2AL	25.03	7.00	110.75
S 797	Gdo VZ469-AA"S" x Stork"S" CD-10113-)G-1AL	26.14	5.67	103.65
T 804	G11"S"^{2}-T.dic.Ver x D58-128 CD-11585-3AL	22.09	6.00	99.10
T 811	BY_E-TAC_E x AA"S"/Fg"S" CD-14723-1AL	23.64	4.33	106.06
T 812	BY_E-TAC_E x AA"S"/Fg"S" CD 14723-2AL	23.45	3.00	105.20
T 824	Tell"S"-Gediz"S" CD-14903-3AL	22.88	5.67	102.65
U 826	(Yemem-Cr"S"xPlc"S"/Sh"S")Gdo471-Br"S"xPg"S" CD 14807-2AL	21.62	3.67	106.08
U 828	(Yemen-Cr"S"xPlc"S"/Sh"S")Gdo471-Br"S"xPg"S" CD 14807-6AL	21.69	5.67	106.43
U 832	Plc"S" x Cr"S"-Ato"S" CD-14942-2AL	19.69	5.00	96.61
V 857	Rabi"S"-Fg"S" x Qfn CD-15299-1AL	19.55	4.67	121.66
V 864	(Plc"S"-Cr"S"/G11"S"xLds-56-1)Corm"S" CD-15317-2AL	19.45	5.33	121.03
V 874	Chap-21413 x Tllo"S"/Kif"S" CD-15413-6AL	20.17	4.00	125.51
W 889	Ruff-Jo"S" x Cr"S"/Kif"S' CD-15644-6AL	22.31	3.67	117.30
W 896	Ruff-Jo"S" x Cr"S"/Kif"S" CD-15644-16AL	21.40	6.00	112.51
W 899	Gta"S"/(Yemen-Cr"S"xPlc"S"/Tc)Mexi"S"/ CD 15663-2AL	22.19	3.67	116.67
X 912	F1 (P1 x Pe)B	24.69	4.00	106.79
X 923	Ggo394-Cit"S"/BY_E^2-TAC_E x AA"S" CD-15215-2AL	24.74	4.00	107.01
X 924	Marte x Chap-21563/D.68.11 CD-14793-1AL	24.86	4.00	107.53
Y 937	Gdo512-Cit"S" x Ruff-Fg"S" CD-10549-0-9M-3Y-3Y-3AL	21.43	3.33	108.07
Y 948	Gdo512-Cit"S" x Ruff-Fg"S" CD 10549-0-12M-1Y-7AL	23.65	5.33	119.26
Z 957	Gdo512-Cit"S"x Ruff-Fg"S" CD 10549-0-12M-1Y-16AL	21.50	3.00	105.96

Average of 3 stations 2 with medium water stress and one with

TABLE A.7. Top yielding varieties of the EDYT*. Algeria 1978-79

Variety No.	Pedigree	Yield Qx/ha	Rank	% Cit**
378	Bittern"S" CM-9799-126M-1M-4Y-0Y	45.50	8.00	126.88
381	Can.02109xJo"S"-AA"S"/S15-Cr"S" CD-10535-D-1M-3Y-0M	48.79	3.50	136.06
384	Geier"S"-USA.0676xJo"S"-Cr"S" CD-10569-C-1M-1Y-0M	45.29	6.5	126.30
394	BD1543-Inrat69 x Coot"S"/Gta"S" CD-13557-J-3Y-3M-1Y-0M	44.89	4.5	125.18
396	Cocorit 71	35.86	19.00	100.00
397	Mexicali 75	34.75	15.00	96.91
398	Pavon 76	47.04	3.00	131.18
399	Mapache	53.93	2.00	150.39

* Average of two stations. One station no moisture stress ~~in~~ the second with medium stress.

** Cit= Cocorit 71

BARLEY

Barley is the second important cereal crop in Algeria. This year it occupied 27.7 percent of the cereal area, 66 percent of this crop was planted by the private sector. It can be an indication that either the private sector hold poor land and the barley does better under those conditions or the use of barley is more in the private sector for feeding purposes. The animal sector in Algeria is predominated by the private sector and barley is mainly used as a forage crop or as a feed grain crop. Saida and Tichdrett are the main varieties in cutlivation. Results of one first year yield trial of introductions at two stations and a second year yield trial at three stations are reported in Tables A-8 and 9. Both these trials indicate that many lines are available which are better than the two local varieties. Also, it is worth noting that due to the

drought this year the yield levels of the barley is better than that of bread wheat and the durums.

TABLE A.8. Top yielding varieties in the 1st year barley yield trials*. Algeria 1978-79.

Variety No.	Variety or cross	Type	Yield Qx/ha	Rank	% Saida
N 651	Aurea	2	32.50	4.0	101.79
N 653	Barberousse	6	34.86	2.0	109.18
N 655	Saida	4	31.93	4.5	100.00
N 657	Arma	6	32.71	4.0	102.44
N 658	Gerbel	6	31.40	4.5	98.34
N 669	Tichdrett	6	31.79	4.0	99.55

* Average of two stations one with no moisture stress the second with extreme stress

TABLE A.9. Best yielding barley varieties and lines in the second year yield trials* Algeria 1978-79.

Variety No.	Variety or cross	Type	Yield Qx/Ha	Rank	% Saida
RA 676	Masurka	2	42.00	4.67	130.80
RA 677	C13C	2	41.56	4.67	129.43
RA 678	Berac	2	40.88	5.33	127.31
RA 681	Antares	6	39.15	9.00	121.93
RA 683	Ager	6	36.63	12.67	114.08
RA 684	WI 2291	2	39.54	8.33	123.14
RA 685	Saida	4	32.11	16.33	100.00
RA 687	Atlas 46 x Promesa	6	41.58	5.33	129.49
RA 688	Zypper-WI 2197	2	38.14	11.33	118.78
RA 689	Impala-Julia	2	38.05	10.33	118.50
RA 696	Zemyr	2	39.56	9.00	123.20

* Average of 3 stations. All stations with medium water stress.

TRITICALES

The International Triticales Yield Nursery was grown at the El Khroub station which was very dry. The highest yielding triticale Drira was 33 percent better than the best bread wheat Pavon. The second best was Beagle. The Elit Durum Yield Trial was grown in two stations with medium moisture stress and the triticale Mapache was 14 percent better than Pavon in that trial. However, under extreme stress as was obtained at the Khroub station Mapache yielded 36 percent less than Pavon. although Mapache has very high yield potential Drira and Beagle seems to have much better drought tolerance. Among the different varieties of different species in this trial the triticales seems to have the best drought tolerance followed by the bread wheat. The durum was the worst.

TABLE A.10. Top yielding triticale varieties in the ITYN* Algeria 1978-79.

Variety No.	Variety or cross	Yield Qx/ha	Rank	% Pavon
5	Beagle	25.00	2	118.48
6	Mapache	13.43	15	63.65
10	Drira 518	28.10	1	133.18
19	M2A-Bgl	21.62	3	102.46
21	IA-Ira x But	20.76	5	98.39
22	Bittern"S" (Durum)	8.67	21	41.09
23	Pavon 76 (Bread Wheat)	21.10	4	100.00
24	Anza (Bread Wheat)	19.38	6	91.85

* Trial grown at El Khroub station which was very dry.

SEPTORIA

Since the year in general was very dry diseases did not play a major role in the crop production, however stripe rust was present on the variety Siete Cerros in the east and central regions. At the Oued Samar Station where there was no moisture stress the infection of Septoria was excellent. Notes were taken on the International Bread Wheat Screening Nursery (IBWSN) and International Durum Screening Nursery (IDSN). The best lines are reported in Table A.11 and A.12. Among the bread wheats the cross Bobwhite was outstanding. In all, there were 43 lines out of 465, had acceptable level of tolerance. Among the durums in contract there were only 10 lines. The best durum cross was Parana x Gs"S"-Cr"S"/Gta "S" CD-10504-H-6M-2Y-7M-1Y-0M and its sister.

Table A-11. 12th IBWSN Lines with Excellent tolerance to Septoria tritici

Septoria Score 3-4/9

Entry No.	Cross and Pedigree
105	Maya 74"s" - Mon"s" CM 29251-3M-17Y-1M-0Y
115	Titmouse"s" CM 30136 - 2Y-2M-2Y-0M
182	Pavon"s" - Huacamayo"s" CM 32537 - 9Y-1M-0Y
217	Bobwhite"s" CM 33203 - G-9M-2Y-500M-500Y-0M
218	Bobwhite"s" CM 33203- G-9M-2Y-501M-500Y-0M
222	Bobwhite"s" CM 33203-K-8M-1Y-1M-1Y-0M
226	Bobwhite"s" CM 33203-K-9M-9Y-4M-1Y-0M
227	Bobwhite"s" CM 33203 - K-9M-9Y-4M-4Y-0M
228	Bobwhite"s" CM - 33203 - K-9M-10Y-1M-4Y-0M
229	Bobwhite"s" CM - 33203 - K-9M-12Y-1M-0Y
230	Bobwhite"s" CM - 33203- K-9M-15Y-1M-4Y-0M
235	Bobwhite"s" CM - 33203-.K-12M-14Y-3M-0Y
236	Bobwhite"s" CM - 33203-N-1M-1Y-1M-1Y-0M
237	Bobwhite"s" CM - 33203-N - 1M-1Y-6M-1Y-0M
279	Nad 63-Tor x Pichon/Bluetit"s" - Mesabi CM 4726-F-2M-2Y-4M-1Y-0M
405	Yding"s" x Kal-Bb/Hork"s" - Mo73 CM 38558-A-7Y-9M-2Y-0M
445	NdD-Sel 101^2 x Pavon"s" SWM-4249-1Y-1M-2Y-0M

Table A-11. Continued...

Good tolerance to Septoria tritici

Septoria Score 5/9

Entry No.	Cross and Pedigree
22	Moncho"s" CM 8288-A-3M-6Y-5M-1Y-0M
25	Pavon"s" CM 8399-D-4M-3Y-1M-0Y (1-26B).
61	Bobwhite"s" CM 33203-K-9M-24Y-0M
62	Bobwhite"s" CM 33203-N-1M-2Y-0M
80	Anza
104	Maya 74"s" - Moncho"s" CM 29251-3M-17Y-1M-0Y
116	Titmouse"s" CM 30136-2Y-2M-6Y-0M
156	Buck Buck"s" CM 31678-R-4Y-2M -500Y-513M-0Y
157	Buck Buck"s" CM 31678-R-4Y-2M-500Y-503M-500Y-0M
201	Veery"s" CM 33027-F-12M-1Y-4M-0Y
212	Chat"s" CM 33090-N-1M-1Y-0M
214	Bobwhite"s" CM 33203-F-4M-4Y-1M-1Y-0M
215	Bobwhite"s" CM 33203-F-4M-8Y-1M-0Y
216	Bobwhite"s" CM 33203-F-4M-8Y-5M-0Y
219	Bobwhite"s" CM 33203-G-9M-2Y-501M-501Y-0M
232	Bobwhite"s" CM 33203-K-9M-33Y-1M-2Y-0M
233	Bobwhite"s" CM 33203-K-12M-1Y-5M-5Y-0M
281	Nad 63 - Tor x Pichon/Bluetit"s" Mesabi"s" CM 34726-F-2M-2Y-4M-2Y-0Y
282	Bjy"s" - Grajo"s" (Maipo"s"/Bb x Tob - Cno) CM 34742-A-1M-1Y-4M-1Y-0M

Table A-11. Continued...

Entry No.	Cross and Pedigree
283	Bjy"s" - Grajo"s" (Maipo"s"/Bv x Tob - Cno) CM 34742-E-2M-8Y-2M-1Y-0M
403	Yding"s" x Kal - Bb/Hork"s" - Mo 73 CM 38558-A-7Y-7M-0Y
404	Yding"s" x Kal - Bb/Hork"s" - Mo 73 CM 38558- A-7Y-9M-1Y-0M
406	Yding"s" x Kal- Bb/Hork"s" - Mo 73 CM 38558-A-7Y-12M-2Y-0M
438	Kvz - HD 2009 SWM - 2984-1M-1Y-1M-2Y-0M
447	NdD-Sel 101^2 x Pavon"s" SWM 4249-1Y-6M-5Y-0M
453	Car 422 - Anahuac 75 SWM 4610-2Y-17M-2Y-0M

TABLE A-12. 10th IDSN. Lines with good tolerance to Septoria tritici

Entry No.	Cross and pedigree
	(Septoria Score 3-5/9
010	Rabi"S"/LD390 x $Bell_E$-Tc^2 CM-10171-2BK-1BK-1B
037	{/(AA"S"-Gs"S"xCit"S"/Ruff"S")T.dic.ver-Gll"S"/Kif"S"} USDA.0595 CD-19571-B-8Y-2M-0Y
080	Balcarceño INTA
081	Gediz"S"-Fg"S"xRabi"S"-31810 CD-16707-G-7M-4Y-2M-0Y
082	Gediz"S"-Fg"S"xRabi"S"-31810 CD-16707-G-7M-4Y-4M-0Y
0201	S.0179^2-$Durum^6$ HRL-861-2B-0Y-2B-100Y-7M
0244	Magh 72-Ch67/(21563/LK_E-LD390xCh67)Gta"S"/ CD-16819-E-6M-3Y-0M
0260	Georgio VZ394
0265	Parana x Gs"S"-Cr"S"/Gta"S" CD-10504-H-6M-2Y-7M-1Y-0M
0266	Parana x Gs"S"-Cr"S"/Gta"S" CD-10504-H-6M-2Y-7M-2Y-0M

MEDICAGO RESEARCH

A. Introduction

This year marks the last of five years of direct CIMMYT involvement in the introduction of Medicago into Algeria and the development of a research effort involving production problems and the evaluation of better adapted local or introduced plant types.

The development of the program has been as follows:

1974/75 : Simple agronomic trials were laid out to answer immediate questions and to serve as a demonstration base.

Quickly, it became obvious that early dry seeding into a well prepared seedbed was preferable where the grassy weed population was not excessive. If, however, there was a very weedy situation, it was shown preferable to wait until one or two generations of weeds were eliminated.

The seeding rate of 10 - 15 kg/ha suggested from results elsewhere in the region proved to be satisfactory in the milder zones although it appeared there could be advantages in increasing the seeding rate at higher altitudes or cold regions.

Seeding depth was shown to have important effects on seeding establishment. The ideal seeding depth was shown to be about 1.5cm.

Phosphate fertilizer trials showed no responses by the Medicago. This suggested high residual rates of phosphate in the soil. This work was carried out on Socialist Sector farms where fertilizer application history is usually good. However, the application of fertilizers to farms in the other sectors (Agrarian Revolution and Private) has not been of nearly the same order and thus some responses to phosphate fertilizer to Medicago can be expected. Medicago should be sown with about 45 units P_2O_5.

With respect to varieties, "Snail" (now renamed "Robinson"), "Jemalong" and "Harbinger" all proved to be satisfactory under the conditions experienced.

1975/76 : New varieties were introduced, notably "Borung", a type well suited to heavy clay soils, and "Cyprus", a short season type with high seed yields.
When tried on the high plateau in that year (which was particularly cold in January) seed yields of "Borung" and "Cyprus" were substantially higher than "Jemalong", "Robinson" or "Harbinger". "Borung" and "Cyprus" however, suffer from low seed permeability characteristics.

Low seeding rates of oats and barley were investigated on the high plateau as a means of protecting the

Medicago from winter kill. This strategy proved to have no effect on survival populations but did allow for earlier grazing.

Substantial benefits were demonstrated on the high plateau by increasing seeding rates to 20 -25 kg/ha.

A farm survey was carried out, involving forty two Socialist Sector farms. This pointed up to several problems. Firstly, seed was very often delivered late to the farms. The medic was therefore seeded under cold conditions, rather more favourable to the indigenous weed flora than the introduced Medicago. Second, and most importantly, the grazing strategy developed during the previous year had not been extended to the farms. Commencement of grazing tended to be delayed far past the optimum time and with excessive stocking rates. Additionally, heavy summer grazing of medic residues produced large losses of seed pods. Following this observation, it has been suggested that at senescence, the field should be lightly disced to bury most of the pods while leaving the large part of the dry residue accessible to the grazing animal. Thirdly, it was demonstrated that Brome grass was becoming a problem over a large area in the cereal zone, due presumably to the replacement of the fallow by alternate crops (including but not exclusively Medicago). Sitona weavil was also shown to be a problem over nearly half the sown area in (western) Algeria. This is a native insect and has at least two predators and one parasite present in

Algeria, so control will hopefully be biological and with a cyclic rhythm. (Indeed it has hardly been noted in the last three years).

1976/77 : In this year, evaluation of local and introduced lines of Medicago was recommenced. This work had been started at the National Institute of Agriculture in 1974. However, due to a change in personel, the program stopped.

The need for such a program was highlighted by the performance of the Australian cultivars on the high plateau where although they grew and persisted (at fairly low densities) their contribution to the total forage was minimal. The Ministry of Agriculture was extremely keen for the evaluation work to continue as it felt that (as Medicago is found throughout the high plateau) this could be a key to increasing animal productivity in this region.

Entries in the nursery grown at Tessala in western Algeria came from the collection at the National Institute of Agriculture, the Medicago breeding program in South Australia, a collection made in Algeria during the summer of 1976, and collections in Lebanon and Syria, seven hundred and seventeen in all, representing ten species of the genus. The nursery was designated an Observation Nursery, the entries being grown as spaced plants.

In variety trials "Borung" and "Jemalong" continued to

demonstrate the widest adaptability of the introduced cultivars.

1977/78 : Sixty eight lines were selected from the Observation Nursery to be advanced into the First Year Evaluation Nurseries (replicated micro-swards), one at Sidi-Bel-Abbes (sub-littoral) and Ain-el-Hadjar (high plateau). Nurseries containing these lines were also despatched to Constantine (sub-littoral) and Setif (high plateau) in eastern Algeria.

In variety trials, three Algerian ecotypes were introduced, these being the top lines from the previous selection program at the National Institute of Agriculture. These lines performed well, particularly in the sub-littoral region. They showed exceptional late spring production, accentuated by the long growing season experienced at the test sites. All three were one to two weeks later than "Jemalong". Interestingly, all three showed tolerance or resistance to Sitona weevil which attacked one trial. All Australian cultivars were substantially attacked.

1978/79 : Second year Evaluation Nurseries were sown at Sidi-Bel-Abbes and Ain-el-Hadjar. An Observation Nursery was sown at Tiaret and similar nurseries were prepared for Constantine and Setif. An observation nursery to find salt-tolerant types was also sown in the sub-littoral zone of western Algeria.

Results from 1977/78 indicated that three species were

especially worthy of further attention - *M. scutellata*, *M. aculeata* and *M. truncatula*, especially for the high plateau. Therefore, additional "interesting" lines of these species from the 1976/77 nursery were sown in an observation nursery at Ain-el-Hadjar. *M. polymorpha* lines were also included as, although this species has an objectionable pod type, it is outstanding in its agronomic performance. This nursery consisted of 131 lines.

B. Evaluation Procedure

The system of evaluation has been devised to obtain better adapted, highly productive lines in the shortest possible time. The sequence proposed is briefly as follows :

Year 1 : a) Observation Nursery

This is an unreplicated spaced plant nursery in rows. Observations are taken on winter vigour compared to the control cultivars (presently *M. truncatula* cv. "Jemalong" and *M. scutellata* cv. "Robinson"), growth habit, date of flowering, podding and maturity. Seed yield is also measured although it is recognised that spaced plant seed yields may bear no relation to sward seed yielding ability.

The siting of this nursery must be such to obtain maximum expression of plant characters.

Year 2 : b) First Year Evaluation Nursery

A replicated nursery of small swards (one square metre, 200 germineable seeds per square metre which is equivalent to approximately 10 kg/ha of pure germinating seed for the majority of species). Observations are made of winter

and spring vigour, growth habit of the sward, date and duration of flowering, podding and maturities. Seed yields are measured. Seed permeability is measured by returning samples of pods to the field as soon as possible (after harvesting, cleaning and weighing) for oversummering. One hundred pods are collected from the field for laboratory germination tests at critical times (most importantly the first or second week of October).

Year 3 : c) Second Year Evaluation Nursery

More seed is available in this year, thus plot size is increased to two square metres, again with 200 germineable seeds per square metre. Observations are similar to those taken in the First Year Evaluation Nursery. A primary objective of this year is the production of a maximum quantity of seed. However, part of this nursery is left unharvested for estimates of natural regeneration in year 4, and subsequent forage yields from that natural regeneration.

Seed permeability is also measured in laboratory tests as outlined for the previous nursery.

Assuming a representative range of sites have been used in these two years and seasonal conditions have demonstrated reasonably wide variability , provisional selection can be made at this stage.

Year 4 : d) Third Year Evaluation Nursery

This nursery is identical to the previous nursery and is designed to confirm the selections made in the previous year.

e) Seed production of selections from years 2 and 3 (10 - 15 lines).

Year 5 : f) "Grazing Trials" - Fourth Year Trials.

The purpose of these trials is to obtain the productivity of the selected lines under real grazing conditions and also to observe the reaction of the plant to the grazing animal.

Controlled grazing trials are extremely expensive to carry out and the results are usually highly site and season specific. The trials proposed here are simple. Briefly an area in the centre of a field to be sown to Medicago is selected. The selections are sown in at least two replicates (individual plot size 20 x 5 metres) at normal seeding rates (10 - 15 kg/ha).

Forage yields (to the end of February, end February to mid-May) are measured using the technique of open and closed quadrats, using the grazing pattern of the farm. Seed yields should be measured.

Weed infestation levels should be measured in the wheat crop of year 6, along with the subsequent wheat yields. It may be possible to obtain estimates of nitrogen input by the selections using a split-plot technique.

Regeneration in year 7 should be measured and forage estimations, particularly to the end of February should also be followed.

Results from Selection Program 1976 - 79.

(i) Selection Philosophy - attributes for a successful cultivar for Algeria :

(a) The level of weeds, in particular grassy weeds is extremely high through much of the cereal zones of Algeria. While some (e.g. wild oats) can be controlled by chemical means in the cereal crop, others such as Brome cannot. High density regeneration is therefore a prime requirement of a medic cultivar. Regeneration is influenced (mainly) by seed yield and the break-down of impermeability by that seed.

As weed populations encountered are frequently as high as 300 -400 plants per square metre, the aim of the program has been to achieve (theoretical) regeneration values of greater than this figure.

(b) The cultivar must have the ability to emerge from greater than optimum depths. In Algeria, commonly available cultivation machinery does not have adequate depth control. Thus seed may be buried deeper than that recommended. There is therefore a reuqirement that the selected cultivar can tolerate these conditions.

Ability to emerge from depth is associated with large seed size.

(c) The cultivar must be capable of rapid early growth to aggressively compete against the weed flora and to provide (high quality) feed during the autumn - winter period which constitutes the most critical feed deficit period.

Early rapid growth of the individual plant is associated with seed size.

Early production from the sward is also related to the plant density. From the observations made during this program, it appears that as components of early sward production, density and plant vigour may be considered as having equal weighting.

Another factor which influences early growth and weed competitivity is rapid germination. The ability to germinate rapidly differs between species. Medicago scutellata has demonstrated slow germination in all laboratory tests. Medicago polymorpha has shown the same effect to a lesser extent. Dormancy does not seem to be involved; more likely the phenomenon is due to a germination inhibitor which presumably is water-soluble.

Spring vigour, whilst of importance as a selection criterion, has been given less weighting than winter vigour, as interplant competition during the spring "flush" tends to impose a ceiling on sward yield, assuming density is maximal.

(d) There has been an attempt to concentrate on prostrate (preferably) or semi-prostrate plant types. Erect types such as the Australian cultivar "Robinson" have proved difficult to manage under the Algerian grazing regimes.

As the grazing management systems will change only very slowly, it is thought preferable to select the plant type to suit the grazing patterns rather than attempt rapid change in the management systems

(e) Cold Tolerance - the imported cultivars do not have any great degree of cold tolerance. Although this attribute is not of great importance in the littoral zones, it becomes more so as altitude increases.

Observations, particularly in the very cold season experienced on the high plateau this year, have indicated the cold tolerance may be related to the maturity of the line. Early flowering lines tend to be more affected by cold than later lines. There also appear to be substantial differences between species, M. orbicularis and M. ciliaris being particularly cold tolerant.

(f) In the five years of direct CIMMYT involvement in Medicago research in Algeria, only one insect has proven to inflict widespread damage, and that insect in one year only.

Sitona lineatus was found over 43% of the total sown area to medic in (western) Algeria in 1975/76. The damage ranged from total to slight. This insect is endemic to the region and several predators and at least one parasite are present. Damage is therefore expected to be cyclic due to the nature of biological control. In fact, damage has been very slight in the last ~~three~~ three years although its presence can always be noted.

No insect control has been carried out in the nurseries so that if the insect occurs, susceptibility can be determined at the earliest stage possible. It is thought that although the pest will occur infrequently, it is desirable for a cultivar to have resistance or, at least, tolerance to Sitona. The Algerian ecotypes have demonstrated greater resistance than imported cultivars.

(g) The only regular disease noted has been Powdery Mildew. This disease is thought to pose problems only in lightly or non-grazed pastures, a situation which in reality arises rarely (except in the case of seed crops). However, the same approach is being taken with regard to diseases as with insects - no control measures are undertaken in the nurseries in order that any susceptibility will be discovered as early as possible.

(h) Finally, attention has been paid to what might be called "commercial aspects".

Many different pod forms are found between and within species. Pods with large hooked spines may become serious contaminants of wool, pod type affects ease of thrashing, and may affect the management of the medic - wheat system as a whole.

The permeability (germineability) of the seed off the thrasher should also be considered in the commercial context - cultivars with low germineability would need to be mechanically scarified after harvesting necessitating another operation using specialised equipment.

(ii) Summary of Nurseries - initial selections.

From the initial observation nursery grown at Tessala in 1976/77, sixty eight lines were selected on the basis of winter vigour, plant type and individual plant seed yield. Within each species, there was an attempt to select lines which were generally similar in the above characteristics but which exhibited different maturities.

This was to answer a question posed by the make-up of the Algerian collection with regard to flowering date. As shown in Table 1, the collection is skewed towards late-flowering types (in relation to the Australian cultivar "Jemalong" which flowered at 101 days). Late flowering, then, may indicate adaptability to Algerian conditions. Certainly, more recent data, as described earlier, tends to suggest that later flowering types are more cold tolerant. However, a commonly-held conception in southern Australia is that early flowering confers fitness on a line to survive the variability of a semi-arid climate.

After the First Year Evaluation Nurseries had been grown at Sidi-Bel-Abbes and Ain-el-Hadjar in 1977/78, it was obvious that certain species (or the best available lines of those species) were generally less adapted. Medicago littoralis, M. tornata and M. rotata exhibited poor seedling and winter vigour and seed yields were low.

These were then deleted from the Second Year Evaluation nurseries grown again at Sidi-Bel-Abbes and Ain-el-Hadjar in 1978/79, these nurseries consisting of 57 ecotypes plus the control (Australian) cultivars.

From the two years results, the provisional selections have been made to begin small scale seed multiplication in 1979/80.

Seasonal conditions over those two years have been such that reasonable confidence can be placed in the selections :-

Sidi-Bel-Abbes: 1977/78 medium-short seasonal length, relatively warm winter; 1978/79 medium-long season, cool winter.

Ain-el-Hadjar: 1977/78 very long cool season; 1978/79 very

TABLE 1: Time to flowering for major species in Algerian collection (expressed as a percentage of each species)

DAYS:	94	101	104	110	115	121	123	128	130
M. polymorpha	10·2	37·8	22·4	6·7	13·4	8·7		0·4	
M. truncatula	2·5	22·9	35·6	4·7	22·9	11·0	0·8		
M. littoralis		44·4	22·2		27·8		5·6		
M. scutellata	36·8	26·3	26·3			10·5			
M. orbicularis		2·6	10·4		1·3	71·4	11·7		2·6
M. ciliaris	14·9	48·9	27·7		4·3	4·3			
M. aculeata		52·9	32·4			11·8	2·9		
M. tornata						76·9	23·1		

short season, late germination, very cold winter with many spring frosts, sharp seasonal finish due to high temperatures.

Table 2 shows the average performances of the twelve selections made from the evaluation nurseries.

Explanation of Table 2

Average Winter Vigour is the average of visual gradings of plant vigour in February at Sidi-Bel-Abbes 1977/78 and 1978/79 and at Ain-el-Hadjar 1977/78 (Ain-el-Hadjar 1978/79 estimations were not made due to the very late germination and heterogeneous emergence).

Average Spring Vigour is the average of visual gradings made in April at Sidi-Bel-Abbes and Ain-el-Hadjar in 1977/78 (warm and cool springs respectively).

Flowering is the date of flowering in relation to "Jemalong".

Average Seed Yield is the mean of the two sites over the two years, similarly Average Seed Size.

Average Permeability is the mean of laboratory germination tests of seed collected from the two sites over two years in early October.

Potential Regeneration is the regeneration calculated as follows:

Algeria, 1977/78 and 1978/79.

Algerian Collection Number	Average Winter Vigour	Average Spring Vigour	Flowering	Average Seed Yield (gm/m²)	Average Seed Size (gm/1000)	Average Permeability (% seed)	Potential Regeneration (plants/m²)	INDEX of PERFORMANCE
M. polymorpha								
58	11·90	11·30	−16	151·9	5·80	9·27	2400	40,340
72	10·90	11·65	−12·5	126·8	5·91	11·41	2450	38,880
263	10·53	12·40	+5·0	125·2	4·74	7·27	1920	31,320
398	10·53	12·60	+7·0	121·3	4·75	10·61	2710	44,930
M. truncatula								
381	9·40	11·25	+8·5	67·7	4·05	16·94	2830	37,410
681	11·03	12·85	−2·0	88·4	4·40	5·30	1080	19,130
735	11·05	12·30	−12·0	108·9	4·48	2·34	570	9,690
762	9·28	11·40	−1·0	100·1	3·11	5·64	1820	24,050
M. scutellata								
816	13·48	14·40	−1·5	161·5	18·29	7·40	650	15,770
M. ciliaris								
573	11·58	13·15	−7·0	127·8	11·52	3·86	430	8,180
M. aculeata								
219	12·35	13·55	−7·5	119·9	9·51	5·03	630	13,180
353	11·88	13·35	+12·5	89·0	8·30	9·08	970	19,220
Jemalong	10·00	10·00	0	56·0	3·46	3·75	610	7,6[illegible]
Robinson	12·75	12·65	−12·0	130·4	14·53	6·55	590	11,240

$$P.R. = \frac{\text{Average Seed Yield } (gm/m^2)}{\text{Average Seed Size (gm/1000 seed)}} \times \frac{1000}{1} \times \frac{\text{Average Permeability}(\%)}{100}$$

$$= \text{plants}/m^2$$

The actual expected regeneration will, ofcourse, be lower than these calculated figures from ungrazed swards.

From experience, under grazed conditions in Algeria, seed yields would be only 25% of those obtained here. Seed size and permeability would also change, but not substantially. Thus actual field regeneration might be expected to approach one quarter of the calculated Potential Regeneration.

The Index of Performance used for selection purposes is calculated as:

$$I.P. = \frac{\text{Potential Regeneration}}{4} \times \text{Average Winter Vigour} \times \frac{\text{Average Spring Vigou}}{2}$$

It can be seen from Table 2, that all selections are superior in the Index of Performance to "Jemalong". Where possible, the selections have been also with regard to flowering date - a range of highly stable, adapted lines have been chosen to represent the range of flowering dates in order to further elucidate this factor in field trials (Fourth Year "Grazing" Trials).

Within M. polymorpha, four lines have been chosen to represent a range of flowering dates over three weeks. Medicago polymorpha is the most commonly found species in Algeria, and while its wide distribution must in part be due to its pod type (transported in wool) the figures shown indicate it's great adaptability

to Algerian conditions. Its main attribute is reliably high seed production (particularly in terms of the number of seed per square metre) and reasonable permeability.

In M. truncatula, the reason for superiority over "Jemalong" is not always the same - for example, plant winter vigour of line 381 is inferior and while seed yield is marginally superior, its main feature is the highly permeable seed along with reasonable spring vigour. On the other hand, line 681 is superior in all attributes (although the selection index is lower than the previous line).

Line 735 was included because, although it is only slightly superior to "Jemalong", it is an example of a very early flowering line of the species.

Line 816, (Medicago scutellata) is the only line of that species which was superior to the cultivar "Robinson". It is outstanding in vigour and has high yields of large seed. It is, however, a semi-erect type although less erect than "Robinson".

The line 573 (M. ciliaris) was included for multiplication as it is the top line of this species tested and although it's selection index is only similar to "Jemalong" (inferior to "Robinson" which has generally the same plant habit) the salt tolerance of the species was thought worthy of further field testing.

Medicago aculeata remains a promising species. While the selection index of the two lines shown here are not as high, for

example, as for M. polymorpha, it has an excellent prostrate to semi-prostrate growth habit, good winter and spring vigour, reliable seed yield and very importantly, stable seed permeability (seed permeability in the other species is more season-dependent). It also tends to form it's pods underneath the plant canopy.

Another otherwise promising line of this species was rejected on the basis of susceptibility to powdery mildew.

It should be noted that the most promising line within each species (with the exception of M. ciliaris) was the latest flowering of those tested.

All these selections now go into small scale multiplication to obtain seed for production testing (Fourth Year "Grazing" Trials).

The Third Year Evaluation Nurseries and regenerated Second Year Evaluation Nurseries will give additional performance data on all lines and hopefully verify the selections made after two years of evaluation.

(iii) Observations from Other Nurseries, 1978/79.

(A) An observation (row) nursery was grown for the first time this year at the experimental station at Dahmouni (Tiaret).

This station is representative of a large area of the Algerian high plateau. As with all the high plateau region in this year, very cold conditions were experienced.

The results obtained are extremely encouraging. Table 3 shows the winter vigour at Tiaret (following a late sowing, December 17) in comparison to the mean winter vigour of the species established in the evaluation nurseries. Most species performed equally well at Tiaret as at the other sites. Medicago truncatula showed superior performance at Tiaret over the other sites.

In addition, a high density varietal trial (using Australian cultivars and a limited number of previous Algerian selections) exhibited excellent forage production in late winter and spring.

These results have increased hopes that by improved cultivar vigour and high regeneration density, the problem of lack of animal fodder (quantity and quality) can be at least partly solved on the high plateau by Medicago.

(B) There has been some concern during this program as to the representivity of the experimental station at Ain-el-Hadjar. Soil is deep alluvial heavy clay and the station is protected on three sides by hills, creating a special micro-climate. The deep soils in particular are responsible for producing a growing season which is unrepresentatively long compared to the shallower soils of lower clay content surrounding the station.

This year a small number of ecotypes were sown in an off-station observation (row) nursery on a state farm some 10 kilometres from the experimental station on a representative shallower sandy-clay soil.

This year was not a particularly good test as, due to a very dry winter, germination and emergence did not occur until

TABLE 3: Comparison of Winter Vigour between Evaluation Nurseries (Sidi-Bel-Abbes, Ain-el-Hadjar 1977-79) and Observation Nursery, Tiaret 1978/79.

	Mean Winter Vigour (Evaluation Nurseries)	Winter Vigour Tiaret 1978/79
M. polymorpha	10.92	10.94
M. truncatula	10.04	11.54
M. scutellata	12.50	13.75
M. orbicularis	7.59	9.75
M. ciliaris	11.32	11.06
M. aculeata	12.13	12.17
Jemalong	10.00	10.00
Snail (Robinson)	13.40	14.00

the end of January. However, indications were that the two sites were different, particularly with respect to the effect of cold. Although absolute plant vigour at the test site was about 25% of that obtained at Ain-el-Hadjar, the relative performance between lines and species (in terms of plant growth) remained approximately the same at the two sites.

These results confirm the suspicion that this station may not truly represent the surrounding high plateau zone (it probably better represents the zone north of Saida where the climate is normally less severe and soils tend to be deeper), and that it may be essential to sow small "satellite" nurseries on surrounding farms as early in the evaluation cycle as possible (depending on human and seed resources) to support the data obtained at Ain-el-Hadjar.

(C) Following the First Year Evaluation Nurseries grown in 1977/78, it was already apparent that the most interesting species, taking all criteria into account were M. aculeata, M. scutellata and M. truncatula. Although M. polymorpha has a less than desirable pod type it has also shown great adaptability under the local conditions.

In 1978/79, 131 lines of these species from the Algerian collection were again evaluated at Ain-el-Hadjar in observation rows. All M. aculeata, all M. scutellata and all M. truncatula with 10% better vigour than "Jemalong" (from the initial observation nursery in 1976/77 at Tessala) were grown.

From this nursery, 18 lines will be advanced into Evaluation Nurseries this year.

For the first time, selection has not only been for grazing (prostrate, semi-prostrate) types but also for hay (erect) types. It has been shown the Medicago can produce forage yields at least as high as that of the traditional legume in Algerian hay crops (vetch). It has other advantages over vetch - although cut for hay, small quantities of seed are left in the field. Over a number of years these quantities may accumulate to produce a self-regenerating situation.

In addition, seed production of medics, particularly M. scutellata which is considered to be the ideal type for hay in association with oats or barley is considerably easier, given the appropriate equipment.

Summary and Conclusions:

Considerable progress has been made towards the introduction of superior cultivars of Medicago, better adapted to Algerian climatic and farm management conditions.

There now needs to be emphasis placed on large scale seed multiplication. This should be organised as a specialist operation. The technical expertise needed for this is not great, rather attention to detail is required - level, flat, weedfree seedbeds; chemical (pre-sowing or pre-emergence) weed control is desirable along with insect control.

On present indications, a maximum of 150 tons of medic seed will be required annually over the next few years. Seed crop yields of 3 - 400 kg per hectare should be easily achieved. Thus about 500 hectares of seed production would be required to satisfy domestic demand.

The harvesting operation would require a maximum of six imported pneumatic seed harvesters. At current seed importation prices, the cost of these machines would be more than fully recouped in the first season.

Field sowings are continuing at a slowly increasing level, very often a limit being imposed by the availability of seed. For instance, in one administrative state in 1978/79, the projected seeding was to be over 5000 hectares. Seed was only available to sow 2000 hectares. Another state in 1979/80 requested seed for 5000 hectares but only received enough to sow 3 - 400 hectares.

While this demand for seed is encouraging, it must be viewed cautiously. Not all the areas sown in previous years remain in medic-wheat rotation. In addition, many farms have seen the undoubted benefits of medic as a source of animal fodder but are treating it as an annual crop, sown after cereal. Thus, although demand for seed is growing, the area sown to medic may not be increasing.

In the coming year (1979/80) an attempt is to be made to examine previous sowings to assess how much land is rotating medic and cereal in a self-regenerating system. It is hoped also, that this study will define further problems which may exist at the farm level with regard to the rotation, building on the data compiled in the farm survey of 1975/76.

There is, undoubtedly, a need for greatly increased extension activities (not only in relation to medic). Grazing management

in the year of establishment continues to be poorly understood, so, too, is the seedbed preparation for wheat following medic.

This latter is a difficult problem. The seedbed preparation following medic requires more workings following the opening rains than the traditional wheat-fallow. However, very often there is insufficient functioning machinery to enable these extra workings during this critical period, or the machinery of that farm is working on another farm as part of a combined machinery pool. The machinery pool makes properly timed soil cultivation almost impossible.

Finally, the rotation medic-wheat was introduced into north Africa as a strict two-course rotation. This was intentional - a two-course rotation is the normal type in the region and thus no great changes in farm management were thought to be necessary.

However, on examination of the farming systems, one finds that strict (permanent) rotations are not practiced. True, cereals are usually grown every second year. But the alternate year is not always fallow or not always grain legumes etc., but rather one of the alternatives.

Thus the introduction of a strict wheat-medic rotation has created some management problems. Over the last two years, the idea of a flexible system has been promoted. The system is flexible assuming a certain seed reservoir has been attained.

Further demonstration and extension of this flexibility should be encouraged to increase the acceptability of medic in certain farming areas where multiple alternative crops are available.