# ANNUAL REPORT CIMMYT-I.D.G.C.

## ALGERIA

## 1977-78


CENTRO INTERNACIONAL DE MEJORAMIENTO DE MAIZ Y TRIGO

INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER

México

# ANNUAL REPORT CIMMYT-I.D.G.C.

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## I INTRODUCTION

The cereal needs of Algeria at present based on about 200 kg/head is 3.66 million M. tons. The population of 18.3 million has one of the highest growth rate (3.2) in the world. The average cereal crop is about 1.85 million M. tons from about 3 million hectares. This means Algeria needs to double its average production in order to arrive at a selfsufficancy level and must then on maintain a growth rate of at least 3.2 percent in order to be in par with the population.

Algeria went through a second season of highly unfavorable crop production conditions during the 1977-78. There was a total failure of preseeding rains in most of the regions. Hence a good part of the cereals were seeded on dry seed bed. During November the rainfall was normal and this allowed all early seeded crops to germinate. The remaining of the cereals were planted during late December. Mid December to end of February was again very dry and the winter was warm. Thus due to lack of adequate weed elimination during the presceding preparations and lack of moisture and warm conditions, the early seeded crop was very poor. Rains started towards the end of February and continued on periodically up to the month of June. The late rains helped to have some harvest on the early seeded crop as well as allowed to have a good crop on the late seeded crop. The details of area distribution and production for the year 1977-78

are reported in Table A-1. The area given is the actual harvested area and is only about 75% of the projected seeded area. The production reported is 14.35 million quintals but this do not take into account the quantities kept back by the private farmers for autoconsumption and seed and the autoconsumption in the other sectors. Taking these into account the production during the 1977-78 crop might have been close to national average.

Stripe rust was the only notable disease. This was limited to the bread wheat variety Siete Cerros and that too only in the central and eastern regions. This was the 3rd year in succession Siete Cerros was highly infected by the stripe rust and this variety needs urgent replacement.

# TABLE A.1

## CEREAL SITUATION ALGERIA 1977-78

| | Socialist | | | Agrarian Revolution | | | Private | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Harvested Area/ Production | % Area | Yield Qx/Ha | Harvested Area/ Production | % Area | Yield Qx/Ha | Harvested Area/ Production | % Area | Yield Qx/Ha | Harvested Area/ Production | % Area | Yield Qx/Ha |
| Bread Wheat | 321.075 | 38.91 | 7.03 | 115.300 | 27.77 | 4.16 | 214.179 | 16.62 | 4.94 | 650.554 | 25.73 | 5.83 |
| | 2.258.111 | | | 479.048 | | | 1.057.848 | | | 3.795.007 | | |
| Durum Wheat | 333.862 | 40.46 | 7.53 | 196.620 | 47.35 | 4.96 | 624.370 | 48.46 | 5.08 | 1.154.852 | 45.67 | 5.77 |
| | 2.512.212 | | | 975.810 | | | 3.173.239 | | | 6.661.261 | | |
| Barley | 131.396 | 15.92 | 9.23 | 93.905 | 22.61 | 4.44 | 405.119 | 31.44 | 4.69 | 630.420 | 24.93 | 5.60 |
| | 1.212.108 | | | 416.510 | | | 1.899.527 | | | 3.528.145 | | |
| Oats | 38.887 | 4.71 | 5.63 | 9.422 | 2.27 | 3.56 | 44.712 | 3.47 | 2.50 | 93.021 | 3.68 | 3.92 |
| | 219.095 | | | 33.561 | | | 111.618 | | | 364.274 | | |
| Total | 825.220 | 32.63 | 7.52 | 415.247 | 16.42 | 4.59 | 1.288.380 | 50.95 | 4.85 | 2.528.847 | 100.00 | 5.67 |
| | 6.201.526 | | | 1.904.929 | | | 6.242.232 | | | 14.348.687 | | |
| Total Area seeded and % Area Harvested | 886.840 | 93.05 | | 499.725 | 83.10 | | 1.997.643 | 64.50 | | 3.384.208 | 74.73 | |

## II. CEREAL BREEDING

### A. Introduction

The agroclimatic conditions of Algeria is variable from region to region. Almost all the cereals are rainfed and the climatic patterns are variable from year to year. As a result the needs are to have different varieties for different agroclimatic zones. Since the climatic patterns within region is also variable from year to year the varieties must have in addition to local adaptation a tremendus flexibility.

### B. Bread Wheat

Algeria started growing the high yield varieties (HYV) of bread wheat in 1971. Today they occupy about 75% of the bread wheat area. Siete Cerros continued to be the predominant variety covering close to 85% of the HYV area. About 10% was under Strampelli and the remaining 5% under Inia, Tobari and Anza. The HYV's were grown mainly in the socialist and reform agrarian sectors due to the lack of its promation in the private sector and unavailability of the seed. Through the release of newer varieties and seed multiplication of these newer varieties the predominance of Siete Cerros will decline. The local varieties in cultivation were Mahon Demias and Florence Aurore. They occupy respectively 80% and 20% of the local varieties area.

During this report year Algeria named five bread wheat varieties. The details are given in Table A-2. All the new varieties are superior to that of Siete Cerros and Strampelli under the stress

TABLE A.2

## A COMPARISON OF NEW BREAD WHEAT VARIETIES WITH THE VARIETIES AT PRESENT IN PRODUCTION IN ALGERIA 1977-78

| Pedigree | New Algerian Names | 1 | | | 2 | | |
|---|---|---|---|---|---|---|---|
| | | Yield Qx/Ha | Rank° | % Stmp°° | Yield Qx/Ha | Rank° | % Stmp°° |
| Strampelli | - | 48.45 | 6.67 | 100.00 | 16.52 | 12.00 | 100.00 |
| Siete Cerros | - | 40.40 | 19.00 | 83.66 | 16.53 | 14.50 | 102.88 |
| FA or MDA[x] | - | 35.07 | 22.67 | 72.12 | 16.71 | 12.88 | 102.24 |
| Anza | Ghriss 75 | 47.45 | 6.67 | 98.38 | 17.49 | 10.63 | 108.99 |
| Syrimex | Setif 76 | 47.34 | 7.17 | 98.12 | 17.87 | 9.63 | 110.41 |
| ARZ | Beni Slimane 76 | 47.30 | 7.00 | 98.34 | 17.85 | 8.38 | 110.82 |
| Mexicano 1481 | Tessalah | 46.54 | 9.50 | 96.52 | 18.58 | 5.88 | 116.66 |
| Pavon "S" CM8399-D-4M-3Y-OM | Cheliff 78 | 48.32 | 6.50 | 100.15 | 17.62 | 10.38 | 110.24 |

1. Zone littoral and sublittoral with good rain distribution. Oued Smar, Guelma and Khroub.

2. Zone sublittoral and high plateau with less rainfall. Saida, Sidi Bel Abbes, Tiaret and Setif.

° Rank among 25 varieties mean of different stations.

°° Stmp = Strampelli

x FA = Florence Aurore and MDA = Mahon Demias.

conditions. At the same time they are in par with them under the good production conditions. Beni Slimane and Setif are adapted to all the agroclimatic zones in Algeria, while Tessalah is suitable only to the western sublittoral zone due to its high susceptability to stripe rust in the east. Ghriss and Cheliff are adapted to the sublittoral and littoral zones of Algeria.

Results of the best 8 varieties out of 50 in the 3rd year yield trials in comparison to Strampelli the best check in the trials are given in Table A.3. These trials were grown in 7 different stations, Pato x CC-Inia is the most stable and promising line of this group. This line is very similar in its appearence and behaviour to that of ANZA or Ghriss. So its chances to be released as a variety is doubtful.

Results of the best five lines out of the 75 in the second year trials conducted in 4 stations are given in Table A-4. Yield and rank of Strampelli the best check variety in each of the trials is also given. All these five crosses hold good promis. There are many sisters of the cross Bb-Kal under testing, only the results of the best two are given in this report. The line NS-14-13 is a Yougoslavian spring wheat selection.

The first year yield trials were grow in 3 different stations. There were in all 300 different lines under trials this year. Results of the best 23 lines from these 12 trials are given in comparison to Strampelli in Table A-5. The best was again a Bb-Kal and this happens to be a reselection made at the Oued Smar station in Algeria. Many lines from Siete Cerros multiline did very well in these trials. In addition to the yield they were also resistant to the stripe rust, the main problem of Siete Cerros in Algeria.

TABLE A.3

PROMISING BREAD WHEAT LINES IN THE ADVANCED YIELD TRIALS ALGERIA 1977-78

| Variety NO. | Pedigree | 1 | | | 2 | | |
|---|---|---|---|---|---|---|---|
| | | Yield Qx/Ha | Rank | % Stmp | Yield Qx/Ha | Rank | % Stmp |
| AB581 | Pato x CC-Inia CM-1021-7MB-14Bj-4Bj | 50.77 | 5.33 | 101.09 | 17.98 | 9.05 | 105.46 |
| AB582 | Pato (R)/Tob-8156(R)xCno"S" CM-1031-2MB-5BK-7Bj | 45.76 | 17.00 | 91.11 | 18.85 | 7.75 | 116.71 |
| AB585 | Strampelli | 50.26 | 6.00 | 100.00 | 17.13 | 10.75 | 100.00 |
| AB586 | CC-Kal(AzxNad-Lr64/Bb) CM-1163-E-IY-IM-3Y-OM | 46.36 | 13.33 | 92.75 | 18.03 | 10.75 | 106.50 |
| AB587 | Bolsena"S" CM-8625-E-IM-4Y-IM-OY | 45.68 | 17.00 | 90.98 | 17.63 | 13.00 | 108.10 |
| AB591 | EMU"S" CM-8327-C-9M-IY-OM | 47.56 | 11.67 | 94.60 | 18.00 | 9.50 | 108.09 |
| BB602 | Cal-CnoxYr.70 Alg.65-IBK-52AL | 42.46 | 13.00 | 90.83 | 17.05 | 10.50 | 108.45 |
| BB603 | Cha-3(Son64-SkE$^{6}$xAn$^{3}$E(St464) Alg-5-IBK-4AL | 42.57 | 11.33 | 91.69 | 17.42 | 7.00 | 110.59 |
| BB606 | Bb-PatoxHD832-Bb CM-15626-4Bj-2AL | 43.66 | 9.33 | 93.90 | 16.41 | 15.00 | 103.28 |
| BB615 | Strampelli | 46.64 | 7.33 | 100.00 | 15.91 | 13.25 | 100.00 |

1. Zone littoral and sublittoral with good rain distribution. Oued Smar, Guelma and Khroub.
2. Zone sublittoral and high plateau with less rainfall. Saida, Sidi Bel Abbes, Tiaret and Setif.

TABLE A.4

PROMISING BREAD WHEATS FROM THE SECOND YEAR YIELD TRIALS ALGERIA 1977-78

| V. No. | Pedigree | Yield Qx/Ha | Rank | % Stmp. |
|---|---|---|---|---|
| AA.462 | CC-IniaxCno-7c CM-4319-IY-2M-IY-2M-OY | 32.63 | 6.75 | 104.90 |
| AA.466 | Bb-Kal CM-9160-11M-5Y-4M-IY-OM | 31.81 | 8.25 | 99.40 |
| AA.465 | Strampelli | 31.16 | 8.25 | 100.00 |
| BA.479 | Bb-Kal CM-9160-11M-5Y-IM-2Y-OM | 34.56 | 7.05 | 99.64 |
| BA.483 | PV18A-Cno67/Tobxcc-Pato Alg 43-2AL-IAL-OG | 33.15 | 9.75 | 96.89 |
| BA.480 | Strampelli | 33.82 | 8.25 | 100.00 |
| CA.513 | NS-14-13 | 30.47 | 8.25 | 101.07 |
| CA.520 | Strampelli | 31.36 | 8.25 | 100.00 |

TABLE A.5

BEST BREAD WHEAT SELECTIONS OF THE FIRST YEAR YIELD TRIALS

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| V. No. | Pedigree | Yield Qx/Ha | Rank | % Stmp |
|---|---|---|---|---|
| A. 1 | Blue Jay"S"<br>CM-5287-J-IY-2M-2Y-3M-OY | 45.90 | 3.5 | 117.89 |
| A. 12 | Oldafo 41A | 43.96 | 4.0 | 115.06 |
| B. 37 | Laschish Line No. 1568/2 | 43.47 | 1.5 | 109.19 |
| B. 42 | Cj 71-Cpr<br>CM-15070-IM-IY-OY | 43.18 | 1.5 | 110.33 |
| B. 47 | 7CxTob-Napo<br>CM-789-21-IA-2Y-OM | 40.40 | 6.0 | 100.74 |
| C. 59 | Tob-Cno"S"xPj62<br>CM-7369-6L-OL | 44.57 | 5.5 | 100.72 |
| C. 61 | Cal-Lundi<br>CM-1076-19M-3Y-OM-2Y-500M-OY | 45.57 | 3.5 | 101.68 |
| D. 81 | Brochi"S"<br>CM-5872-B-8Y-IM-2Y-4M-OY-OAL | 42.25 | 8.5 | 107.95 |
| D. 83 | 601 VD V Turquie | 42.07 | 9.0 | 107.17 |
| D. 86 | Tob"S"-Napox7C<br>II 30415-10S-IS-3S-OAL | 46.00 | 1.0 | 117.55 |
| D. 89 | Mex.50-B21-Cal"S"<br>Tu147-IBK-3AL-IAL-OAL | 44.32 | 3.5 | 111.41 |
| D. 93 | CgnxKal-Bb<br>CM-15133-26Bj-3AL-IAL-OAL | 43.18 | 6.5 | 107.80 |

Continuation next page

Continuation TABLE A.5

| V. No. | Pedigree | Yield Qx/Ha | Rank | % Stmp |
|---|---|---|---|---|
| D. 99 | Pato(R)-Cal<br>CM-1036-IMB-4BK-OBK-19AL-IAL-OAL | 41.68 | 9.5 | 107.18 |
| E.103 | PV18A-Cno67xCrt"S"<br>CM-21467-12Bj-IS-IS-OS | 41.43 | 3.0 | 114.88 |
| E.107 | PV18A-Cno67xNar"S"-Pj"S"<br>CM-21469-6Bj-IS-3S-OS | 40.43 | 6.5 | 114.63 |
| E.117 | CC-Kal(AZ67xNad-LR64/Bb)<br>CM-1663-E-IY-IM-2Y-OM | 42.18 | 1.0 | 117.79 |
| F.128 | RR68-WW15/Ji"S"xCno-No$^{66}$<br>CM12272-N-IY-IM-OY-OBK | 43.50 | 7.0 | 103.00 |
| F.146 | Tzpp-Son64/Cno-JarxKvz<br>CM-20707-A-IY-8M-IY-OY-1Ptz | 44.17 | 4.7 | 105.95 |
| F.150 | Brochi"S"<br>CM 5872-C-IY-5M-IY-3M-OY-2Ptz | 41.71 | 8.7 | 101.48 |
| J.237 | Bb-Kal<br>CM-9160-IIM-5Y-5M-2Y-OM | 41.31 | 4.0 | 99.68 |
| K.252 | Kal-Cal"S"<br>Tu.71-29-34Bj-53j-OBj-3AL | 45.27 | 3.3 | 97.39 |
| K.261 | Bb-Kal<br>CM9160-11M-5Y-5M-2Y-OM-2AL | 48.44 | 2.0 | 103.23 |
| L.298 | Castan | 46.02 | 4.0 | 99.57 |

The program continued to screen a wide range of germplasum. Special emphasis is being made to exploit the winter spring germplasum at the Setif and Saida the two high plateau stations.

C. Durum Wheat

Durum wheat occupies about 45% of the cereal area or about 65% of the wheat area in Algeria. It is grown mainly in the sublittoral and high plateau areas. The agroclimatic conditions of these areas are highly variable and thus demand varieties of high yield stability to buffer the adverse conditions.

The predominant local varieties are Bidi 17, Mohamed Ben Bachir, Hedba 3 and Oued Zenati . Polonicum x Z.B., although a recent variety can also be classed in this group. Joric 69, was introduced during 1971-72, but is not well adapted and soon will go out of cultivation. Cocorit 71 is well adapted to the littoral and sublittoral zones but the high yellow berry tendency makes its extension difficult. Mexicali 74 although has the same adaptational pattern as Cocorit with less yellow berry, it is highly susceptable to the leaf rust. INRAT 69 of Tunisian origin and Capeiti of Italy are also in limited cultivation but are again not very stable in its yield potential.

During this year the program released 5 new lines for seed increase (Table A-6) Tell 76 and Timgad 73 are well adapted to the high plateau and sublittoral zones- the two main durum zones of Algeria. Tassili 77 and Khroub 76 show general adaptation to all the zones but

TABLE A.6

NEW ALGERIAN DURUM VARIETIES

| Varietal Name | Pedigree |
|---|---|
| TIMGAD 73 | Cisne"S" D 27617-21M-300Y-OBK |
| KHROUB 76 | MASA 8Y-OM-OBK |
| TELL 76 | Cr"S"-F3TuxAA"S"/Fg"S"<br>CM-10200-IBK |
| TASSILI 77 | Rabi"S"-Fg"S"<br>CM-10162-76M-4Y-OM |
| SAHEL 77 | Cit"S"xPg"S"-AA"S"/RuffxT.Dic.Ver-Gl"S"<br>CM-14528-C-IY-IM-OY |

are better suitable for sublittoral and littoral zones. The variety Sahel 77 is best under the littoral conditions but can be extended to the sublittoral zones also. Most of these lines are local selections and with the availability of seed for general production, will releave the problem of lack of high yielding stable durum varieties for the high plateau and sublittoral zones of Algeria.

Results of the promising lines in the advanced yield trials are reported in Table A-7. Two crosses Plc"S"-Cr"S"/Mca"S"xPg"S"-Par and Plc"S"-Ruff x Gta"S"-Rol showed excellent adaptation to the different agroclimatic zones of Algeria and are potential candidates for new varieties. A Turkish high plateau selection Uveyik 126x61-130 is also doing very well in the high plateau and some sublittoral zones of Algeria. But its performance in the littoral zone and some sublittoral zone is not promising.

The promising lines in the preliminary trials are 21563-AA"S"xFg"S", Mexi-Fg"S" and (Gr"S"-Fg"S"/21563-Gs"S"xCit"S")Par66/270.

More than 300 lines from F3 and F4 were bulked during this year for yield trials and this is the first time such a great number of local selections are entering the yield trials for the durums in Algeria.

The program continued to make crosses and selection from a very wide range of germplasum.

TABLE A.7

PROMISING DURUM LINES IN THE ADVANCED YIELD TRIALS ALGERIA 1977-78

| Variety No. | Pedigree | 1 | | | 2 | | |
|---|---|---|---|---|---|---|---|
| | | Yield Qx/Ha | Rank | % Cocorit | Yield Qx/Ha | Rank | % Cocorit |
| 551 | Plc"S"-RuffxGta"S"-Rol CM-17904-B-3M-IY-IY | 47.61 | 4.00 | 107.18 | 16.63 | 8.25 | 101.36 |
| 562 | Plc"S"-RuffxGta"S"-Rol CM-17904-B-3M-IY | 47.39 | 5.00 | 106.60 | 17.03 | 10.25 | 102.22 |
| 552 | Stk"S"xChap-21563 CD-1894-18Y-OY | 45.62 | 6.07 | 103.07 | 16.31 | 12.25 | 99.22 |
| 559 | Tassili 76 | 46.44 | 5.00 | 104.67 | 16.00 | 13.25 | 98.54 |
| 563 | Plc"S"-Cr"S"/Mca"S"xPg"S"-Par CM-18001-B-3M-7Y | 46.58 | 7.00 | 104.45 | 16.98 | 5.75 | 104.33 |
| 567 | Uveyik 126 x 61 -1130 C23-9-OA | 41.08 | 15.00 | 92.32 | 17.31 | 9.05 | 106.27 |
| 571 | Sahel 77 | 43.89 | 10.33 | 98.99 | 15.98 | 10.00 | 99.47 |
| 560 | Capeiti | 39.90 | 17.68 | 89.62 | 14.91 | 14.75 | 93.13 |
| 570 | INRAT 69 | 42.69 | 12.00 | 96.12 | 15.28 | 17.00 | 91.13 |
| 565 | Cocorit 71 | 44.45 | 9.00 | 100.00 | 16.16 | 10.00 | 100.00 |

1. Zone littoral and sublittoral with good rain distribution. Oued Smar, Guelma and Khroub.

2. Zone sublittoral and high plateau with less rainfall. Saida, Sidi Bel Abbes, Tiaret and Setif.

## III PRODUCTION AGRONOMY

The Institute continued to have on farm and on station agronomic trials. Since there was no CIMMYT staff directly involved in this field the detailed results are not reported. The main axis of the agronomic research was to find methods of weed control through chemical and cultural practices. The team evaluated a number of new products for weed control during the year. Dichlorophenoxy Methyl a Hoe product seems to hold extreme promis as a broad spectrum Gramini weed killer. There were many large scale demonstrations of dosenex and Sufix throughout the cereal belts of Algeria.

In addition to the weed control efforts the team had a few fertilizer studies, on farm evaluation of potential cereal varieties and evaluation of farm implements.

## IV MEDICAGO RESEARCH

### A. Introduction

The commercial sowing of annual Medicago commenced in 1972-73 in the milder cereal zones in Algeria. The varieties used were the currently available Australian cultivars "Jemalong", "Harbinger" and "Robinson" (ex. Snail medic).

These cultivars have proved to be of great value at the lower altitudes (less than 800 meters) in replacement of the fallow by a high producing, nutritive animal foodstuff. Indeed, a grazing experiment carried out this year showed lambs to double their daily gain when grazing medic as compared to grazing weed "fallow".

There have been problems encoutered during the initial phase of introduction:

Although the medic-cereal rotation has been promoted as a simple system, it does involve changes in farm management which are relatively complex. Cultivation practices must be altered, fertilizer application timing must be changed, cereal seeding date may have to be later than that presently practised and the management issues involved with the integration of livestock into what was predominantly a cereal enterprise must be mastered.

Because these management changes have not been accepted, weed levels in wheat following medic have reduces cereal yield. Control measures are available for the broadleaf weeds and wild oats.

However, the introduction of medic, and the subsequent elimination of the fallow, appears to have increased the relative importance of brome grass (Brohum ridigus; B. rubens; B. madritensis) in cereal culture. No chemical control is available for brome in wheat, although a high level of control is thought possible by cultural means.

Medicago research within Algeria has evolved from a program orientated towards the practical parameters (date, rate and depth of seeding, rate of fertilizer, choice of commercial Australian cultivars) to one largely concentrating on the evaluation of local ecotypes which may better fit the environments encoutered in Algeria.

This is especially true for the high plateau areas. In this large cereal zone, the Australian cultivars will persist but their contribution to total feed availability is low, and their weed competitive ability is practically nil under the very cold winter conditions.

This report will discuss the results obtained from Medicago nurseries during 1977-78 with some reference to on-farm medic variety trials.

## B. Medicago Ecotype Evaluation

In 1976-77, over 700 lines of medic collected from Australia, Tunisia, Syria and Europe (plus some selections from the South Australian medic breeding program) were sown in observation rows at Tessala (600 metres). This site has several advantages

as an initial screening station. Firstly, there is a high probability of frost during winter and spring, although the itensity and duration is less than that of the high plateau. This, then gives an initial insight into cold tolerance.

Secondly, it is considered a "safe" area which is rarely touched by severe drought. Thus, valuable seed will not be lost through drought.

Thirdly, it has deep soil with a high moisture holding capacity. The lines are able to express the maximum of their potential with regard to the lenght of growth stages.

Of these 700 lines, sixty eight lines were selected, mainly with respect to winter vigour (although consideration was made of flowering characteristics and lenghts of growing season, along with plant seed yield) for advancement into a replicated micro-sward nursery.

This nursery was sown in 1977-78 at two locations - Sidi-Bel-Abbes (500 metres altitude) and Ain-el-Hadjar (1000 metres).

Seed was rubbed out of the seed pods by hand between denticulated rubber. This was effective but very time consuming. The resultant seed had very low germination rates (0-71%) and all seed was therefore scarified using a vibrating electric sander fitted with very coarse emery paper. By this means, the seed germination levels were brought to an acceptable figure (74-100%).

Seed rates were adjusted in accordance with the laboratory germination test. The nurseries were hand-seeded in plots of one metre by one metre.

Sidi-Bel-Abbes:

The nursery was dry-sown on November 16, 1977 at a seed rate of 100 germinable seeds per square metre. Rains were recorded on 22-24 November and emergence commenced about four days later. Emergence was most rapid in the cases of M. aculeata, M. polymorpha and M. truncatula. M. ciliaris and M. orbicularis were late in emerging and M. ciliaris in particular appeared to have several different emergences.

Seedling establishment in January as a percentage of germinable seed sown is shown in Table A-8 as an average for the principal species studied, in comparison with the four standard cultivars used.

In comparison with "Jemalong", all species except M. tornata established satisfactorily, with M. aculeata being outstanding.

Winter vigour (plant vigour, 4/2/78; Table A-8) was estimated at 68 days after emergence. The plant vigour was estimated in comparison with that of "Jemalong" (=10) on a scale of 0-20. M. scutellata, followed by M. aculeata were the superior species.

In the plant vigour at 117 days (Table A-8; plant vigour 25/3/78), the same two species performed well, followed by M. polymorpha. This estimation took place when most lines were at full-flowering.

Again, plant vigour was estimated when most lines appeared to be at a peak of production (18/4/78). M. scutellata and M. aculeata were still clearly outstanding.

TABLE A.8

SUMMARY OF MEDICAGO SPECIES, SIDI BEL ABBES, 1977-78.

| | % Seed Establishment | Plant Vigour 4/2/78 | Plant Vigour 25/3/78 | Plant Vigour 18/4/78 | Days to flowering | Days of flowering | Days to debut maturity | Seed Yield ($gm/m^2$) | "Soft" Seed % |
|---|---|---|---|---|---|---|---|---|---|
| Medicago polymorpha | 68.3 | 11.1 | 12.3 | 11.5 | 98 | 63 | 156 | 101.8 | 3.84 |
| Medicago truncatula | 63.2 | 10.1 | 11.7 | 11.9 | 103 | 61 | 161 | 94.5 | 11.88 |
| Medicago scutellata | 65.5 | 13.2 | 13.8 | 12.8 | 92 | 63 | 155 | 143.5 | 12.82 |
| Medicago orbicularis | 46.3 | 6.4 | 8.4 | 8.8 | 114 | 53 | 167 | 72.6 | 1.71 |
| Medicago ciliaris | 56.8 | 11.1 | 11.9 | 11.4 | 97 | 69 | 166 | 161.1 | 2.32 |
| Medicago aculeata | 78.9 | 12.0 | 12.6 | 12.3 | 100 | 60 | 164 | 133.2 | 10.02 |
| Medicago tornata | 36.6 | 5.3 | 7.9 | 8.6 | 114 | 56 | 165 | 46.9 | 4.92 |
| Medicago truncatula "Jemalong" | 51.4 | 10.0 | 10.0 | 10.0 | 100 | 59 | 164 | 65.8 | 5.45 |
| Medicago truncatula "Borung" | 65.5 | 9.3 | 11.7 | 11.8 | 99 | 60 | 159 | 83.6 | 3.80 |
| Medicago littoralis "Harbinger " | 41.4 | 7.5 | 10.3 | 10.3 | 90 | 77 | 166 | 64.9 | 3.97 |
| Medicago scutellata "Robinson" | 83.3 | 13.8 | 14.0 | 12.5 | 89 | 61 | 151 | 169.9 | 23.68 |

Table A-8 also shows the averages for each species with respect to flowering date and duration, and the time until the plants began maturing. The overall range of flowering dates was from 84 to 130 days. Late flowering was related to poor winter vigour. However, early flowering was not necessarily linked to good winter vigour.

Seed yields were generally acceptable. As winter forage production will be highly dependent on population density, the seed production ability of a line is of great importance. So too, is the seedcoat permeability characteristic important in determining regeneration populations.

The change from totally impermeable ("hard") seeds at maturity to the proportion permeable at the true seasonal opening was studied by carrying out laboratory germinations of pods during the period from July to the end of October.

Briefly, the procedure was to harvest all pods in the three replicates, clean and weigh the samples, bulk all three replicates and return the pods to the field to undergo over-summering. One hundred of these pods were then collected at approximately three-weeks intervals for germination tests.

The average figures at the last germination are shown in the last colum of Table A-8. It shows the percentage of seed which germinated at the end of October, the seasonal opening for 1978-79. It can be seen that there are large differences between species in this characteristic. The range of all lines was from 0.53% ( a line of M. polymorpha) up to 39.25% (an M. truncatula) .

It has been suggested that permeability of about 20% at the seasonal opening would be the ideal. There are lines mainly within M. truncatula, M. scutellata and M. aculeata with this characteristic.

Ain-el-Hadjar

The nursery at Ain-el-Hadjar was dry sown and also germinated with the rains of November 22-24.

The data recorded, averaged over the principal species is shown in Table A-9. By comparing this table with table A-8, it is possible to see differences between the two sites.

Seedling establishment (as a percentage of germinable seed sown) is lower. This was to be expected following seeding rate trials over the previous three years. For this reason, seeding rates for the nursery at Ain-el-Hadjar were 200 germinable seed per square metre, thus in point of fact, seedling density was higher than that at Sidi-Bel-Abbes.

The most spectacular decreases in establishment were noticed for M. tornata and the standard cultivar "Harbinger". This was to be expected from the mild climatic nature of their naturalised distribution. Their inability to perform under cold conditions is further demonstrated in the results of plant vigour.

Relatively (to "Jemalong") all except M. aculeata and M. ciliaris performed less well at Ain-el-Hadjar with respect to winter vigour.

## TABLE A.9

## SUMMARY OF MEDICAGO SPECIES, AIN EL HADJAR, 1977-78.

| | % Seed Establishment | Plant Vigour 19/2/78 | Plant Vigour 26/3/78 | Plant Vigour 19/4/78 | Days to flowering | Days of flowering | Days to debut maturity | Seed Yield ($gm/m^2$) | "Soft" Seed % |
|---|---|---|---|---|---|---|---|---|---|
| Medicago polymorpha | 46.1 | 10.6 | 12.4 | 12.1 | 108 | 61 | 172 | 126.7 | 2.90 |
| Medicago truncatula | 41.6 | 9.4 | 11.4 | 11.5 | 114 | 60 | 176 | 103.7 | 3.15 |
| Medicago scutellata | 51.5 | 11.7 | 12.8 | 13.4 | 102 | 67 | 174 | 202.0 | 1.11 |
| Medicago orbicularis | 27.9 | 6.4 | 9.7 | 9.6 | 116 | 53 | 175 | 119.1 | 0.83 |
| Medicago ciliaris | 47.4 | 11.3 | 13.0 | 13.2 | 106 | 66 | 177 | 218.5 | 0.18 |
| Medicago aculeata | 57.5 | 12.1 | 13.1 | 13.3 | 108 | 61 | 179 | 168.6 | 5.14 |
| Medicago tornata | 10.7 | 3.7 | 6.7 | 5.3 | 123 | 60 | 186 | 32.4 | 2.31 |
| Medicago truncatula "Jemalong" | 41.5 | 10.0 | 10.0 | 10.0 | 112 | 58 | 174 | 44.7 | 2.49 |
| Medicago truncatula "Borung" | 42.1 | 8.5 | 9.8 | 10.5 | 110 | 63 | 176 | 81.7 | 1.32 |
| Medicago littoralis "Harbinger" | 12.3 | 3.0 | 6.1 | 6.3 | 104 | 80 | 182 | 22.8 | 0.98 |
| Medicago scutellata "Robinson" | 61.9 | 12.1 | 13.3 | 12.8 | 103 | 65 | 175 | 166.9 | 1.21 |

M. aculeata showed strong growth throughout the growing season, producing a good seed yield with acceptable "soft" seed characteristic.

Flowering commenced from about 2 days to 2 weeks later depending on the species at Ain-el-Hadjar. Although large differences in flowering duration between sites are not apparent, generally higher seed yields were obtained at Ain-el-Hadjar, possibly due to the milder spring conditions, and higher plant populations.

The milder conditions and the increased period between flowering and maturity are believed to be the cause of the dramatic fall in "soft" seed at Ain-el-Hadjar. The most affected species was M. scutellata, in particular the standard cultivar "Robinson". This large affect of growing environment on seed permeability is undoubtably the cause of conflicting regeneration data for that cultivar.

Conclusions from Nursery Data:

The nurseries reported here were compiled with two principal purposes:

a. To define the species which may best suit local conditions.
b. To agronomically define the environments into which the plants will be introduced.

To properly fulfil these two objectives, the same nurseries should be sown for at least two years. This is, in fact, being done, with this nursery being sown in six locations in 1978-79.

However, from this first year, it is possible to draw some conclusions:

Medicago aculeata is an extremely promising species, especially on the high plateau. It germinates rapidly, has strong seedling growth and under the cold winter conditions assumes an extremely prostrate habit forming a dense mat on the soil surface. Its competitive ability is therefore assumed to be good. As temperatures rise, it becomes semi-erect and as a pure ungrazed sward reaches a height of about forty centimetres. Most pods are formed very low on the plant and are thus protected from grazing animal. Some lines of this species have a tendency to bury their pods. There are lines within the present collection which exhibit ideal seed permeability characteristics. The pod spines do not appear to be of a type as to cause serious wool fault. Note, however, must be made of the fact that some lines of this species were attacked quite severely by powdery mildew at Sidi-Bel-Abbes, where it was one of the two species affected, the other being M. orbicularis. In laboratory pod germination tests, some seedling damping-off was also noted.

Medicago scutellata has strong winter vigour. Under ungrazed conditions, its forage yields throughout the growing season are always highest. This is demonstrated in Table A-10 and A-11 which show the best line of each of the principal species. M. scutellata is always the species with best vigour at all three observations at both sites. However, it has an upright growth habit, making it very prone to overgrazing with subsequent effect on seed yield and continuation of the system. This really is a problem of education or experience, and there is no reason why grazing techniques for this species cannot be formulated in the future. In addition, M. scutellata may well find a place as a hay species for the high plateau areas.

## TABLE A.10

## TOP LINES OF THE MOST PROMISING SPECIES, SIDI BEL ABBES, 1977-78

| | Ident. of 1977/78 | Country of origin | Vigour 4/2/78 | Vigour 25/3/78 | Vigour 18/4/78 | Days to flower | Days of flower | Days to pod | Days to debut maturity | Days to complete maturity | Seed Yield ($gm/m^2$) | Regen Popu-lation° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M. polymorpha | 3 | Tunisia | 14.0 | 13.7 | 12.2 | 93 | 64 | 112 | 150 | 170 | 82.7 | 450 |
| M. truncatula | 30 | Algeria | 11.5 | 13.0 | 12.8 | 91 | 67 | 110 | 157 | 173 | 151.0 | 1380 |
| M. scutellata | 42 | Australia | 14.0 | 14.5 | 13.2 | 84 | 65 | 107 | 151 | 168 | 183.3 | 670 |
| M. ciliaris | 54 | Algeria | 12.0 | 13.2 | 12.8 | 97 | 63 | 110 | 164 | 174 | 223.3 | 790 |
| M. aculeata | 60 | Algeria | 12.7 | 13.2 | 12.8 | 96 | 60 | 112 | 167 | 176 | 175.1 | 540 |

° Regeneration Population ($pants/m^2$) =
Seed Yield x % Soft Seed x Number Seed/gm.

TABLE A.11

TOP LINES OF THE MOST PROMISING SPECIES, AIN EL HADJAR, 1977-78

| | Ident no 1977/78 | Country of Origin | Vigour 19/2/78 | Vigour 26/3/78 | Vigour 19/4/78 | Days to flower | Days of flower | Days to pod | Days to debut maturity | Days to complete maturity | Seed Yield ($gm/m^2$) | Regen Population° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M. polymorpha | 3 | Tunisia | 12.3 | 13.5 | 12.6 | 103 | 65 | 121 | 173 | 186 | 138.1 | 900 |
| M. truncatula | 24 | Algeria | 11.8 | 12.5 | 13.1 | 116 | 56 | 124 | 177 | 195 | 118.3 | 940 |
| M. scutellata | 41 | Sicily | 13.0 | 14.3 | 15.6 | 107 | 61 | 127 | 175 | 190 | 258.3 | 290 |
| M. ciliaris | 53 | Algeria | 12.5 | 14.3 | 14.3 | 103 | 69 | 122 | 177 | 190 | 266.2 | 0 |
| M. aculeata | 62 | Algeria | 12.6 | 13.5 | 13.6 | 104 | 64 | 121 | 177 | 192 | 188.2 | 280 |

° Regeneration Population ($plants/m^2$) =

Seed Yield x % "Soft Seed x Number Seed/gm.

Medicago truncatula shows reasonable winter vigour, although lower than the other four lines shown in Tables A-10 and A-11. However, it is extremely adaptable and over the past four years, cultivars from this species have shown good drought tolerance. Its reaction to grazing is good and seed yields are normally high. The premeability characteristics of seed are reasonable and regeneration is acceptable.

Medicago polymorpha is the most widespread species in North Africa. It is well adapted to most regions. There is, however, one main problem associated with it. The seed pods have long spines which are very often hooked at the tip. Thus the pods can become very severe contaminants of wool. Two questions then arise: - As it is so widespread, should one be concerned about wool fault? And as most local sheep have bare legs and bellies, does the problem of wool fault arise? The answer in both cases is yes. One must be concerned about this aspect as the problem already exists and should not be increased.

Unfortunately in the Algerian collection of about 250 lines of this species, degree of pod spine is correlated with winter vigour, the most vigorous types having very large hooked spines.

Medicago ciliaris is a vigorous erect species well suited, it seems, to cold conditions except for its very low level of permeable seed (Table A-9, Table A-11). The seed after thrashing also has very low germination, a problem which could affect the commercialisation of this species (Table A-12). In addition, the species seems very susceptible to pod-borne insects which destroy seed.

It is, however, the species best adapted to saline soils.

Of the other species tested (M. orbicularis, M. tornata, M. rotata, M. littoralis, M. littoralis x M. truncatula) there was little immediate promise shown.

Table A-12 shows two aspects which could affect the commercialisation of the species- the case of thrashing and the germination of seed after thrashing. The thrasher used in this test has an incline base of idented tin (much like kitchengrater) over which is mounted an electric belt sander fitted with a highly abrasive metal-finishing belt. The aperture between the base and belt is adjustable for different pod sizes.

It can be seen that M. truncatula and M. aculeata are relatively easy to thrash with M. scutellata slightly more difficult. Germination after thrashing of all three is quite acceptable.

M. polymorpha presents difficulties to thrashing due to it having a soft (non-woody) pod. Its germinability after thrashing is low.

Considering all factors, three species have been selected for further study in 1978-79 - M. aculeata, M. truncatula, M. scutellata.

C. Medicago Variety Trials.

Variety trials were continued at a limited number of locations in 1977-78.

TABLE A.12

THRASHING CHARACTERISTICS, MEDICAGO SPECIES, 1977-78

| | Ease of Thrashing ° | Germination after Thrashing |
|---|---|---|
| M. polymorpha | 4 | 38.1 |
| M. truncatula | 2 | 77.7 |
| M. scutellata | 3 | 69.5 |
| M. orbicularis | 1 | 28.7 |
| M. ciliaris | 3 | 18.9 |
| M. aculeata | 2 | 58.7 |
| M. tornata | 2 | 64.2 |
| M. truncatula, "Jemalong | 2 | 87.3 |
| M. truncatula, "Borung" | 2 | 74.2 |
| M. littoralis, "Harbinger" | 2 | 82.1 |
| M. scutellata, "Robinson" | 3 | 71.3 |

° Ease of thrashing on 1-4 scale estimated from results using experimental laboratory thrasher.

Trials were established at four locations in October 1977. One trials at Oran suffered drought after germination and the seedlings were killed. It was resown with the same result a second time.

At Ain-el-Hadjar, the trial was inundated with broad-leaf weeds and observations only were recorded.

Trials at Telagh (1000 metres) and Tessala (600 metres) established normally.

Medicago forage yields during the month of March are shown in Table A-13. Of the cultivars and lines of M. truncatula, "Cyprus" produced the most forage during winter. "Ghor" which is earlier than "Cyprus" suffers from poor seedling growth and is not suitable for most Algerian conditions. At Tessala, AR52 performed well.

In a second cut of the same plots on May 5 (to measure recovery) at Telgh, the growth pattern were very obvious, the Algerian lines producing forage late into the season and being substantially superior to "Jemalong" in spring growth. By this stage, "Ghor", "Cyprus" and "Harbinger" were beginning to mature.

At Tessala, the total forage produced by all three of the Algerian lines was more than two and a half times of "Jemalong".

In that trial, there was an attack of Powdery Mildew. This only tends to be a problem in heavy lush growth; a situation which rarely exists in a properly grazed field. However, it is worthwhile to report that "Borung" and "Harbinger" suffered the heaviest attacks.

TABLE A.13

WINTER FORAGE YIELDS, MEDICAGO VARIETY TRIALS 1977-78,

(From Seeding Rate 12 Kg/Ha)

| | TESSALA | | TELAGH | |
|---|---|---|---|---|
| | Medicago (Kg DM/Ha) | Medic as % Total DW | Medicago (Kg DM/Ha) | Medic as % Total DW |
| M. truncatula "Jemalong" | 92 | 24.5 | 203 | 9.4 |
| M. truncatula "Ghor" | 73 | 22.5 | 122 | 7.1 |
| M. truncatula "Borung" | 162 | 36.2 | 215 | 15.3 |
| M. truncatula "Cyprus" | 187 | 36.3 | 164 | 18.4 |
| M. truncatula AR52 (Algeria) | 174 | 40.1 | 146 | 7.2 |
| M. truncatula AR5260 (Algeria) | 131 | 24.3 | 185 | 10.4 |
| M. littoralis "Harbinger" | 148 | 28.2 | 189 | 9.8 |
| M. scutellata "Robinson" | 95 | 18.8 | 169 | 17.1 |
| M. orbicularis Mo 49 (Algeria) | 154 | 27.0 | 104 | 6.1 |

Also at Tessala, damage was caused by Sitona lineata. All Australian cultivars were attacked. Of the Algerian ecotypes, AR5260 was mildly affected, AR52 was only slightly touched and it was impossible to find any sign of attack on Mo 49.

Seed yields of the trials are shown in Table A-14.

The Algerian ecotypes AR5260 and AR52 are shown to have good seed yields under the milder conditions of Tessala, and are relatively stable under cutting.

As would be expected, there is a tendency for late maturing types to perform better under this type of test.

There was no strong effect of seeding rate on subsequent seed yields at Tessala. There was, however, a significant overall effect of doubling seeding rate at Telagh. Yields of the late maturing Algerian ecotypes were affected by two days of "Sirocco" in Mid-May.

In conclusion, of the cultivars, "Borung" has continued to demonstrate superiority over "Jemalong" in forage and seed yields. "Cyprus" appears promising, especially with regard to winter forage yield. It has high seed yields but this may not necessarily mean that regeneration will be reliable as the seed of this cultivar is highly impermeable.

Of the Algerian ecotypes, AR5260 appears to be the more interesting, especially for the colder areas. It is a mixture of at least two lines and contains a range of plant types. In fact the best line of M. truncatula in the nursery at Ain-el-Hadjar (Line 24) is a selection from this bulk.

TABLE A.14

SEED YIELDS, MEDICAGO VARIETY TRIALS , 1977-78 (Kg/Ha)

| | TESSALA | | | TELAGH | | |
|---|---|---|---|---|---|---|
| 12 Kg/Ha | 1[x] | 2 | 3 | 1 | 2 | 3 |
| Jemalong | 186 | 188 | 145 | 173 | 148 | 66 |
| Ghor | 145 | 65 | 25 | 113 | 68 | 45 |
| Borung | 201 | 300 | 270 | 316 | 243 | 181 |
| Cyprus | 158 | 167 | 131 | 304 | 216 | 184 |
| AR 52 | 221 | 327 | 287 | 156 | 186 | 111 |
| AR 5260 | 188 | 446 | 392 | 176 | 174 | 82 |
| Harbinger | 111 | 144 | 129 | 204 | 124 | 75 |
| Robinson (ex. Snail) | 126 | 161 | 106 | 103 | 75 | 66 |
| Mo 49 | 93 | 249 | 248 | 153 | 203 | 128 |
| 24 Kg/Ha | | | | | | |
| Jemalong | 99 | 148 | 126 | 223 | 172 | 147 |
| Borung | 209 | 333 | 129 | 366 | 252 | 226 |
| Cyprus | 263 | 216 | 217 | 466 | 176 | 170 |
| Harbinger | 106 | 176 | 108 | 305 | 228 | 236 |
| Robinson | 124 | 158 | 174 | 246 | 139 | 119 |

x 1 = Seed yields from uncut plots
2 = Seed yields from plots cut once
3 = Seed yields from plots cut twice