CHEMONICS

INRA SEED PRIVATIZATION STUDY

Prepared by:

Claudic Bragantini

Prepared for:

U.S. Agency for International Development
National Agronomic Research Institute
The Ministry of Agriculture and Agrarian Reform
Kingdom of Morocco

Under Contract No. PDC-1406-I-00-0033-00

July 1991

2000 M St., N.W.
Suite 230
Washington, D.C. 20036

Tel: (202) 466-3340 or 293-1178
Fax: (202) 331-8602

TABLE OF CONTENTS

SECTION I
INTRODUCTION

A major concern of developed countries is the inability of many developing countries to increase crop yields. Research in the last two decades has resulted in considerable advances in plant breeding that have led to the production of high-yielding cultivars of food crops that can tolerate various production constraints. The promotion and adoption of these cultivars has the potential to rapidly and substantially increase crop production in developing countries.

However, efforts to develop seed production and distribution programs in developing countries face many challenges, particularly in providing incentives for the private sector to produce seeds for distribution where markets are small and fragmented.

The response to this challenge has typically required the involvement of government in all stages of seed production. In Morocco, the National Seed Program was established by the government with donors providing large capital investments, especially in conditioning units and storage facilities. Rigid regulations were established to ensure the production and distribution of high quality seed. To encourage use of these seeds, government agencies distributed them at subsidized prices.

These efforts, however, have not adequately solved the problems. In fact, heavy government involvement and rigid regulations in Morocco have made private sector participation even less likely. Experience has shown it is more constructive to create an environment that encourages the private sector to take part in production and distribution activities.

A. Study Purpose, Scope, and Methodology

1. Purpose

The Government of Morocco (GOM) is beginning to privatize 112 state holdings over the next five years, including the Societé National de Commercialisation de Semences (SONACOS) which, under current legislation, has a monopoly to produce certified cereal seed and exclusive rights to produce all varieties developed by the Institut National de Recherche Agronomique (INRA) until 1998.

The privatization of SONACOS has prompted INRA to develop a new relationship with the private seed sector, which could soon become the direct recipient of INRA research through the release of new varieties. At the same time, INRA is looking forward to producing revenue through the sale of seeds and by charging royalties for the use of its varieties.

The purpose of the study is to assist INRA in formulating procedures for furnishing seed to the private sector for multiplication and sale, taking into consideration the institution's interest in recovering research costs. Emphasis is on privatization of the cereal seed grains industry and on . e changes INRA will face.

2. Scope

The study highlights three principal areas:

- The cereal seed grain industry (céréales d'automne) because it will be privatized and because it represents the majority of seed INRA produces.
- Current legislation, particularly its appropriateness in a setting in which seed is produced and marketed by the private sector.
- INRA's needs to accomplish goals in infrastructure, personnel training, and administrative procedures.

3. Methodology

The seed expert spent approximately one month in Morocco and performed a comprehensive review of documentation made available by INRA, USAID, and other participating GOM agencies. He conducted extensive interviews with officials and technicians from participating GOM agencies, large and small companies in seed production and marketing, and public and private sector organizations. The expert also made several trips to research stations and private sector seed multiplication operations.

A list of the individuals and field sites visited appears in annex B; documents consulted appear in annex C.

B. Study Context

The production of grain cereals covers more than 80 percent of all cultivated land in Morocco and provides the most important staple food. Although the country's cereal production has been unstable due to climatic conditions in the last 15 years, areas planted with grain cereals have remained almost constant (see graphic 1, below).

Most farmers use improved imported varieties and save their own seed for replanting from season to season. All certified seed in the markets is produced by SONACOS, a parastatal with a monopoly on cereal seed production as well as the exclusive right to commercialize INRA's cultivars.

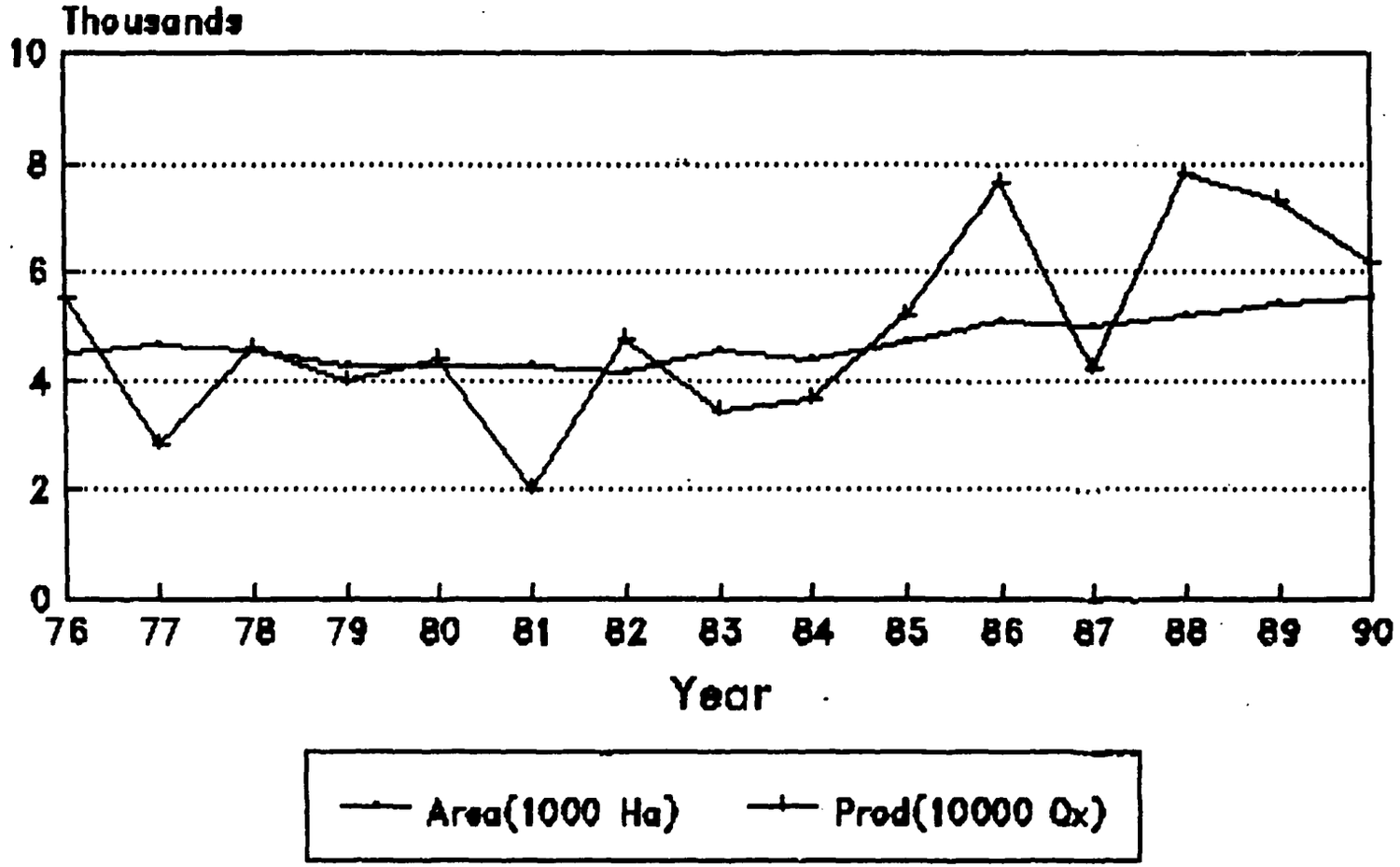
The amount of cereal seed produced by SONACOS is determined at meetings at which all governmental institutions, including INRA, are represented. The Ministry of Agriculture establishes seed production goals based on market information provided by SONACOS. Each group then plays its role: INRA produces the foundation seed,

SONACOS produces subsequent generations through contract growers, the Division de Production Végétale (DPV) finances and pays the subsidies, and the Division de Protection des Végétaux, Contrôle et Répression des Fraudes (DPVCTRF) oversees quality control of the seed produced.

Under a newly liberalized Moroccan economy, many opportunities will be available to the private sector in the seed production system. INRA foresees the release of new cultivars directly to private companies and expects to recover costs for research and development of improved cultivars.

To facilitate comprehension in the Moroccan context the writer has used international seed terminology following Organization of Economic Cooperation and Development definitions,which are more common in Morocco. For example, the American system of seed classification uses "breeder" and "foundation" seed, OECD utilizes the terms "pre-basic" and "basic," respectively.

Evolution of Cereal Production
in Morocco



GRAPHIC 1

SECTION II
THE CURRENT SYSTEM: ISSUES AND PROBLEMS

A. Cultivar Development and Release

Cereal breeders are not sufficiently involved. Although crop research is the foundation of a good seed program, multiplication of the new varieties is critical to safeguarding genetic identity and purity. In Morocco, technicians and field personnel, not cereal breeders, are involved in this first step of seed multiplication. According to accepted practices for the maintenance of the cultivar, seed purity should be the responsibility of the breeder.

Release of new cereal cultivars is erratic. A breeding program is usually evaluated by the development of improved cultivars. Therefore it is expected that, after a period of maturity, new cultivars are progressively released, justifying breeder efforts. This does not, however, occur with cereals. About 50 percent of all hard and soft wheat cultivars in the national catalogue were introduced by INRA in 1988 after a lag of six years.

The replacement of old cereal cultivars is slow. Most certified wheat seed is produced from cultivars introduced in the early 1980s. There is no certified seed from cultivars introduced since 1988. This seems to be caused by SONACOS' unwillingness to produce these varieties without being certain the market will accept them. Although INRA states it produces prebasic seed varieties based on SONACOS' needs, the system does not encourage INRA to promote new cultivars.

On-farm demonstrations are used to disseminate new cultivars. Testing in farmers' fields by the crop research and development program allows farmers to evaluate the varieties and learn how they perform under farm conditions. However, these tests are also being used to distribute new seed varieties to farmers without going through the seed program. Although it is important to know the reaction of farmers to the performance of new varieties, this type of promotion is dangerous for two reasons: the comparative advantage of a new cultivar may be diluted quickly by varietal mixtures, risking INRA's credibility, and potential buyers may lose interest due to distribution of the variety before it is properly field tested.

The private sector is increasingly interested in importing cereal varieties. Although public crop research through breeding or testing is the main source of new cereal cultivars in Morocco, commercial trade channels are beginning to introduce and develop varieties that can surely contribute to agricultural productivity. The franchised seed operation is one way foreign enterprises can participate in the Morocco seed program. Through a franchise, a local seed enterprise receives germplasm from a seed company

overseas. For a franchise to work, proprietary rights must be recognized and an arrangement reached under which the originator receives payment for use of its cultivars. The exclusivity that has favored SONACOS has forced private seed companies to look for other options. A few private cultivars are already included in the national catalogue and many others are underway. This means there will be a strong and welcome competition between INRA's cultivars and those that are imported in the future.

B. Seed Multiplication Distribution and Commercialization

Experiment stations are decreasing production of basic seed. The initial steps of seed multiplication require attention to maintain the genetic purity of a cultivar and ensure it is quickly delivered to farmers. INRA's production of prebasic and basic cereal seeds in experiment stations has recently decreased. Reasons cited include the fact that INRA's administrative system is not suited for production. Although the consultant agrees that this is the case, the same research stations, with the pretext of generating funds, have become more involved in production of certified seed (R-1 and R-2) as contract growers of SONACOS.

There has been no increase in certified cereal seed available in the market in the last five years. In fact, the availability of certified cereal seed has varied dramatically due to climatic conditions but on average remained the same (see graphic 1 above).

Demand for certified seed exceeds supply. Based on interviews and a review of documents it is clear that the amount of certified seed in the market is not enough to serve interested farmers. Further, recent reports show that SONACOS limited production of cereal seed after 1987, possibly because of difficulties in distribution.

SONACOS yields in cereal seed fields are quite low (1,500 kg/ha). This forces INRA to increase in prebasic seed production to compensate for SONACOS' inefficiency. In addition, SONACOS is producing less certified R-2 and concentrating on R-1. The removal of one generation could force INRA to produce still more prebasic seed.

Private companies tried unsuccessfully to deal with INRA last year. Some companies were surprised by the objective of this study. Their attempts to produce seed from INRA's varieties last year were turned down because of the contract of exclusivity. However, their interest suggests private seed companies will quickly respond to privatization.

The size of the cereal seed market is unknown. The need for information on the size of this market was noted during the 1985 Seed Seminar but no document on the subject was available. A cereal market study is said to have been conducted by SONACOS, but was not made available to the seed expert.

Private enterprises will be unable to compete with SONACOS for the cereal seed market if it continues to receive subsidies from the GOM.

Private companies already in the market do not see the acquisition of exclusivity over new INRA cultivars as a requirement. Although SONACOS is not interested in

producing seeds of cultivars that are available to the public, private companies would be. Since successful competition will depend on the speed by which products reach the market, private companies can take advantage of the novelty and invest in multiplication before the cultivar is released to the public.

Some middlemen buy certified seed from commercialization points for illegal resale at higher prices. This suggests that some demand is not satisfied and that a favorable economic climate exists for the formation of small private seed enterprises.

Some entrepreneurs invest in small equipment to clean and treat grain for sale as seeds. This is against current law but is another sign of a good market for cereal seeds. These entrepreneurs could become authorized seed producers who, because they are small local firms, can better reach scattered markets in their regions.

The amount of certified seed SONACOS delivers to the commercialization points is never enough and frequently arrives late. This mostly affects small farmers who buy seeds from commercialization points and suggests a management and distribution problem common among parastatals.

Most large farmers buy certified seed directly from SONACOS. Large farmers are those with more than 20 ha; they work about 33 percent of the total land area and can better command the respect of parastatals than can small farm holders.

C. Legislation and Quality Control

A contract signed in 1988 between INRA and SONACOS gives exclusivity rights to INRA cultivars for ten years. Although there is said to have been an agreement between the two institutions terminating this exclusivity, no document canceling this clause was found.

The effect of the private sector on seed system decision-making is minimal. The private sector is not represented on most of the commissions and committees involved on this subject. The Comité National de la Sélection des Semences et Plants consists of ten members of the public sector and only two representatives of the private sector.

INRA's needs for cereal seed production infrastructure and equipment are minimal. INRA's two major cereal experiment stations are well equipped for seed production activities. Marchouch and Douyet together have more than 1,300 ha of good land that needs to be exploited.

FAO provided two seed conditioning units and storage facilities. Marchouch and Douyet received these units in 1985 but they are presently underutilized, particularly at Douyet.

The Italian cooperation agency provides field machinery and implements. Tractors, combines, and implements are presently being sent to Marchouch and other stations.

A Japanese project will soon provide tractors, small combines, seed conditioning units and laboratory equipment, irrigation systems, computers, and vehicles. The project is designed to improve the rice seed production program in Sidi Allal Tazi Experiment Station, but the other two stations will also benefit.

D. Private Seed Sector

There is a lack of confidence in INRA's ability to respond to private sector needs. Many private sector concerns are related to INRA's administrative rigidity. This was made clear during interviews with private company administrators. It is also a concern for the MIAC project team.

Although 113 firms are authorized to commercialize seeds, only a few are ready to begin cereal seed production and marketing activities. These firms will need to invest in seed storage and conditioning equipment as well as distribution and commercialization facilities.

Some private seed companies already invest in cereal seed facilities. Large investments in seed conditioning and storage facilities are underway; some will be ready by next season.

Some companies import varieties from overseas, introduce it in the national catalogue, and negotiate with SONACOS the right to exploit it. It was expected that, after introducing an imported cultivar in the catalogue, private companies would make investments to produce the certified seed. The expert was unable to determine if these companies are franchised seed operations. This suggests there are also seed companies waiting to invest in their cereal seed programs.

The private sector is not organized into associations. Private firms do not have a seed grower association that can represent their interests.

Royalties are paid by private companies for every bag of certified seed they sell. Private companies could accept the idea of royalties more readily if they were based on the amount of seed the company multiplies from the basic seed. Payment could be made when the basic seed is delivered and based on the variety's average yield.

Payment of royalties only makes sense if it is made over a short period of time, such as three to five years, as the self-pollinated cereal crop can be retained by farmers and used as cereal seed the following season. After this initial period, royalties should stop and varieties can be sold by farmers at lower cost.

E. Other Cereals and Crops

Although the main objective of this study is to focus on the cereal seed grains industry, information from other cereals and crops is included in this section.

It is well known that rice is not a cereal of major importance in Morocco. The few varieties recognized in the national catalogue are of INRA origin and only 5.4 ha were inscribed for certification last year. The importance of rice, however, is greater than these numbers suggest. The private sector has completely taken over the crop, from varietal selection to seed production and distribution. It imports varieties from overseas, does its own selection, and produces seed outside the government quality control system. INRA has little to do besides improve its rice development and/or introduction program.

In this case, the government quality control program hampers the development of seed programs. A private seed producer mentioned that he considered inscribing his cultivars but decided not to when he learned he should mention their origin. He also said the life span of his varieties is very short and that he needs to keep looking for better cultivars to import.

As for maize, most hybrids in the national catalogue belong to large multinational seed companies and only 57 ha have been inscribed for certification. Increased demand for INRA's materials in this market is unlikely.

The market for forage seed was until recently in the hands of the private sector. SONACOS now claims to have more than 60 percent of it and presents this information as an example of its marketing aggressiveness. On the other hand, the private sector says SONACOS has no more than 15 percent of the forage seed market and that this market is increasing. They accuse the parastatal of selling seed for a price below the actual cost.

INRA's future in forage seeds is difficult to predict. Private companies have their own imported varieties and their interest in INRA's cultivars depends on the comparative performance of the two.

Although there has been a rapid increase in demand for oil seeds in Morocco, multinationals have responded by importing high-yielding, oil-rich corn hybrids. INRA's sunflower seeds are used by COMAPRA but are losing ground to imported hybrid seeds, which cost seven times more but yield almost twice as much oil.

With the possible exception of forage crops (where INRA's ability to compete with imported varieties is not known) and legumes, wheat (soft and hard) and barley seem to be crops where INRA cultivars have a better chance for success.

SECTION III
FORECASTING SEED DEMAND AND UTILIZATION

The liberalization of the Moroccan economy will surely affect the current seed supply system. Although it is difficult to predict the results of such changes, at least two cereal seed production scenarios can be envisioned.

Ideal and conservative scenarios were developed based on the following assumptions:

- The total area planted with cereals in Morocco remains stable.
- Demand for certified cereal seed exceeds supply.
- Demand for certified seed of wheat and barley increases (see graphic 2 below).
- Private companies produce yields in their seed fields comparable to any good farmer's.
- Royalties paid by private companies are based on expected production of the seed they receive from INRA.

For both scenarios, projections of seed demand, areas to plant, and revenues through royalties and seed sales for wheat and barley in the years 1995 and 2000 were calculated. These may be found in annex A.

A. The Ideal Scenario

The ideal scenario assumes two major changes for INRA:

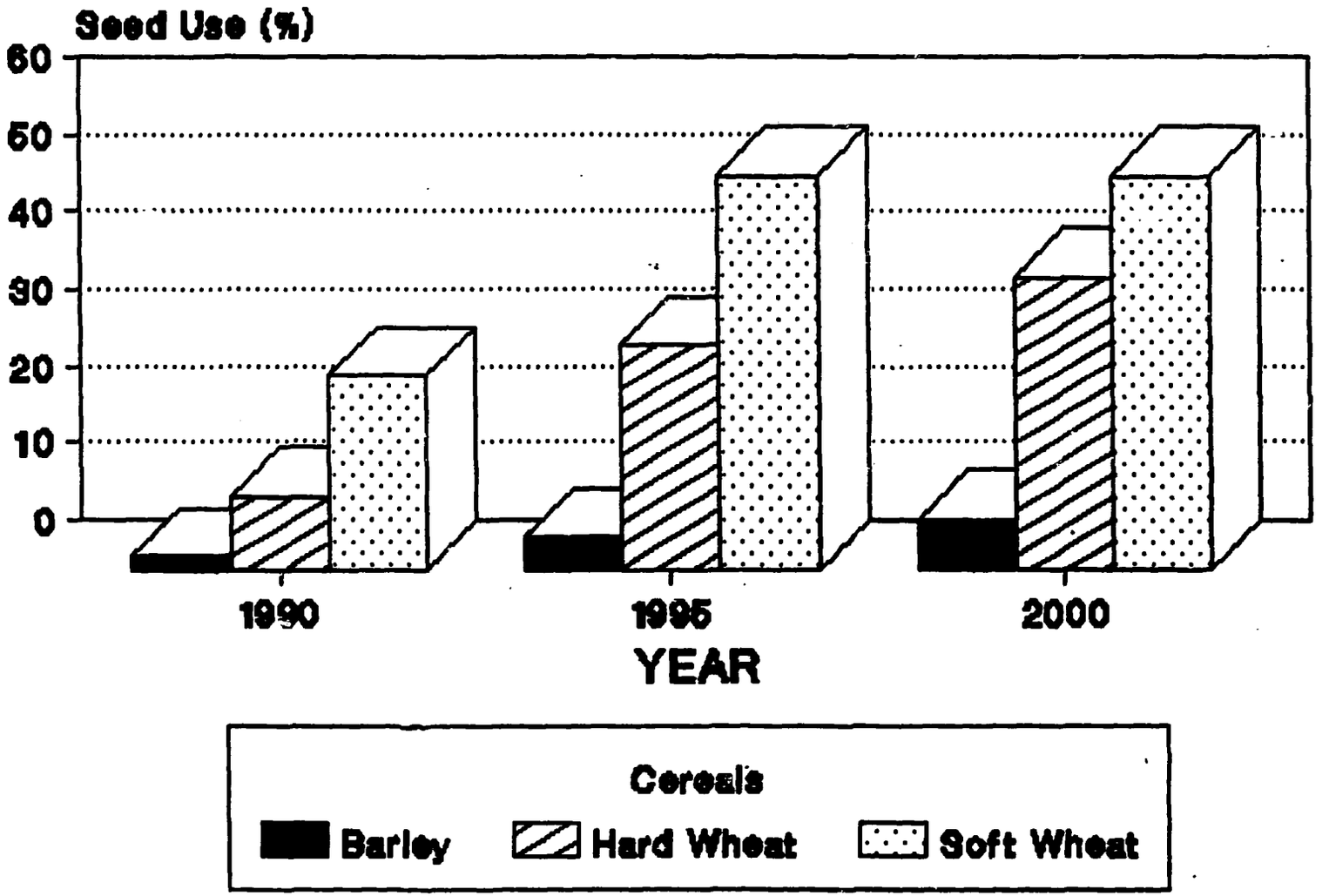
1. INRA produces better, more competitive seed varieties more quickly. As soon as one variety reaches its potential, a new cultivar is available to replace it. This approach will require an active crop development and introduction program.

2. INRA develops more administrative flexibility, providing more autonomy to experiment stations. The increase in availability of basic seed will require a large-scale utilization of INRA's seed production capabilities (around 600 to 800 ha), with the result that private companies will operate as small agricultural enterprises.

Once these conditions are met, the other assumptions are as follows:

- INRA produces the required amount of basic seed (G4) for private companies.

Seed L...zation Projections



GRAPHIC 2

- New INRA varieties keep 70 to 90 percent of the cereal market when cultivars imported by private companies enter the competition.

- The replacement of old varieties by new ones reaches 80 percent in 1995 and 100 percent in the year 2000.

It is important to understand that, unlike hybrids, self-pollinated cereal crops frequently have two seed production systems: conventional and traditional. Under the conventional system, several groups participate in an organized chain. Participants in this chain include the research institution and its breeding program, the basic seed production program, seed companies, and the seed certification and quality control program.

Under the traditional system, characterized by its diversity, farmers keep seed for use in the next crop season. Some farmers use native varieties, others use improved cultivars that have been cultivated in the region for some time. The latter are often mixed with other varieties and degenerate to the point where their desirable characteristics are lost. There is also a kind of commerce or barter involving one or two farmers known in the neighborhood for the seed they produce. Finally, there are cases where farmers decide to renew their plant material, buying grains in local markets, and selecting those with better physical appearance for use as seed.

Despite the fact that the conventional system also provides a final product presented in clean bags guaranteed to the consumer, the traditional system strongly competes with it for the same market. It has been calculated that 80 percent of the cereal seed used for planting comes from the traditional system. Indeed, in the traditional system, the degeneration of improved cultivars occurs over a few seasons, resulting in shorter productive life, lower yields, and lower quality products.

A new variety is a tremendous tool of the conventional system to increase its share of the seed market. Hopes to improve yields by using new varieties push farmers to look for certified seed.

The ideal scenario presented here is based on the assumption that improved cultivars are introduced in large quantities. Since they are self-pollinated crops, these cultivars can be easily reproduced outside the conventional seed production chain; demand not satisfied early on can be satisfied by the traditional chain.

Therefore, if INRA delivers more basic seed of a new variety to a private company, it will be able to place more seed in the market more quickly. Royalties are based on the amount of seed the company produces from the seed delivered by INRA. As a result, the more basic seed INRA delivers, the more royalties will be paid. The system depends on the amount of certified seed the private company can sell. It is in the interest of both the private company and INRA to get the largest share of the market quickly before the variety is available through the traditional seed system.

B. A Conservative Scenario

The ideal scenario requires that INRA work with the private sector with a high degree of administrative flexibility. However, the degree of liberalization expected under that scenario may be difficult to accomplish because of INRA's rigid administrative procedures. For that reason, a conservative scenario takes into consideration the maintenance of the current administrative system and, since revenues are dependent on the amount of seed produced, lowering profit projections. This scenario assumes that:

- INRA limits its cereal seed production program to the prebasic G3 generation.
- INRA gives more of its market to imported cereal cultivars. By producing only a few bags of a new cultivar for private companies, INRA may lose its comparative advantage to imported varieties.
- New (royalty-paying) varieties possibly take longer to enter the market due to slower release by INRA.

In this scenario INRA loses revenue as it is only providing the germplasm. The task of distributing new varieties is gradually transferred to the private sector, which will determine the speed by which they are multiplied and released to the public.

SECTION IV
RECOMMENDATIONS

The franchising contract that gives a private company exclusivity for multiplication of an INRA cultivar is not the best option for Morocco. INRA's responsibility in the privatization process goes beyond the development of improved varieties. During interviews, many people could only identify private enterprise as large-scale, capital intensive industrial complexes. Indeed, this is the situation in the country. Cereal seed production for many years favored the development of a seed industry for export of grain legume and grain legumes in general. However, the stability of cereal seed supply in Morocco also requires the presence of small- and medium-scale seed producers which can address regional, micro-climatic cereal needs.

A franchising contract providing exclusivity will openly favor large companies and will restrict them to the multiplication of INRA's cultivars. Therefore, it is INRA's responsibility to encourage and promote the free entry of these groups, without favoring any one type. Although this approach should be adopted by the government's privatization program as a whole, INRA should make its cultivars available to anyone interested in cereal seed production in the future.

Payment of royalties for the multiplication of INRA's cultivars could be applied as a fee. Royalties can serve two purposes: to establish the concept that what is good needs to be paid for and to help finance seed-related activities. However, royalties will never cover the total cost of research. If certified seed costs become too high, large companies will be forced to look for other varieties overseas, thereby inhibiting the growth of small and medium enterprises that cannot afford to pay import costs.

It is also necessary to consider that a new variety usually has a good market while it is a novelty. As most varieties are self-pollinated, they are spread countrywide after three to five years. At this point a new, higher yielding variety should be released (and accrue royalties).

The United States receives an estimated annual dividend of $75 on each dollar spent on hybrid corn research. INRA should not expect the same return for self-pollinated cereals as they are easily multiplied. The continuation of royalties for old cultivars may force the seed multiplication to go through unofficial channels because farmers can easily reproduce and sell these self-pollinated varieties.

It is premature to start the bidding process of the Tilila variety. Several obstacles must be overcome before INRA presents new cultivars to the public. INRA needs to improve its image in the country in general and in the seed sector specifically. The cultivar Tilila could be used for both purposes. Publicity campaigns could show the public that INRA's research is achieving its goals and could create interest on the part of cereal growers

and seed companies. Another type of promotion program should be aimed at diversifying INRA's client base. A media campaign could make clear to farmers and their associations that they could become, with a small investment, cereal seed producers. As a service to groups that are close to the experiment stations, INRA could process their seed for a modest fee.

Efforts should be concentrated inside experiment stations to increase the availability of basic seed. A marketing program only makes sense if there is enough high quality seed. To take advantage of a new INRA cultivar, private companies need to make large quantities available to the public. It is always risky to recommend that a public institution become involved in seed production because of its heavy administration and low efficiency, however, given the situation in Morocco, INRA's experiment stations have large quantities of land and all the infrastructure needed to produce the quantities of basic seed needed.

INRA personnel need to be motivated. Satisfying private sector needs in cereal seed breeding and production will be difficult. The breeding program will need to produce cultivars with higher frequency and experiment stations will need to produce more and better quality seed.

The best way to motivate breeders and INRA personnel is through the establishment of a reward system. It is important that the breeder's work is recognized. INRA should introduce ways to motivate its personnel to improve their breeding work through professional development such as study tours, specialized training, etc.

A cereal seed market study is needed. Information on consumer profiles, real demand per region and varieties, and preferences and constraints could help the private sector and INRA direct efforts toward the consumer. The best time for a seed market study would be right before the planting period.

Variety releases must consider commercial strategies. Release of an INRA varietyshould be delayed if a similar cultivar is still on the market. The delay will allow the older cultivar to reach maturity and the private sector to take advantage of what it is paying royalties to produce.

Varieties presented to farmers through on-farm demonstration plots need to be codified to avoid their being distributed outside the seed certification system. Tests have been openly used to spread a new cultivar through unofficial, traditional channels of seed multiplication. Codification will expose farmers to the best lines and will help to collect information that will support decisions regarding promising cultivars. This will protect cultivars from early degeneration and preserve the market for new ones.

Cereal breeders, not technicians, should be responsible for panicle selection and first multiplication of new cultivars. Selection by breeders will minimize possible deviations on cultivar characteristics. The availability of greenhouses in Settat could also speed up the first steps of seed multiplication through multiple generations in one season.

The panicle selection program should start during the advanced stages of field trials. It is considered an investment to start the breeder seed production program with promising lines. Some will surely be discarded but those selected will be in the market sooner.

The seed production program for old cultivars should be maintained. The only requirement INRA should propose to SONACOS is that it attain the same yields achieved by the private sector on subsequent generations. This will significantly decrease INRA's current workload with these cultivars.

Government price regulations for cereal seeds should be phased out. The liberalization of cereal seed prices will be important as privatization takes place and demand for certified seed stabilizes. All SONACOS subsidies, from production to commerce, should be phased out in two or three years to allow the private sector to compete for the same markets.

The quality control of the seed market must be reinforced. Since cereal seed commercialization channels will be diversified with the presence of the private sector, seeds will be sold through small stores, together with fertilizers, pesticides, etc. This phase will require good seed quality control, which is the responsibility of DPVCTRF. With DPVCTRF controlling seed quality through it rigorous certification and farmer education programs, organized commerce of seeds will stimulate the private sector, and farmers will demand more certified seed.

The quality control program should be presented as a tool to help the private sector provide quality seed to farmers, not as a governmental service. Quality control is often thought to regulate the seed supply system by detecting deficiencies in quality and imposing sanctions. However, the program's role will be to educate, orient, and support the formation of seed enterprises. The DPVCTRF needs to promote this approach to the private sector and to its own agents.

The Plant Protection Act can help organize the ownership of plant materials but is not a requirement for the cereal seed privatization process. Protecting new varieties and plants began in, and was confined to, a few countries in Europe where private plant breeding and an interest in protecting privately bred cultivars existed. It then expanded to other countries where private crop breeding is encouraged.

INRA must have a marketing unit that links research with the private sector. Since seeds are the major channel for INRA's technology transfer and marketing, the Service de Semence could function as the linkage between research, basic seed production, and the private sector. It could look after promising lines in the breeder program, show them to private companies to catch their interest, organize media campaigns for release, etc.

The INRA seed production program will need help to overcome administrative constraints. Public administration is heavy and inefficient. In addition, roadblocks to the innovations mentioned above may arise. Foreign assistance could help by providing technical guidance and a revolving fund inside each seed production unit, with a separate

accounting system. Fortunately, because seed is a marketable form of technology, resources can be generated to finance expenses. Project involvement inside INRA's seed production program would be phased out as the institution incorporates a new management approach.

Morocco needs an organized seed privatization program. The organization and support of the seed privatization process is fundamental to the development of a cereal seed system in Morocco. The cereal seed market has been in the hands of the public sector for many years, which has inhibited the formation of diversified private sector seed companies.

A seed industry does not appear spontaneously. The government should promote the formation of local seed enterprises, which could then be organized into associations together with existing companies. Associations are the best way to represent the private seed sector in the country. Both large- and small-scale enterprises are important to satisfying the needs of the agricultural sector. While the public seed company is being privatized, the rise of other private seed companies need to be encouraged.

Although INRA's seed personnel is reduced, a training program should be prepared for the future. The lack of individuals skilled in seed technology can be a major barrier to a sound seed program. These are the areas where a training program is needed:

- Academic training at the M.S. level. Two or three positions inside INRA will require this training. Because it is the most expensive and difficult type of training to obtain, academic training should be restricted to those working at higher management levels, with strong agronomic backgrounds.

- Short courses, particularly in post-harvest handling: seed conditioning, storage, and marketing.

- In-service training, particularly in seed conditioning, promotion, and commercialization.

Finally, INRA's capability in seed production are limited. Increasing this capability will require providing more personnel dedicated full time to seed production activities.

ANNEX A
DEMAND AND REVUE PROJECTIONS: TWO SCENARIOS

TABLE 1. SEED DEMAND AND REVENUE PROJECTIONS FOR SOFT WHEAT IN 1995

THE IDEAL SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	2500,00	2500,00	2500,00	2500,00	2000,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	140,00	140,00	140,00	140,00	140,00
Pure seed produced (kg):	3209,81	46284,35	669470,06	9145439,22	105499173,91
Total seed needed (kg):	222,60	3209,81	46284,35	669470,06	9145439,22
Hectares to plant:	1,59	22,93	330,60	4781,93	65324,57

REVENUE CALCULATIONS:

Through Royalties:			Through Seed Production:	
Price of seed (q):	300,00	Price of seed (DH):	320,00	
Royalty (%):	0,15	Amount Produced (Q):	6694,70	
% of market for INRA:	0,80	Production Cost (DH/ha):	1284,99	
% paying royalties:	0,80			
Quintals Paying Royalties:	58530,81			
Total Income Through Royalties:	2633886,50	Total Profit (DH):	1717483,29	

A CONSERVATIVE SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	2500,00	2500,00	2500,00	2500,00	2000,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	140,00	140,00	140,00	140,00	140,00
Pure seed produced (kg):	3209,81	46284,35	669470,06	9145439,22	105499173,91
Total seed needed (kg):	222,60	3209,81	46284,35	669470,06	9145439,22
Hectares to plant:	1,59	22,93	330,60	4781,93	65324,57

REVENUE CALCULATIONS:

Through Royalties:			Through Seed Production:	
Price of seed (q):	300,00	Price of seed (DH/Q):	320,00	
Royalty (%):	0,40	Seed Produced (Q):	462,84	
% of market for INRA:	0,70	Production cost (DH/ha):	1284,99	
% paying royalties	0,50			
Quintals Paying Royalties:	2343,15			
Total Income Through Royalties:	281177,43	Total Profit (DH):	118648,66	

TABLE 2. SEED [illegible] ... [illegible] in 1995

THE IDEAL SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	2500,00	2500,00	2500,00	2500,00	2000,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	140,00	140,00	140,00	140,00	140,00
Pure seed produced (kg):	1453,50	20958,95	303156,25	4141330,97	47773210,83
Total seed needed (kg):	100,80	1453,50	20958,95	303156,25	4141330,97
Hectares to plant:	0,72	10,38	149,71	2165,40	29580,94

REVENUE CALCULATIONS:

Through Royalties:				Through Seed Production:	
Price of seed (q):	350,00	Price of seed (DH):		340,00	
Royalty (%):	0,15	Amount Produced (Q):		3031,56	
% of market for INRA:	0,80	Production Cost (DH/ha):		1315,61	
% paying royalties:	0,80				
Quintals Paying Royalties:	26504,52				
Total Income Through Royalties:	1391487,21	Total Profit (DH):		833775,51	

A CONSERVATIVE SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	2500,00	2500,00	2500,00	2500,00	2000,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	140,00	140,00	140,00	140,00	140,00
Pure seed produced (kg):	1453,50	20958,95	303156,25	4141330,97	47773210,83
Total seed needed (kg):	100,80	1453,50	20958,95	303156,25	4141330,97
Hectares to plant:	0,72	10,38	149,71	2165,40	29580,94

REVENUE CALCULATIONS:

Through Royalties:				Through Seed Production:	
Price of seed (q):	350,00	Price of seed (DH/Q):		340,00	
Royalty (%):	0,40	Seed Produced (Q):		209,59	
% of market for INRA:	0,70	Production cost (DH/ha):		1315,60	
% paying royalties:	0,50				
Quintals Paying Royalties:	1061,05				
Total Income Through Royalties:	148546,56	Total Profit (DH):		57601,69	

TABLE 3. SEED DEMAND AND [illegible] MODEL.

THE IDEAL SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	1600,00	1600,00	1600,00	1600,00	1600,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	120,00	120,00	120,00	120,00	120,00
Pure seed produced (kg):	1085,28	11684,85	126196,36	1287202,86	13858884,08
Total seed needed (kg):	100,80	1085,28	11684,85	126196,36	1287202,86
Hectares to plant:	0,84	9,04	97,37	1051,64	10726,69

REVENUE CALCULATIONS:

Through Royalties:				Through Seed Production:	
Price of seed (q):	210,00	Price of seed (DH):		245,00	
Royalty (%):	0,15	Amount Produced (Q):		1261,96	
% of market for INRA:	0,90	Production Cost (DH/ha):		986,30	
% paying royalties:	0,70				
Quintals Paying Royalties:	8109,38				
Total Income Through Royalties:	255445,41	Total Profit (DH):		213141,36	

A CONSERVATIVE SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	1600,00	1600,00	1600,00	1600,00	1600,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	120,00	120,00	120,00	120,00	120,00
Pure seed produced (kg):	1085,28	11684,85	126196,36	1287202,86	13858884,08
Total seed needed (kg):	100,80	1085,28	11684,85	126196,36	1287202,86
Hectares to plant:	0,84	9,04	97,37	1051,64	10726,69

REVENUE CALCULATIONS:

Through Royalties:				Through Seed Production:	
Price of seed (q):	210,00	Price of seed (DH/Q):		245,00	
Royalty (%):	0,40	Seed Produced (Q):		116,85	
% of market for INRA:	0,80	Production cost (DH/ha):		986,30	
% paying royalties:	0,60				
Quintals Paying Royalties:	605,74				
Total Income Through Royalties:	50882,37	Total Profit (DH):		19707,78	

TABLE 4. SEED DEMAND AND REVENUE PROJECTIONS FOR SOFT WHEAT IN 2000.

THE IDEAL SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	2500,00	2500,00	2500,00	2500,00	2000,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	140,00	140,00	140,00	140,00	140,00
Pure seed produced (kg):	3209,81	46284,35	669470,06	9145439,22	105499173,91
Total seed needed (kg):	222,60	3209,81	46284,35	669470,06	9145439,22
Hectares to plant:	1,59	22,93	330,60	4781,93	65324,57

REVENUE CALCULATIONS:

Through Royalties:			Through Seed Production:
Price of seed (q):	300,00	Price of seed (DH):	320,00
Royalty (%):	0,15	Amount Produced (Q):	6694,70
% of market for INRA:	0,70	Production Cost (DH/ha):	1284,99
% paying royalties:	1,00		
Quintals Paying Royalties:	64018,07		
Total Income Through Royalties:	2880813,36	Total Profit (DH):	1717483,29

A CONSERVATIVE SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	2500,00	2500,00	2500,00	2500,00	2000,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	140,00	140,00	140,00	140,00	140,00
Pure seed produced (kg):	3209,81	46284,35	669470,06	9145439,22	105499173,91
Total seed needed (kg):	222,60	3209,81	46284,35	669470,06	9145439,22
Hectares to plant:	1,59	22,93	330,60	4781,93	65324,57

REVENUE CALCULATIONS:

Through Royalties:			Through Seed Production:
Price of seed (q):	300,00	Price of seed (DH/Q):	320,00
Royalty (%):	0,40	Seed Produced (Q):	462,84
% of market for INRA:	0,70	Production cost (DH/ha):	1284,99
% paying royalties	0,50		
Quintals Paying Royalties:	2343,15		
Total Income Through Royalties:	281177,43	Total Profit (DH):	118648,66

Annex 5. SEED DEMAND AND REVENUE PROJECTIONS FOR HARD WHEAT IN 2000.

THE IDEAL SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	2500,00	2500,00	2500,00	2500,00	2000,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	140,00	140,00	140,00	140,00	140,00
Pure seed produced (kg):	1897,63	27363,07	395787,33	5406737,65	62370580,80
Total seed needed (kg):	131,60	1897,63	27363,07	395787,33	5406737,65
Hectares to plant:	0,94	13,55	195,45	2827,05	38619,55

REVENUE CALCULATIONS:

Through Royalties:			Through Seed Production:
Price of seed (q):	350,00	Price of seed (DH):	340,00
Royalty (%):	0,15	Amount Produced (Q):	3957,87
% of market for INRA:	0,70	Production Cost (DH/ha):	1315,61
% paying royalties:	1,00		
Quintals Paying Royalties:	37847,16		
Total Income Through Royalties:	1986976,09	Total Profit (DH):	1088540,25

A CONSERVATIVE SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	2500,00	2500,00	2500,00	2500,00	2000,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	140,00	140,00	140,00	140,00	140,00
Pure seed produced (kg):	1897,63	27363,07	395787,33	5406737,65	62370580,80
Total seed needed (kg):	131,60	1897,63	27363,07	395787,33	5406737,65
Hectares to plant:	0,94	13,55	195,45	2827,05	38619,55

REVENUE CALCULATIONS:

Through Royalties:			Through Seed Production:
Price of seed (q):	350,00	Price of seed (DH/Q):	340,00
Royalty (%):	0,40	Seed Produced (Q):	273,63
% of market for INRA:	0,60	Production cost (DH/ha):	1315,60
% paying royalties:	0,60		
Quintals Paying Royalties:	1424,83		
Total Income Through Royalties:	199476,82	Total Profit (DH):	75202,20

TABLE 6. SEED DEMAND AND REVENUE PROJECTIONS FOR BARLEY IN 2000.

THE IDEAL SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	1600,00	1600,00	1600,00	1600,00	1600,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	120,00	120,00	120,00	120,00	120,00
Pure seed produced (kg):	1447,04	15579,80	168261,81	1716270,47	18478512,11
Total seed needed (kg):	134,40	1447,04	15579,80	168261,81	1716270,47
Hectares to plant:	1,12	12,06	129,83	1402,18	14302,25

REVENUE CALCULATIONS:

Through Royalties:			Through Seed Production:	
Price of seed (q):	210,00	Price of seed (DH):	245,00	
Royalty (%)	0,15	Amount Produced (Q):	1682,62	
% of market for INRA:	0,80	Production Cost (DH/ha):	986,30	
% paying royalties:	1,00			
Quintals Paying Royalties:	13730,16			
Total Income Through Royalties:	432500,16	Total Profit (DH):	284188,49	

A CONSERVATIVE SCENARIO

	P-BASE G2	P-BASE G3	BASE G4	CERT. R-1	CERT. R-2
Aver. yield:	1600,00	1600,00	1600,00	1600,00	1600,00
Expected field rejection:	0,05	0,05	0,10	0,15	0,15
Conditioning losses:	0,15	0,15	0,10	0,10	0,05
Seeding rate (kg/ha):	120,00	120,00	120,00	120,00	120,00
Pure seed produced (kg):	1447,04	15579,80	168261,81	1716270,47	18478512,11
Total seed needed (kg):	134,40	1447,04	15579,80	168261,81	1716270,47
Hectares to plant:	1,12	12,06	129,83	1402,18	14302,25

REVENUE CALCULATIONS:

Through Royalties:			Through Seed Production:	
Price of seed (q):	210,00	Price of seed (DH/Q):	245,00	
Royalty (%):	0,40	Seed Produced (Q):	155,80	
% of market for INRA:	0,70	Production cost (DH/ha):	986,30	
% paying royalties:	0,60			
Quintals Paying Royalties:	706,70			
Total Income Through Royalties:	59362,77	Total Profit (DH):	26277,04	

24

Table 7. Projected Revenues.

The Ideal Scenario in 1995

	Hectares	Income	
		Royalty	Production
Soft Wheat	330.60	2633886.5	1717483.3
Hard Wheat	149.71	1391487.2	833775.5
Barley	97.37	255445.4	213114.4
Total	577.68	4280819.1	2764373.2

The Ideal Scenario in 2000

Soft Wheat	330.6	2880813.4	1717483.3
Hard Wheat	195.45	1986976.1	1088540.2
Barley	129.83	432500.2	284188.5
Total	655.88	5300289.7	3090212.0

A Conservative Scenario in 1995

Soft Wheat	22.93	281177.4	118648.7
Hard Wheat	10.38	148546.6	57601.7
Barley	9.04	50882.4	19707.8
Total	42.35	480606.4	195958.2

A Conservative Scenario in 2000

Soft Wheat	22.93	281177.4	118648.7
Hard Wheat	13.55	199476.8	75202.2
Barley	12.06	59362.8	26277.0
Total	48.54	540017.0	220127.9

ANNEX B
LIST OF CONTACTS

ANNEX B
LIST OF CONTACTS

Benyassine Abderrahim
Chef du SAFP, DPV, Rabat, Morocco

Bouayad Abdallah
Agro-économiste, CRRA-INRA, B.P. 290, Settat, Morocco

Bouchoutrouch
Service de Semences, INRA, Morocco

Bouzoubaa M.
Director, SONACOS, 20, Rue Mecknes, B.P. 67, Rabat, Morocco

Chami Louafi
Président Directeur Général, Agrex Maroc
Quartier Industriel Sidi Brahim, B.P. 1683, Fez, Morocco

David L. Keith
Professor of Entomology, University of Nebraska, Lincoln
Chief of party, MIAC

David Wilcock
Development Alternatives, Inc., 7250 Woodmont Avenue, Suite 200, Bethesda, Maryland 20814

Driss Mesky
Agricultural Economist, Agricultural Division, USAID/Morocco

Fenton B. Sands
Economist, Agricultural Division, USAID/Morocco

Gunter Jaritz
Forage Breeder, GTZ/INRA

Hamdali Abdeslam
Chef du Domaine Experimental, Marchouch, Morocco

H'Main Larbi
Directeur Technique, SONACOS, 20, Rue Mecknes, B.P. 67, Rabat, Morocco

21

Jean Agache
Directeur Délégué, Inter semences, Cité Oukacha - Ain Sebaa, Casablanca 05, Morocco

Lahcen Abdane
Directeur Technique, Ets. Benchaïb-Marosem, Rue Soldat Mariscal, Ain El Borja, Casablanca, Morocco

Maazaz, M.
Amaroc S.A., 152 Bd Abdellah Ben. Yacine, Casablanca, Morocco

Mlah B. Mchiche
President, Syndicat Unifié des Riziculteurs du Gharb, Route 206 Quartier Industriel, Kenitra, Morocco

Moatassi Mm.
Technicien Agricole, Domaine Expérimental, Douyet, Ct 32-03

Mohamed Fezzaz
Responsable Technique, COMAPRA, Direction Technique 25, Rue Oued-ziz-Agdal, Rabat, Morocco

Richard F. Cartier
Administrative Officer, MIAC, Morocco

Sefrioui Abdelilah
INRA, B.P. 589, Settat, Morocco

Stitou M.
Chef du Domaine Expérimental, Sidi Allal Tazi

Tounassi M.
Agrex Maroc, Quartier Industriel Sidi Brahim, B.P. 1683, Fez, Morocco

Zouttane El Madani
Chef de la Division des Affaires Administratives, INRA, B.P. 415,

28

ANNEX C
LIST OF PUBLICATIONS

ANNEX C
LIST OF PUBLICATIONS

Chaibi, M., *Le Secteur des Semences Fourragères. Situation Actuelle et Perspectives*, Deutsche Gesellschaft for Technische Zusammenarbeit (GTZ), Février 1989.

Institut National de la Recherche Agronomique, *Contrat de Concession de Droit de Reproduction et de Vente de Variété Végétale* (draft).

Mid America International Agricultural Consortium, Agricultural Economics Bulletin Number 11, November 1989.

Ministère de l'Agriculture et de la Réforme Agraire, *Céréales Principales*, Campagne 1989/90, Septembre 1990.

_____, *Réglement Technique de la Production, du Contrôle, du Conditionnement et de la Certification des Semences des Blés, d'Orge, d'Avoine, de Triticale, de Seigle et de Riz.*

_____, *Enquête Agricole. Principales productions végétales.* Campagne 1987/88, Août 1989.

_____, *Les Variétés de Céréales d'Automne Cultivées au Maroc.*

_____, *Projet de Production de Semences pour le Développement Agricole au Maroc* (draft), Mai 1991.

_____, *Rapport d'Activités du Service du Contrôle des Semences et des Plants*, Campagne 1989/1990.

_____, *Séminaire sur le Secteur Semencière*, Rabat, Avril 1985.

Ouattar, S. and T.E. Ameziane, *Les Céréales au Maroc. De la Recherche à l'Amélioration des Techniques de Production.*

Riddle, Richard A., *Seed Sales in Safi Province.* Sociology and Agricultural Economics Sections, MIAC, November 1990.

_____, *Seed Sales in Abda Region of Safi Province* (preliminary trip report), MIAC, October 1990.

Société Nationale de Commercialisation de Semences, *Multiplication des Semences*, 1987/1988.

_____, *Multiplication des Semences*, 1988/1989.

USAID/Morocco, *Programming for the 1990's: A Concept Paper*, July 1990.

Wilcock, David C., et. al., Kingdom of Morocco: *Agribusiness Sector Assessment*, Development Alternatives Inc., Washington, D.C., August, 1990.