Objectives - profiles - methods

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Roundtable: Objectives - Profiles - Methods

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I - General objectives and profiles

1. Training objectives are reflected by the study areas and by the qualifications expected of graduates. They are obviously tied to and evolve with the job market.

Such objectives can be defined by the identification of training programs, as determined by the length of studies, the type of disciplines and their distribution, the quality of the students and the teaching staff, the original topics of research and development, as well as the areas of excellence which provide support for the training program.

2. With certain variations according to the countries, higher agricultural education provides training for engineers and senior personnel in agriculture, forestry, agro-industry with an emphasis on agro-food, rural planning and conservation of the natural environment.

The degree of differentiation between training streams leading to these different sectors is variable. Training programs are unique or diversified with regard to level and orientations.

Training programs of different levels may or may not be offered by the same establishment. Despite this great diversity, it is possible to divide the various programs in three groups according to their main objective and their duration after the secondary school diploma.

2.1. Short training programs, lasting approximately two years, training specialized senior technicians.

2.2. Training programs oriented toward a practical application of science and technology, generally specializing in a branch of agriculture, forestry or agricultural and food industries, usually lasting four years. They may or may not be sanctioned by a degree in technical engineering.

2.3. Long term programs mostly training people capable of dealing with concrete problems both analytically and synthetically, of defining methods based on their knowledge and their grasp of the basic sciences. These programs last five or six years, and are often sanctioned by a degree in

agronomic engineering - though other university degrees are also awarded.

The degree in engineering, at this high level, must guarantee both technical and professional competence, as well as a certain level of general knowledge and a capacity for reasoning, for adapting to circumstances and for directing people.

These programs may be prolonged by two to four years of training in research, and this type of training may, or may not, include specific courses leading to a doctorate.

3. Training profiles are described with precision in the reports, but the debate should reveal the trends in the evolution of sectors involved, as well as the connections between various training levels.

II - Defining objectives

II.1. Modalities

The first question one may ask is what are the dispositions and structures that make it possible to define objectives.

1. From the reports that examine this aspect, it appears that there is a preoccupation with the involvement of education in the economic sectors, and *vice versa*. In certain cases, some establishment regulations provide for councils or commissions in charge of approving programs, that include not only teachers and students, but also people from the economic, scientific and technical sectors outside of the establishment.

2. More generally, regular consultations make it possible for the teaching staff to make the necessary contacts with these sectors. In addition, it should be emphasized that there is considerable advantage in having teachers actively participate as experts in commissions, councils or work groups that deal with matters related to their field.

3. This type of involvement is particularly sought after in order to make sure that training is oriented toward the kinds of jobs that will be available. It appears to me to be - in regard to the participation of teachers as experts - largely tied to their activities in research and development. This point deserves to be further discussed.

4. Lastly, when training at similar levels is provided in a given country by several establishments, we sometimes observe that councils or commissions have been set up to ensure some measure of coordination - on the one hand, to provide coherent training programs, and on the other, to economize resources, since student exchanges can take place between establishments for certain specialized programs.

Coordination between training at different levels could also be considered, at the national or even the international levels, in order to establish an overall plan for the development of higher agricultural education that would be adapted to current needs. This point would also justify a discussion.

II.2. Criteria

Objectives are essentially tied to the job market, but they also depend on student characteristics, on the establishment's geographical situation, on education provided by other educational streams and on the development of continuing education.

1) The job market

1. Depending on the country, the distribution of employment between the public sector and the private sector is highly variable.

For agronomic engineers and other high level personnel, the demand is sometimes spread over an ever broadening spectrum. It comes not only from agriculture and agro-industry in the broadest sense, but also from the most varied sectors of the economy that seek to recruit graduates whose training is based on biological sciences, physics, mathematics, economics and social sciences, and develops a realistic appreciation of concrete problems.

2. The range of jobs does not facilitate the task of defining the content of training programs. Differences may appear between needs expressed by various sectors of the economy. These differences concern both the degree of specialization, and the aptitude to communicate

and eventually even the nature of the degree awarded by a given program.

As for the aptitude to communicate, it appears appropriate to underline its importance in training at all levels, not only for graduates who will be employed by extension and development services, but also for those who will work in other sectors.

3. Under these conditions different establishments, within the framework of their own vocation, tend to respond to the need for qualified personnel, which leads them to reflect on the type of people they must train.

One notes that agronomic engineers and other graduates trained by higher agricultural education must be prepared to adapt to changes in the economic context of agriculture and to new situations they may be confronted with. They will be called on to conceive and apply new techniques, to promote new economic structures, to conceive programs for construction, planning them and supervising their execution. They can only meet these requirements if they have been trained in such a way as to develop the type of behaviour that will enable them to improve their qualifications throughout their career, to remain open to new developments, and be capable of constructive action based on discriminative perception, thoughtfulness and common sense.

One can thus say that there is a double purpose in the training process: it must provide future graduates with the character training that is expected of them, and must prepare them for the leading types of scientific, technical and economic careers in which they will become qualified professionals.

4. Educational programs must have a high cultural content so as to allow for adaptation in the future but will obviously be strongly marked by their specificity pertaining to the sectors requiring personnel. It should be noted, however, that training programs must not only plan to fill present needs, but also prepare to fill those that have not yet become apparent. Training programs must be adapted to take into account the evolution of the job market. For example, at a time when there is an increasing number of openings in processing and distribution industries, the importance of training in the areas of company management and marketing is becoming increasingly significant.

5. Job opportunities obviously differ with each establishment and country. It would be interesting, however, in the course of the discussion to examine whether these jobs are of a traditional type, or whether changes that have occurred in the past few years - or that could take place in the near future - lead to significant modifications in the training programs or even to rethinking them entirely.

Most of the reports show that, at the present time, job possibilities for higher agricultural education graduates are to be found in the areas below; a hierarchy is difficult to establish because of the plurality of situations and of training levels:

5.1. **Extension and development services**: the importance of these services is most often emphasized for the improvement of agricultural production.

5.2. **Research**, essentially **agronomic**, in the broadest sense, including economy, sociology and rural development.

In this regard, the agronomist's role in agronomic research should be discussed. It appears to me that this role is justified at every stage: from conceiving topics to interpreting results, and then integrating them in a development program. Such participation naturally supposes that agronomic training includes a sufficient grounding in the basic sciences, as well as an initiation to research in a specialized field. In actual fact, in the final phase of training, after having received general training in science, economics and agronomy, the future agronomic engineer is obliged to continue his scientific, technical and methodological education in a specific area so as to be able either to contribute to the progress of knowledge, or to develop and carry out a project. At this stage, there seems to me to be certain common, or at least similar, phases in the training of research engineers and of development engineers. I think it difficult, at this high level of training, to compare the researcher's training with that of the engineer. This is naturally not the case when the engineer is at the technical level, in the framework of training programs concerning applied engineers as mentioned earlier.

The above remarks are obviously not meant to question the useful contribution made to agronomic research by researchers having received general university level training.

5.3. **Agricultural education at the technical and higher levels**. In the first case, education is sometimes associated with extension work and development; in the second case, it is associated with research.

5.4. **Other public services**, on various grounds, might employ higher agricultural education graduates. Such services might be directly under the authority of the Department of Agriculture, or of other departments dealing with problems concerning agriculture or agricultural products. Such is the case, for example, of economic planning or foreign trade.

5.5. Depending on the evolution of structures and policies in different countries, **agricultural organizations**, conforming with their responsibilities, require agronomic engineers or technical engineers, in particular for their extension and development programs.

5.6. **Agricultural industries**, at the production and post-harvest stages, recruit graduates of higher education, including supervisors for employees having completed specialized short training programs, manufacturing engineers for those who are trained as technical engineers, and engineers in charge of management, marketing, applied research and innovation, as well as executives responsible for overall planning in the case of the highest level engineers and graduates.

Let us also add that special training programs in agricultural and food industries have often been developed at various levels. It should be pointed out, however, that the demand in industry is not expressed in terms of academic qualification, and that this demand often appears difficult to determine in the long term for a better definition of training profiles and programs. Agro-food industrialists often give more precise descriptions of the personal qualifications they look for in their future employees - such as knowledge of foreign languages, executive ability, and the capacity to resolve problems within the company - rather than of scientific and technical qualifications *per se*. Even when they speak of the latter, they are particularly attached to the candidate's capacity to adapt.

5.7. **Credit establishments, banks, economic research agencies and regional development institutions** represent considerable opportunities for engineers of both levels and assimilated graduates. This area requires increasing attention in the development of training programs.

5.8. Lastly, **farming** seems to represent a share in the job market that decreases as the level of training increases. Significant differences can be observed, however, in various types of agrarian structures and farming surfaces. In countries with individual properties, engineers and high level graduates become active in running a farm mostly for family, rather than strictly professional reasons.

5.9. **International technical cooperation** covers all of the above activities, and offers job possibilities, the amplitude and position of which vary with the countries involved and policies conducted in this field. It seems, however, that this type of activity is taken into consideration by many establishments in setting up their programs.

6. From the above-described job market, it can be inferred that engineers and high level graduates must go through pluridisciplinary scientific and agronomic training, this being the attribute of a design engineer's education, which is concerned more with principles and methods than with specialized techniques.

On the other hand, as concerns technical engineers, scientific training should be more particularly oriented toward technical specialization, and the latter more specifically directed toward applications.

It would be interesting for the discussion to shed light on how different countries perceive the evolution of the job market for graduates at the various levels, and what consequences this may have on their training programs.

2) Student characteristics

2.1. Student characteristics have an impact on training programs. They not only influence the contents of these programs, but also the

pedagogical methods which may be applied. These characteristics refer to previous studies and the homogeneity of a group's level, on the one hand, and to the areas of interest, aspirations and other factors that could constitute student motivation on the other hand.

2.2. Relatively homogeneous groups of students are generated in countries where students are recruited through competitiveexaminations with a previously set number of candidates that might be granted admission in each establishment.

2.3. It should be pointed out, however, that if recruitment occurs in the course of the training process, after two years for example, this provides an advantage with regard to the scientific homogenization of groups of students entering a specific school, as well as to an objective selection of candidates. Certain difficulties may occur, however. This type of recruitment tends to create a disjunction between basic scientific training and the agronomic and economic programs taught at the school. The first cycle program, which prepares the student for the competitive exam, is tending to increase abnormally because of the large number of schools that recruit their candidates in this program. The latter has a heavy impact on the choice of subject matters taught in the schools, and it is often difficult to maintain a balance in the following three years between a common basic program for engineers and the necessary specialization. In addition, a hierarchy is established between the schools: the best candidates choose a general type of program, so that certain specializations that are important from the economic point of view run the risk of being neglected. Nevertheless, the advantages are greater than the disadvantages and countries that use this system, such as France, tend to preserve it by diversifying the students' backgrounds and encouraging both student exchanges and associations between different establishments, so as to use each one's potential in the best possible way.

However that may be, the quality of a training program mainly depends on the quality of the students. The discussion should bring out the type of criteria used in selecting students admitted to agronomic training.

3) Geographic location

Educational programs are often influenced by an establishment's geographic location, either because of the regional nature of certain job opportunities, or because of the existence of research subjects and application possibilities in the area. This influence can moreover be particularly felt in the final phase of training, when the educational process comes closest to approaching the immediate job market and espouses research subjects while at the same time giving attention to applied situations.

In some countries, however, it seems that this kind of influence is avoided in order to preserve the homogeneity of training programs.

4) Educational programs provided by other establishments

The choice of training programs must take into account the educational programs provided in other establishments of the same level, so as to make it easier to enter parallel training programs and to avoid duplication.

In this regard, it would be interesting to examine to what extent agronomic and agro-food training programs are or are not conceived in such a way as to favour exchanges with other training streams.

In France, for example, the training model for agronomic engineers that has been chosen by higher agronomic education is the one which has been adopted by the university and other schools requiring the same type of training. The training process includes three successive cycles, with different directions possible after each one.

Furthermore, in order to avoid redundancy, higher agronomic education establishments may be led to call upon, or associate themselves with, other establishments to contribute to training their students.

In France, all types of situations are to be found in the final specialized phase of training for agronomic engineers. Complementarity among establishments is sought through student exchanges and the association of schools in the common organization of a speciality.

The question may be extended to different training streams.

5) Continuing education

Few questions have been raised concerning continuing education, and yet the choice of programs in the initial training process will necessarily have to take into account the possibilities offered to graduates throughout their lifetime.

These possibilities are twofold: on the one hand, they should make it possible for graduates to update their knowledge in a given area, to specialize or to change careers. On the other hand, they should be able to provide access to promotion for persons having had a professional activity and wishing to increase their level of training. For example, by making it possible for senior technicians, with two years of specialized training at the higher education level, to be promoted to the rank of technical engineer.

The latter preoccupation is not a part of the subject of the present study. However, one should take into consideration the existence of a continuing education process that can provide for updating knowledge, for specialization or change of careers.

Certain gaps in the technical education of an engineer are thus acceptable to the extent that they can later be filled if necessary. However, an engineer must, in the course of his studies, have acquired a certain language and a solid methodology to benefit from further education, and this latter possibility should not lead to a training process that would be full of gaps.

6) Teaching personnel and orientation of research

6.1. The content and the evolution of programs are largely determined by the teaching personnel's qualifications, by the research topics of the laboratories they run or work with, as well as by establishment's reputation.

The dynamic nature of education is directly tied to teacher's qualifications and to their responsibilities in research and development. If teachers were not expected to work regularly on research or development programs in a particular area of their speciality, one might fear that this would lead, in the long run, to a certain degree of sclerosis.

6.2. The quality of the teaching personnel, and consequently of the education, depends on how teachers are recruited and subsequently evaluated. Their status and the relative level of remuneration should both be considered.

Moreover, it is rare that an establishment is able to develop research and development activities covering the entire spectrum of disciplines to be taught. This situation requires schools to dispose of a certain number of areas of excellence with full-time permanent personnel, and to use part-time contractual or titulary personnel, replacements, associated personnel and national or foreign visitors for sectors that are not covered in the program or for highly specialized programs.

The discussion should disclose the main trends, whether or not a certain flexibility is desired, whether or not a contribution is expected from participants other than permanent or titulary teachers, and the possible limits of this evolution.

7) Class sizes

7.1. The dynamic evolution of establishments presupposes a certain size, to ensure an expansion leading to the creation of new educational programs, and to dispose of the means which make it possible to implement active pedagogical methods. Furthermore, the number of employees justifies research and development structures, and the latter in turn strengthen the educational process and provide support for specialization.

Since the number of students in the initial and continuing education programs necessarily constitutes the limiting factor both for the means and the number of teachers, establishments with a small number of students are hindered in their adaptation to the evolution and expansion of disciplines.

On the other hand, there probably is a maximum limit, which is difficult to quantify, and which is both numerical and geographical. Qualitatively speaking, two criteria can be retained:

- the number of teachers, in all the disciplines taken together, should not exceed a threshold

beyond which these teachers would no longer be able to get to know each other, work together, and, as concerns the heads of various disciplines, to jointly plan pluridisciplinary training programs. Beyond this threshold, teachers will meet according to their speciality or by groups of specialities, and the training of engineers will become more difficult to carry out;

- the second criterion emerges from the relationship between teachers and students. When numbers increase, communication becomes more difficult, and the participation of students in pedagogical planning is reduced for the same reasons as those mentioned above with regard to teachers. A school must keep a human dimension so that personal relations can develop between its members. Even more so, geographical distance between various centers of a training program is unfavourable and creates many constraints. In practice, it is often easier for the teachers to move from one place to another than for students to do so if the latter are in a phase of their training where groups are very large.

7.2. Furthermore, the number of students influences the choice of pedagogical methods, and thereby the program's content. Certain kinds of knowledge require working in small groups in order to facilitate communication and exchanges. It follows that the application of active pedagogical methods implies a significant increase in the load of teachers and supervisors, which makes itself all the more strongly felt that the number of students per class is greater.

7.3. An optimum must therefore be attained in the number of students per class: enough so that the establishment may be big enough to evolve actively, but limited so as to ensure the kind of coordination which is necessary for the development of an interdisciplinary educational program and for the application of active pedagogical methods.

III - Programs and pedagogical methods

III.1. Distribution, equilibrium and relationship between disciplines

1. Programs depend on training objectives, on the duration of studies, the level of students and on teacher characteristics. The content of educational programs should constitute a coherent whole, and must necessarily be adapted to their goals. This being the case, it is difficult to include shorter training programs in longer ones.

The discussion should shed light on this point.

2. Programs are characterized by a balance between the different disciplines, and primarily by the share devoted to general training in science, economy, social and human sciences, on the one hand, and technical and professional training (including practicums), on the other.

The significance of a training course can be evaluated, in particular, by determining the relative share of general scientific training. Thus in France, two-year programs leading to senior technician diplomas are necessarily specialized, and of a technical and professional nature. Four or five-year training programs leading to a technical engineering diploma are based on both scientific orientations, that constitute 30 to 40% of the programs, and on the main technical and economic disciplines. Five-year training programs for agronomic engineers include a general and oriented scientific education that constitutes 60 to 70% of the program's content.

3. Within each group of scientific disciplines, one should also look for the distribution between various disciplines, and in particular the respective shares of biology, physical sciences and mathematics.

It can be said that for the training of engineers at the highest level, an equilibrium should be maintained between the biological sciences (including their diverse molecular and cellular aspects and the biology of organized beings) physics, mathematics and electronic data processing (EDP), sciences of the physical environment, economic and social sciences, and agronomic and agro-food science and technology.

As an example, in France, the training program for agronomic engineers, (depending on the specialization chosen in the final year) can be broken down as follows:

Biological and earth sciences Physics and chemistry Mathematics and EDP	60 to 70%
Agronomic and agro-food science and technology Economic and social sciences	20 to 30%
Foreign languages	12%

4. Training programs for engineers are predominantly scientific and technical in nature, but they must reserve a significant slot for economic and social sciences, a point that deserves to be specified during the discussion. At least 10-20% of the training course as a whole is suggested.

5. The training of engineers is necessarily pluri- and interdisciplinary, as they must be prepared to make decisions in order to resolve concrete problems by using all of the knowledge they have acquired. Interdisciplinarity is a complex goal to achieve. It cannot be acquired by the simple juxtaposition of parallel courses in different disciplines. It can be approached through the study of themes and developed by case studies. In this way, it favours the transfer from "cultural knowledge" to "professional knowledge".

III.2. Specialization

1. Short term programs are necessarily specialized; we will therefore consider only longer training programs.

2. Many configurations are to be found in the specialized training of engineers. They cover specific streams for agriculture, forestry, and agro-food, and extend to phases in introductory common training programs lasting two to four years followed by one or two year specializations.

The solution which is adopted obviously depends on training objectives and on employment opportunities, and especially on the career profiles of graduates.

3. The more training objectives aim at producing graduates with a general education capable of adapting over time to different functions, the more a general training program must be broad in scope and thorough, with specialization being introduced later. This then becomes an opportunity for the student to acquire the most advanced knowledge in a given area, to develop a discriminating attitude and simultaneously to prepare for innovation and decision-making.

Specialization thus has a greater impact on an engineer's first professional activity, whereas throughout his career he will rely on his general training. The goal is to prepare engineers with a sufficient capacity for adapting. This requires a strongly developed pluridisciplinary scientific education with an emphasis on biology applied to agronomic and agro-food technology, with attention also given to the economic and social context.

This objective does not imply such a wide scope of knowledge that would make it superficial due to the wide range of subjects, thereby becoming ineffective. What is required is methodological training based on a solid education acquired in an interdisciplinary framework. Methodological training concerns both the disciplines being taught and the students' education as human beings.

At the inception stage - considering late specialization - programs must obviously take into account the range of specialities offered in the final training phase.

Thus a program of studies which leads to both agriculture and agro-food will first consist of a phase with a balanced program in biology, physics, chemistry and mathematics. This will be followed by an intermediary phase including molecular and cellular biology, biology of organized beings, earth sciences, biochemistry, analytical chemistry, thermodynamics, genetic engineering, biotechnologies, engineering in agro-industrial processes, physics applied to biology and engineering, statistics and EDP, human nutrition, science and technology of animal and plant production. At the same time, courses will be taught in general economics, agro-food economics, business economy and trade, particularly international trade.

A flexible structure should thus allow each student to gradually specialize, depending on his own aspirations and on the needs of the economy, building on a broad educational basis.

4. If, on the other hand, the goal is to train engineers to be quickly operational in a production sector, then specialization can take place earlier.

5. Whatever their degree of specialization, engineers must acquire a language which will enable them to understand scientists and technicians from other areas with whom they will have to work, and whose problems they will have to deal with.

An example is provided by biotechnologies, whose implementation means that engineers in the life sciences often have to work with engineers in the physical sciences, particularly chemical engineering.

In order to work together efficiently, it is essential that each person be able to understand the other's problems, while at the same time excelling in his own field.

III.3. Pedagogical methods

It is important to establish a balance between pedagogical and methodological approaches that deal with thematic study, documentary research, written and oral expression, common or optional programs, the nature of pedagogical activities (courses, guided studies, practical work, study tours and trips, practical training sessions, procedures for measuring student progress, etc.).

1. Objectives of the various forms of education

1.1. Classes make it possible to teach an essential body of knowledge to the greatest number of people in the least amount of time.

1.2. Practical applications provide the intellectual or material support for the principles and concepts taught in classes; they allow the student to understand the finality of such courses.

1.3. Seminars and guided work lead the students to pursue in-depth study on their own. Students are thus trained to study a problem with the help of material (particularly bibliographic material which they have gathered themselves), to make written and oral presentations in front of an audience, to develop a capacity for critically judging their own work and that of their classmates, of working in groups in the preparation stage and when the presentation is discussed. Furthermore, these pedagogical methods make it possible for the teacher to get to know each student better, particularly through the relations he establishes within his group.

1.4. There are often two main types of practical training sessions: that in agricultural or industrial enterprises, and the session for the preparation of the final paper. Both must be well prepared as part of the educational process.

Their goal is to confront the student with concrete problems similar to those he will encounter later. They place the student in an environmant which differs both technically and socially from that of the school so that he can exercise his thinking and discriminatory perception under conditions that closely resemble those of professional situations.

The student is obliged to deal with concrete situations, to organize his knowledge, and to present conclusions that are based on reality.

Finally, such sessions are a valuable means for judging a student's personal qualities.

They also make it possible for the student to become known in the professional areas that may employ him. In this way, practical training sessions play a role in facilitating the school's insertion into the economy, by multiplying its ties with the economic world.

In our opinion, relations between the educational and economic milieu should be established early in the course of studies. Let us add that contacts with different professional areas are always enriching.

1.5. Study tours and trips should allow the student to broaden his experience of concrete cases that he can observe and reflect upon.

2. Goals of educational techniques

2.1. The oral presentation is a traditional technique which is widely used because of the direct communication thereby established between the teacher and student, and also because of the dialogue which ensues, with the volley of questions and answers at the beginning, during or after the presentation.

2.2. Written documents are used as a support for theoretical and practical education. They provide the students with a broader documentary basis, and sometimes with complementary sources of reflection, or else with a means of evaluating their knowledge in the form of questions or problems.

2.3. Audiovisual material (slides, films) are widely used in certain courses. Teachers use them in class or in practical application, which makes it possible to ignore seasonal constraints.

2.4. Simulation techniques make it possible to study the coherence and impact of different decisions in given situations. They are used in particular in the economic disciplines (business games).

These techniques are very effective in teaching students a sense of relativity and a taste for reasoned judgement.

2.5. The repeated monitoring of progress, with or without systematic grading, provides good training in handling certain data and using habitual modes of reasoning.

2.6. The examination of different educational forms and techniques shows that they concur in achieving training objectives: they ensure the acquisition of knowledge, its mobilization in concrete cases, an initiation to teamwork, and the development of a sense of responsibility.

3) Pedagogical progression

In a long term training course, the pedagogical program can successively have the following goals:

- during the initial phase, to allow the student to acquire a basic scientific education, to get used to intellectual work emphasizing quickness of mind, sustained effort and the presentation of acquired results;

- in the second phase, to initiate the student-engineer to the problems and the language of agronomy and agro-food science, see that he acquires the essential general and fundamental elements of knowledge, and that he becomes familiar with a pluridisciplinary mode of reasoning;

- lastly, in the final phase, theoretical and concrete knowledge in a given sector should be pursued in-depth. The student should be introduced to certain types of behavior and relations, so as to facilitate his insertion into a professional career.

IV - Student exchanges and criteria for identifying training levels

IV.1. Evaluating training levels

1. An analysis of the criteria used in evaluating training levels is necessary for the development of international student exchanges. This problem would be of interest to the participants of this seminar if they wish to encourage exchanges among institutions in the different Mediterranean countries represented here, but it also concerns exchanges between the above countries and other regions of the world.

2. The problem is the question of equivalence. Personally, we think that there is not a single answer for a given degree. The idea of equivalence has no meaning in the absolute sense; it only means something in relation to a particular situation. For example, if a person wishes to register for a training cycle, or apply for a position, is a given degree equivalent to another which is usually required? An equivalence between two diplomas, recognized in this case, will not have an automatic bearing on another situation; it may, however, be taken into consideration as an element in the dossier.

Certain countries have set up regulations governing admission into higher agronomic education. Others have set up offices or information centers for this purpose, with extensive documentation on schooling and higher education in other countries. These centers can make it easier to evaluate a candidate with a foreign degree. In most cases, however, the universities and higher education establishment must make decisions themselves in this matter. Sometimes lists of equivalences are published for registering in a given level at certain universities.

In all cases, candidates must furnish a dossier when appying. Certain recommendations should be strongly made in this regard:

- documents given by the student should be certified and bear the seal of the establishment which issued them;

- the establishment's objectives and training policies should be mentioned to facilitate the interpretation of the dossier;

- any appraisals, whether given in figures or words, should be accompanied by an explanation as to what they are based on;

- results obtained by the candidate should make it possible to place him in the group in which he did the studies in question.

3. The following criteria could be used in the evaluation of training levels for student exchange purposes:

- duration of studies, and educational objectives,
- conditions for student admission and exclusion,
- programs.

3.1. Duration of studies and educational objectives.

Initial training in higher education is a prolongation of primary and secondary schooling, the length and content of which may vary from one country to another.

The duration of advanced studies should be interpreted in relation to objectives which are particularly embodied in the organization of different disciplinary groups and in the share of general scientific training.

3.2. In evaluating a diploma, it is important to consider the situation at the time of admission, as the level of the students will have an impact on training programs.

3.3. Training programs may differ by their degree of scientific and technical specialization. At the highest degree, exchanges will be made easier by the existence of a comparable level and scope of scientific training.

4.2. Student exchanges

1. Student exchanges are easier to contemplate in the final phases of training, but they are not excluded in other phases.

The training of high level engineers, or "Masters of Science" in five or six years can be prolonged by a two to four year preparation of a doctorate. This degree bears different names depending on the country, but it always covers objectives of the same nature and has a similar duration. Be it a "Ph.D", "Doctor-Engineer", or "Doctorate", this diploma sanctions training through research without presuppositions as to the means by which these graduates were admitted into higher education.

Three successive phases may be distinguished in the process leading to a doctorate:

1.1. The first phase, lasting three to four years, includes scientific, economic and technical training, as well as an initiation to professional training of a practical type.

This stage may or may not be sanctioned by a diploma - such as the "Bachelor of Science". Can exchanges take place at this level? Only specific experiments would make it possible to answer this question. One could imagine that a student studies for one year in a foreign country, for example his fourth year, all the while continuing to do the research for the degree awarded by his school of origin. The latter would take into account the results obtained by the student abroad in awarding his degree.

In France, the trend in engineering schools is to admit the "Bachelor of Science" into the second year of studies, thus establishing an equivalence with three years of study beyond the baccalaureate.

1.2. The second phase, lasting one to two years, consists of programs that cover subjects in greater depth, with partial or total specialization.

This second phase, which includes training through research, may be sanctioned by a diploma such as the "Master of Science" or "Master of Agriculture" or "Agronomic Engineer".

Exchanges may take place during this phase of training, notably to take advantage of specialized programs developed in the area in which a particular school excels. When the school of origin awards a degree in agronomic or agro-food engineering at the end of this second phase, one

may ask whether this establishment can take into account results obtained abroad in awarding this degree. This possibility appears to be desirable.

But the student may also study for the specific degrees awarded by the establishment in which he is doing his specialization. This is the case, in France, of the *Diplôme d'Agronomie Approfondie* (Degree in Advanced Agronomy) granted to students who successfully complete the final year of specialization in programs leading to a degree in agronomic engineering.

1.3. The third phase leading to the doctorate is generally tied to the preceding phase, and student transfers often occur at this level, unless the candidate has already acquired experience as a researcher in his own country by having worked for several years in a research department.

1.4. At this stage of our considerations, one may ask whether it is possible to imagine that complementary programs might be organized in establishments of different countries.

If so, then agronomic training in the Mediterranean region would enter a new, constructive situation.

V - Conclusions

1. The aim of agronomic training programs in the Mediterranean area is to train senior technicians, engineers and executives in agriculture, forestry, agro-industry and agro-food, biotechnology, agro-equipment and agro-supplies. Veterinary training is organized parallel to the above.

2. Training objectives depend on the existing and projected job market (which is difficult to quantify and to qualify, on student characteristics, on the geographic location of establishments, on educational programs in other establishments, on continuing education, on the teaching staff and its orientations in research and development, and on the number of students in a class.

3. The study of the job market often shows the need to provide agronomic engineers and high level graduates with a solid basis in science, economics and social sciences. This enables them to adapt to changing conditions in agriculture as well as in the overall socio-economic context. Graduates must be familiar with research methods, trained to summon their knowledge and to carry out projects with critical analysis, thoughtfulness and common sense.

4. The training of technical engineers must be oriented towards practical application of scientific and technical methods. Training of senior technicians must be tied in with a specific technical field and with the corresponding practical applications. Transfers may occur between different training programs.

5. An equilibrium must be sought between general and oriented educational programs in science, economics, social and human sciences on the one hand, and between technical and professional training programs on the other.

6. The more training objectives are directed toward education of generalists who are capable of adapting over time to different functions, the more this type of training should be broad and thorough, and the later specialization should be introduced.

If, on the contrary, the aim is to train engineers who can become operational more quickly in a production sector, then specialization can take place earlier.

7. An equilibrium must be sought between the pedagogical and methodological approaches dealing with thematic studies, documentary research, written and oral expression, teamwork, decision-making, the common or optional nature of programs and the type of pedagogical activities.

8. Practical training sessions, and more generally the relations between educational establishments and the professional and economic sectors, are vitally important in providing training that is in contact with concrete situations and in preparing students for professional life - from the scientific, technical, economic and human points of view.

9. The analysis of criteria used in evaluating training levels, the recognition of studies pursued abroad, and of diplomas awarded, is necessary for the development of international student exchanges. The concept of degree equivalence is significant only in specific cases, for example, if agraduate wishes to pursue his studies or apply for a position.

Criteria for identifying training levels for student exchanges must take into account the duration of advanced studies with reference to previous education, training objectives, programs and conditions for student admission.

10. Student exchanges are easier to arrange in the final training phases, but are excluded in the other phases.

If necessary, provisions should be made to adjust conditions for awarding national diplomas in such a way as to make it possible for students to pursue part of their studies abroad.

11. The question is whether it is possible to imagine that complementary training programs might be organized between Mediterranean countries.

In order to facilitate exchange, documentation should be collected on higher education programs in agronomy, forestry, agro-food and veterinary medicine in Mediterranean countries, and on diplomas awarded in these areas. Student and teacher exchanges should be encouraged.