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Higher Education in Agronomy and Agro-food in France

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The current organization of French technical agricultural education, which is under the responsibility of the Ministry of Agriculture, is 25 years old. Its origins, however, go back over one hundred years. The present diversity of the forms of education and the multiplication of options are tied to strong academic and cultural traditions, as well as to the capacity of adapting to mutations in the agricultural sector.

Secondary Technical Agricultural Education *instituted by the law of August 2 1960, which aimed to adjust the professional agricultural education system to other professional education systems, has been integrated into the educational system as a whole (same establishment structure, same examination levels), while preserving both the originality of its biological instruction, which is directed towards the agricultural and rural sphere, and its pedagogical methods.*

There were 123,000 students in this type of educational program in 1983-84, divided up among the 1,062 establishments that remain small despite progressive centralization. The short cycle (Schools) dominates. The private sector accounts for 60% of the total number of students (compared to only 30% in the national education system), with 40% in the public sector.

In 1984, 69% of the total number of students in agricultural technical education were in the short cycle, 26% in the long cycle (High Schools), 6.2% in higher education (technicians and preparatory classes for advanced schools of agronomic and veterinary studies).

Since 1970, the number of children of farmers and agricultural employees has tended to diminish (47% of the total number of students in 1983-84, with variations according to types of establishments), whereas at the same time, the number of students in agricultural education is increasing slightly. Parallel to this increase in the number of children from non farming families (notably professionals and senior personnel), job opportunities for agricultural trainees are increasing in the para-agricultural and agro-food sectors.

The laws of 1984 preserve the specific nature of the vocation of French agricultural technical education, under the tutelage of the Ministry of Agriculture. At the same time, they focus the educational process on training, on a continuous evolution in qualifications of differents agents in the agricultural and agro-food sectors, as well as on participation in agricultural development and international cooperation programs.

Advanced Agronomic and Veterinary Education *is based on the French system of* Grandes Ecoles. *They concentrate on an education with a biological orientation, aiming at an analysis of relations between people and the living world. These schools depend for the most part on the Ministry of Agriculture, whereas education in agro-food, which is more recent, has tended to develop more from within the separate university system in the past 15 years.*

This educational sector represents significant potential: 8,000 students, 500 of them abroad in 1985-86, in 41 schools, centers and institutes for education and research, with 700 teachers-researchers in 260 educational and research units. The small size of such establishments is a characteristic of the French system, rather than a particularity of higher agronomic education. Public establishments predominate over private ones (5,900 students in public education, 2,100 in private education). The National Agronomic Institute of Paris-Grignon, with 684 students, is the second school in France in terms of attendance, behind the Polytechnical School; and this Institute is one of the leaders among the Grandes Ecoles *(1).*

The growth in attendance in higher agronomic education is greater than the growth in engineering schools as a whole: from 1962 to 1983, there was a 150% increase for agriculture as opposed to 70% for all schools. This growth reflects the opening of a new school (National Veterinary School of Nantes) and the limited registration of students in the university system (DEUG level - degree in general university studies).

In all advanced training streams in France, one may observe a general increase in the number of higher education degrees. This stems from the increase in the number of high school or bac graduates, and also from a growth in the success of advanced studies. The "closed" streams, to which a student can only be admitted by a selective process (competitive examination or dossier), because of little available room, are growing more rapidly than "open" streams, to which any graduate can be admitted.

Advanced agronomic and veterinary training is open to foreign students, in particular those from French-speaking developing countries, who are admitted into any of these establishments.

A total of 500 foreign students is admitted into higher education establishments every year, in particular into the "third cycle" or doctoral program (66%). They mainly come from northern and central Africa, Asia (Thaïland and Indonesia), the Near East and South America.

Permanent exchanges are maintained with about 60 universities in Europe, North America and developing countries.

Each year, teachers make about 500 visits abroad: 350 for training purposes and 150 for research (one third in the EEC, one third in developing countries, one third in North America and Eastern Europe).

These missions are conducted on behalf of the EEC, the FAO, ministries of foreign affairs or cooperation, ICAMAS, or the countries involved.

They consist primarily of:

- presentation of reports at scientific meetings,

- participation in or direction of scientific and technical cooperation programs.

I - Types of advanced training

Four main training levels are offered in French higher agricultural education:

- **Senior Technicians** (created in 1965): these specialized professionals, who master their techniques and are capable of thinking out their adaptation to a changing agriculture, are trained in two years of study after the Baccalaureate or the Agriculture Technician's Certificate. This course is given in agricultural high schools and private establishments having the same level. 9,000 students are involved, divided up into 130 classes (40 of which are private). These students are chosen from about 10,000 applications. 3,400 degrees in 19 specializations (covering the fields of production, economy, agricultural industry, agricultural machinery, forestry, tropical agronomy) were awarded in 1985 to 4,500 candidates (75% success rate).

- **Specialized Engineers**: Four years of study after the Baccalaureate, or for a small number, after the Agricultural Technician's Certificate, the Senior Technician's Certificate (BTS) or the Technological University Degree (DUT). This makes it possible to obtain a degree in Applied Engineering for production techniques, economy,

agro-food industries, forestry, rural engineering and sanitary techniques.

Eight National Schools for Technical Engineering (public) (ENIT), first created in 1962 and seven Advanced Agricultural Institutes (private) first created in 1854 provide this type of training.

The ENITs recruit on the basis of a competitive examination after one or sometimes two years in 14 preparatory classes of agricultural high schools. They award 340 different degrees per year, with various specialities: in particular, horticulture (ENIT of Angers) and agro-food industries (ENIT of Nantes). Three schools (Bordeaux, Clermont-Ferrand and Dijon) deal more generally with agricultural problems as a whole.

All of these schools train a certain number of government employees, in particular the National School of Engineers in Rural Works and Sanitary Technicians (Strasbourg) and the National School of Engineers for Waterways and Forests (Nogent sur Vernisson). The latter two hold a competitive examination in common with the ENSA, and train approximately two thirds of the employees of the Administration of Waterways and Forests and Rural Engineering, and one third of the French and foreign civil engineers.

460 agricultural engineers, recruited on the basis of an application and an interview, are trained every year in seven private Advanced Agricultural Institutes. One of these, the Advanced School for Wood, recruits its students among those eligible for the common examination of the National Advanced Schools of Agronomy, and trains specialized engineers for the wood transformation industries - 30 to 40% of the graduates come from farming backgrounds.

- **Veterinary Surgeons and Agronomic Engineers**: these studies, lasting five years after the Baccalaureate, are sanctioned by a degree as Veterinary Surgeon or Agronomic Engineer, with a mention of the school in which the degree was obtained: National Veterinary School (ENV), National Agronomic Institute of Paris - Grignon (INA-PG) or National Advanced School of Agronomy (ENSA), respectively.

Four ENVs (first created in 1762), with no hierarchic status in relation to each other, recruit on the basis of a competitive examination after one year of preparation in specialized preparatory classes in the national education system's high schools. After four years of study, 520 to 540 degrees are awarded every year.

The National Agronomic Institute and the four ENSAs (first created in 1826), the National School of Agricultural and Food Industries (ENSIAA) and the National School of Applied Biology for Nutrition and Food in Dijon (ENSBANA) recruit on the basis of a common competitive examination, after two years of preparation organized in specialized high school classes of the National Education system.

The INA-PG, the ENSAs of Montpellier and Rennes and the ENSIAA are under the authority of the Ministry of Agriculture, and the three others (ENSAs of Nancy and Toulouse and the ENSBANA), are under the authority of the Ministry of National Education. However, an *ad hoc* group ensures the effective coordination of such education which aims at training (design) engineers who can master a global analysis of problems in the agricultural sector and thus methods of improvement. The annual number of graduates is about 600.

Apart from the first cycle, which takes place in the preparatory classes, training at the INA-PG and in the ENSAs includes two cycles: the second cycle, lasting two years, is sanctioned by the Degree in General Agronomy (DAG). This must be completed by a third year of the third cycle, which makes it possible to obtain the Degree in Advanced Agronomy (Diplôme d'Agronomie Approfondie - QAA), which is required in order to obtain the Degree of Agronomic Engineer granted by the school in which the second cycle was completed (DAG). The DAA can be prepared at INA, in an ENSA, or in a center for the third cycle.

- **Engineers of the Ministry of Agriculture and Doctorates**: the applied schools of the ENSA and the ENV (three schools for specialization and four third cycle training centers) complete a training course lasting six to seven years after the Baccalaureate: Engineers in Rural Engineering, Waterways and Forests (ENGREF), Agronomic Engineers (the Dijon ENSSAA) and Veterinary Inspectors (the ENV at Maison-Alfort).

The applied schools of INA and the ENSAs admit students who may be government employees, but also civil engineers with a French or a foreign degree.

The specialized schools deal with horticulture (National Higher School of Horticulture), landscaping (National Advanced School of Landscaping) and agronomy in warm climates (National Center for Agronomic Studies of Warm Regions - CNEARC in Montpellier).

In addition, many of the INA and ENSA professorships, together with academic teams, constitute centers where theses are prepared.

The volume of training is approximately 100 government employees per year and about 150 doctorates of different levels.

Table 1 and the **map** that follows summarize the organization and geographic location of these 41 establishments that constitute the French Higher Agronomic Education System. It covers all sectors related to agronomy except pisciculture and halieutics which remain largely dependent on the university system.

II - Training objectives

1. Relative share in job openings

Senior agricultural technicians enjoy employment possibilities that are mainly centered on professional agricultural and para-agricultural sectors (63% of graduates in 1980); but the range of jobs is much greater and more diversified for engineers.

Technical engineers (ENIT) and engineers from the Advanced Agricultural Schools (ESA) work within the same sectors of activity as design engineers (INA and ENSA), but with differing job profiles. Even though one cannot exclude the existence of competition and possibly overlapping functions, competition is stronger between schools of the same level.

Current tendencies in the apportionment among sectors of activity, and the evolution in the number of engineers (INA and ENSA) that will be provided (2) remain valid for applied engineers (BAC + 4), with smaller numbers to be found in the fields of research and higher education.

Administration and **teaching research** sectors (both public and private) are relatively stable on the whole and employ a little less than half of the engineers. The public sector as a whole employs no more than 30% of the total number of engineers.

Administration and **official bodies** accounted for 12% in 1985, relatively stable sectors that are going through internal evolutions: the agricultural administration is being reduced (technical and administrative staff of the central and territorial services), whereas staff is on the increase in other ministries, territorial collectivities and mixed economy companies.

In the **teaching** and **research** sector (22%), secondary agricultural education recruitment peaked in the period 1970-1975. It is characterized by a strong percentage of medium age groups and has been in relative decline since 1980. The same is true for advanced agronomic education but **general education**, **training centers** and **private institutes** are experiencing strong growth. Both public research (INRA, ORSTOM, CNRS, CIRAD, technical research centers) and private research are increasing slightly.

The private sector, which is characterized by large numbers of employees in the industrial field as well as in professional and economic agricultural bodies, employs over half of all engineers.

Several branches are growing:

- very rapidly, in the **agro-food industries** (7%);

- more moderately in the **non-food industries** and **trade** (19%);

- rapidly in the professional and inter-professional groups (13%) that have a younger age group. The association, federation and union sectors are presently the most promising.

Other private sectors are more stable, or are losing ground: Crédit-Coopération - Mutuelle Sociale Agricole (9%) are declining, whereas the **banking** sector (other than the Credit Agricole) (1.4%) is slowly growing. **Farming and production enterprises** (10%), which have an older age group, are declining.

In the sector that includes **liberal professions** and **consulting firms** (6%), which is more or less stable, consulting firms are definitely progressing.

For the past several years, there has been a diversification in employment opportunities, with a general tendency to reduction in sectors that are

directly tied to agriculture, to the benefit of other sectors, such as agricultural and food industries. This is reflected by changing enrolment patterns in schools, particularly according to the specialities taught in some of them. Furthermore, considerable mobility (professional, geographic) has been observed in the first ten years of a career, notably in the industrial sector.

Employment in Third World countries is less popular, both because of the waning job market and the difficulty experienced by non-government employees in reintegrating into the labour market in France. Working in the Third World is highly appreciated, however, to fulfil one's military service.

2. Curricula

The originality of advanced agronomic training in France, whatever the training levels and streams, is the privileged access to biological sciences, compared with other areas, such as engineering sciences (math, physics, chemistry, engineering, etc.) and the social sciences (economy and rural sociology, communication, etc.). The considerable flexibility and adaptability of the *Grandes Ecoles* system in relation to short term economic needs has made it possible to diversify training programs provided by the schools. Nevertheless, agro-food courses are currently inadequate to handle rapid expansion of this sector - a priority for the national economy which needs both more specialists and more generalists.

Current tendencies differ according to the courses of study. For senior technicians (BAC+ 2), the multiplication of options (19) has led to narrow specialization, which can lead to reduced professional mobility and increased difficulty to transfer from one training stream to another. Since 1983, 12 establishments are experimenting with the Senior Agricultural Technician's Certificate by credit units in four of the options; this process is based on a goal-oriented pedagogical process.

Three basic orientations determined the design of this experiment:

- an analysis of the profession and its required qualifications is an essential element for the constitution of credit units;

- the principle of a decisive final exam is replaced by a system based on continuous evaluation (within the establishment) of the student's progress. The student is awarded credit units and receives a final external evaluation based on his or her performance during a practical training session (capacity to manage in a professional situation). This provides pedagogical teams with greater autonomy (local situations are better exploited, and training is adjusted to reflect local development actions);

- the struggle against academic failure is carried out through differentiated training systems, pedagogical support and by a system of capitalizing credit units, the latter making it possible to establish links later on between the initial training process and continuing education.

There is a noticeable difference in the evolution of training courses of the ENITs (BAC + 4), the INA-PG and the ENSAs (BAC + 5). Except for specialized courses (horticulture, agro-food, forestry and rural construction), the present view of the ENITs is still to train field engineers who are strongly oriented toward the application of agricultural techniques. These schools maintain a comprehensive training program in general science and technology (First year: acquiring the proper level in general disciplines and scientific training; Second year: agronomic sciences). This leads into a broad methodological training course and a practical session (animal production, plant production and agronomy, economic sciences, etc.).

Current discussions concern the transformation of the above courses into BAC + 5 training courses. The decision has been made by the private advanced schools of agriculture, and the alternative under consideration for the ENITs is to prolong the duration of preparatory classes (two years instead of one) that take place in agricultural high schools. Another alternative being discussed is the possibility of integrating this second year of preparatory class into the ENIT training course, and instituting a new curriculum (First cycle lasting two years, Second cycle lasting three years).

The ENSAs, as opposed to the ENITs, tend to diversify their specializations more and more narrowly. Here too, a debate is taking place among the schools on the possible orientations between the training of a design engineer - which is not highly specialized - and a training course for high-technology specialists in a scientific or technical research field. Both points of view could be reconciled by a polyvalent training course, based

on streams, but open to highly specialized training that could be pursued beyond the BAC + 5 years. This could result in a Doctorate (Mothes report). In that case, basic courses in the first year, particularly basic sciences, social sciences, communication and data processing, would be reinforced.

Teaching methods vary greatly from one establishment to another, according to the faculties and the level of studies reached within each specialization.

Generally speaking, the trio of *ex cathedra* lectures, practical courses and applied work is relatively frequent in the first year, and even in the second year, but during the common core of courses, other pedagogical practices have been used in the past two decades, though they are not as yet sufficiently developed. These practices aim to motivate the students and give them a sense of responsibility, to control their own training process, and to put them in contact with the professional and social realities of the agricultural and rural world, as well as the agro-food sector.

Team and group work approaches tend to develop during the last year of study. Audiovisual tools are used less systematically. The use of computers for scientific calculation is developing rapidly, particularly during the last year and for the use of professional agricultural software. The most striking innovation is no doubt the increasing use of various practical sessions, with reports written about them, in all the establishments (sessions on a farm, in an industry, a laboratory or research center, or abroad, etc.). These sessions have different purposes: observation, knowledge of an environment, increasing one's responsibilities, etc.). They can be spread over long periods (up to six months in a year), and can represent a sizable coefficient in the students' results. Visits (to farms, companies, cooperatives, etc.) and study tours are widely used methods of teaching.

The research and preparation of reports and term papers is commonly used in specialized programs given the autonomy that it demands from students.

Continuing education has also developed, in two directions:

- in 1968, the Ministry of Agriculture instituted advanced training courses, making it possible for adults with several years of professional experience to enrol in agricultural degree programs. These are identical to the degrees granted by corresponding initial programs at the BTSA (in one year instead of two), and for the level of engineer in agricultural techniques (in two years instead of four), by the National Institute for Advanced Agricultural Promotion (INPSA-Dijon). The latter is moving towards alternating with five-year training courses for agro-food engineers;

- short training sessions have developed in cooperation with professional organizations, industries, etc., particularly since the enactment of legislation in 1971 on professional training. This policy, an initiative of the schools, based on market prospects and dynamics, has led to a profusion of initiatives in all the related professional fields - a development which would in itself require a special study.

Some engineering establishments, depending on how long they have been located in the region and integrated into its activities, have been able to develop a distinctive regional identity. By recruiting a large number of their students locally and integrating them into local industries, some have even created specializations that are specifically oriented toward regional production, for example, specialized livestock raising for ENSA in Rennes, viticulture and Mediterranean cultures for ENSA in Montpellier.

Apart from training courses for senior technicians that are being developed by the National Institute for Pedagogical Research and Application (INRAP) in consultation with a national commission for curriculum, each engineering school has considerable autonomy in evaluating and adapting its courses. There is at present no equivalent in the Ministry of Agriculture of the National Committee for the Evaluation of Public Scientific, Cultural and Professional Establishments, nor of the interministerial Commission for Prospective and Orientation of Advanced Training Courses, instituted under the law of January 1984 on higher education.

The average ratio of staff to students is: 1 teacher for 4.5 students at INA and the ENSAs; 1 teacher for 7.5 students in the ENITAs; and 1 teacher for 8.5 students in the ENVs.

As far as the private educational system is concerned, it is difficult to give figures for the number of students per teacher because of the large number of temporary positions staffed from

the public and research sectors and the number of part-time teachers.

The sections concerned with senior agricultural technicians are staffed mostly with teachers who are also in charge of training agricultural technicians.

III - Organization

1. Establishments

Except for the classes for senior technicians, which are held within establishments for technical agricultural education and depend closely on the Ministry of Agriculture's educational services, all centers for higher agricultural education are largely autonomous schools or institutes. The National Advanced Schools of Agronomy in Nancy and Toulouse are, however, part of a Polytechnical Institute managed by the University, and the National Advanced School of Biology Applied to Nutrition and Food in Dijon is attached to the University of Burgundy. All other schools or institutes come under the responsibility of the Ministry of Agriculture.

Without losing their autonomy, establishments in the same region tend to combine into an institute in order to concentrate their means to gain greater effectiveness. That, is the case, for example, of the Advanced Agro-Veterinary Institute of Toulouse, an educational and research complex associating the Veterinary School of Toulouse, the National Advanced School of Agronomy of Toulouse, the National School for Agronomic Training, the Advanced School of Agriculture of Purpan and the Toulouse Center of the National Institute for Agronomic Research.

Organizations dealing more particularly with problems of developing countries have been created, for example, in Montpellier, within the framework of Agropolis which unites 18 establishments oriented toward research, training and development in the areas of agronomy, agro-food and engineering. About 1,000 instructors or researchers work in 28 scientific sectors. On a world scale, Agropolis is one of the largest scientific and geographic centers to specialize in agriculture in Mediterranean and tropical zones, particularly in the area of training agronomists, agro-food engineers and foresters:

- the Mediterranean Agronomic Institute - IAM;

- the National Agronomic Study Center for Warm Regions - CNEARC;

- the Engineering Section, Agricultural and Food Industries in Warm Regions (SIARC), Warm Regions Section of ENSIA;

- the National School for Rural Engineering, Waterways and Forests (ENGREF) (forests in warm regions).

2. Curricula

For the training of senior technicians, curricula for different specialities are discussed in commissions established by the Ministry of Agriculture. They are essentially composed of representatives of the administration, education, research and agricultural professions. They are officially published by the Ministry of Agriculture.

As far as the other schools are concerned, either the school's General Council, or an *ad hoc* Council (Guidance and Improvement Council) decide on the curricula. The administration, teachers and researchers as well as the producing sector are represented in proportions that vary according to the nature of the establishments. In the case of the National Veterinary Schools, however, a common curriculum for the four schools is decreed by the Ministry of Agriculture.

Even though there are plans to establish national pedagogical control over training programs for senior technicians, other schools enjoy considerable autonomy with regard to professorships and teachers who remain solely responsible for the content of their courses and for their pedagogical methods.

Training for agricultural engineers in the Advanced Agricultural Institutes is controlled by the Ministry of Agriculture which delivers a degree recognized by the State (Agricultural Engineer).

3. Relations between teaching and research

Only a few applied research activities and experiments are conducted on farms belonging to senior technician training centers.

In the other schools for higher agronomic education, the research situation varies considerably. Research assignments occupy an important place in the National Veterinary Schools, the National Institute of Agronomy, the National Advanced Schools of Agronomy, the Schools for Application and post-graduate Centers. In the other schools, especially in private establishments, research activities concern limited sectors and largely depend on the initiative of certain teachers.

The main goal of research in advanced agronomic education establishments is to keep training at the highest possible level by contributing effectively to the on-going training of teachers-researchers, and by providing the students with particularly effective analytical methods (in particular team work and final term papers).

Good higher education cannot exist without research activities which make an important contribution to the activities of the National Institute for Agronomic Research (INRA).

Higher agronomic education, which originated agronomic research, provides INRA researchers with their initial training and makes a significant contribution to their on-going education.

The status of INRA researchers is similar to that of teachers in higher agronomic education, and there are many exchanges between these two groups. Researchers are appointed to faculties and most tenured professors (ENSA and ENV) are directors of a research laboratory at INRA. There are 73 laboratories associated with faculties, with 191 INRA researchers and 286 teachers-researchers, 60 of whom are in charge of research units. Activities as a whole in each faculty are coordinated through discussions within the scientific department to which they are attached at INRA. To this one must add research that is directly financed by industry or the agricultural profession. This type of research is generally of the applied type and makes it possible for INRA to continue its more basic research activities. In addition, the teaching staff contributes to research evaluation commissions and participates in juries for scientific competitions.

Very few research funds come from agricultural education, but INRA manages to finance the research laboratories of faculties between 40-60%. The rest of the funds come from contracts with private institutions. Relations are also developed with other research centers: CNRS (National Center for Scientific Research), CEMAGREF (National Center for Agricultural Machinery, Rural Engineering, Waterways and Forests), CIRAD (Center for International Cooperation in Agronomic Research for Development), ORSTOM (French Scientific Research Institute for Development in Cooperation), Institut Pasteur, CEA (Center for Atomic Energy), and IFREMER (French Research Institute for the Exploitation of Ocean Resources).

For the large majority of cases, this system ensures proper coordination of the research activities of INRA and the advanced agronomic educational establishments.

4. Teaching staff

Higher agronomic education employs about 700 teachers-researchers divided among 260 educational and research units that correspond to faculties or departments. Except for the advanced schools of agriculture, which have a private status, all teachers are permanent government employees. The number of teachers under contrat is very small.

The presence of research laboratories (INRA) associated with these units makes it possible for establishments to use researchers' scientific competence in teaching activities. A certain number of temporary staff or lecturers from professional circles, research or other schools, ensures the plurality of information in various areas of the training process. Their role, together with practical training sessions, end-term papers, visits and study tours, completes the necessary transition from theoretical education to professional realities and the scientific movement. The principle of visiting professors and foreign professors is practically non-existent in French higher agricultural education. Every year, only a few foreign teachers-researchers, on sabbatical, participate in various activities of these establishments.

There are numerous classifications for teachers-researchers (31 different groups), given the diversity of the schools. Those of the INA-PG and the ENSAs and ENVs provide them with the same statutory guarantees as the University. The difference of ranks is greater than is the case in the universities (Professor/Associate Professor, Assistant Professor, Lecturer). The transfer from

one to another occurs by competition. Teachers are not recruited by a national competition as is the case for universities, but by means of an open competition of the school. This is not without bearing on the geographic mobility and career development of teachers. In most cases, candidates are recruited on the basis of three criteria: depending on whether the category in question is Professor/Associate Professor or Assistant Professor/Lecturer, they must have set up a course or written an academic paper, developed a teaching and research program, or have organized the pedagogical aspect of a course with accomplishments in terms of academic titles and research work. This mode of recruitment is generally favorable to teachers already working in the school, but also makes it possible to hire candidates coming from the research field, from other schools or from the university. Over the last ten years, the number of doctorates has increased as it is indispensable in educational and research units that participate in post-graduate courses.

Training courses for teachers abroad are not highly developed at this point, except in certain areas such as agro-food, economy, etc.

5. Students

Senior technicians are recruited on the basis of applications to the National Selection Commission for public establishments (10,752 candidates for 4,045 students admitted in 1985), and according to the individual procedures of each private establishment.

Private advanced schools of agriculture recruit either on the basis of an examination that is common to certain schools, or on the basis of an application, or an application and an interview.

The INA-PG and the National Higher Schools of Agronomy, the National Veterinary Schools, the National Schools for Civil Engineers have a common examination for each type of school. The selection rate varies with the training streams (1/3 to 1/2). The students have already gone through a selection process based on their academic record upon entering preparatory classes, and this fact should be taken into consideration.

Entrance conditions for students with degrees in secondary technical agricultural education (BTAG, BTAO and D Baccalaureate) are quite open in the BTSA training channels (BTAO: 19.4%, BTAG: 38.2%, BAC D: 14.8% of all students admitted in 1985), but more restricted in engineering and veterinary schools (from 1.6 to 0.4% in the INA and the ENSAs in 1971 and 1979). The C and D Baccalaureates are indeed more appropriate for entering classes that prepare for the competitive entrance exams of the INA, the ENSAs and the ENVs. The fact that access is difficult through the French technical education streams is not unique to higher agricultural education: this is one of the characteristics of the French educational system.

6. Cost of Studies

It is difficult to define how the cost of education is calculated because of the numerous and varied sources of financing. The relative share of this type of financing can vary from one school to another. The main sources are:

- student resources (tuition fees paid by the students - 23-30% in private establishments), revenue from school farms;

- financial aid from the Ministry of Agriculture (no more than 50% for many establishments);

- other subsidies (other ministries, contribution of local governments, in particular public regional bodies and governments);

- the apprenticeship tax (highly dependent on the number of contracts each school has with companies who must pay this tax);

- study and research contracts and the indirect participation of research (INRA, Ministry of Research), in particular participation in the educational process of researchers from laboratories attached to an establishment's faculties and departments (see **Table** in **Annex**).

IV- Major problems - Topics for discussion

Although the French higher agronomic educational system appears, at the European level, to be one of the most well adapted to the agricultural sector's requirements, the rapid evolution in science and technology as well as international competition require various

structural changes that are indispensable if one is to train the high level engineers and specialists that are needed to have an impact at the international level.

We will briefly mention the main problems presently being discussed within the scientific community with the responsible ministry.

The weight of tradition has led to a hierarchy among advanced agronomic schools, which could be harmful to the needs of rapidly growing and important socio-economic sectors such as the agro-food industries, notably regarding the choice students make upon completing common curricula. One can observe a relative devaluation of agro-food schools, particularly in the area of product transformation.

The autonomy of these schools has allowed them to develop many initiatives but their small size, with limited numbers of students and teachers-researchers, as well as the multiplication of programs, has several drawbacks:

- the universities have set up University Institutes of Technology (IUT) which train graduates (DUT degree) with qualifications that are close to those of senior technicians, and results in competition in the job market;

- both the separation between establishments and the absence of coordination between initiatives launched by educational institutions have led the Ministry of Agriculture to encourage more collaboration and even the combination of establishments in order to create centres with a number of students and teachers-researchers that would be comparable to those of the most highly developed countries. Several hypotheses are being discussed: the creation of regional polytechnical establishments, grouping various training courses under a single entity connected with the university. An example of this is the Advanced Agro-Veterinary Institute of Toulouse. Another possibility is a more functional combination of distinct groups of schools that have the same training streams (ENSA/veterinary schools/ENIT/private agricultural schools. It is also necesary to coordinate agronomic and veterinary training courses more effectively;

- separation between schools has also led to considerable divergence in teacher-researcher classification for those who remain attached to their establishment: 36 different employment structures, with 31 distinct groups of government employees. This situation can cause problems within the establishments, leading to a deficiency in the functional and geographic mobility of the staff. A reform is presently under study, aimed at simplifying classification and nationalizing recruitment examinations, as is the case for the universities;

- The recent reforms (Law of 26 January 1984 on the orientation of higher education) highlight the problem of the policy that is to be followed with regard to doctoral training: the "Doctor in Engineering" diploma and a single doctorate of the Ph.D. type are to replace the third cycle doctorate and the State Doctorate and would harmonize the French system with systems of the most developed countries, as well as improve the status of our degrees on the international level, particularly in Europe. Establishments belonging to the Ministry of Agriculture are empowered to grant these diplomas. Furthermore, the present focus of university post-graduate centres on basic disciplines is not very appropriate for the preparation of agronomic theses in technical-economical subjects. Finally, the creation, by the French *Grandes Ecoles* of a masters level training course, following the Anglo-Saxon model, brings up the problem of the position of this course in relation to the DEA - Advanced Studies Degree (*Diplôme d'Etudes Approfondies*).

As for North-South exchanges, and the institution of a new economic order oriented toward a better balance of exchange and the development of education, international organizations (FAO, UNESCO, ILO, ICAMAS) could contribute to having curricula pay more attention to these problems (content of training courses, practical sessions, etc.) and by developing a more structured exchange policy (visiting professors, twinning of schools, etc.). At the present time, the training of foreign civil engineers, in particular those from French-speaking countries, is suffering from the dispersion of university establishments, and the inappropriateness of the content of the proposed curricula to the local realities that these engineers will be confronted with. The combination of certain curricula and students within the Montpellier center of AGROPOLIS, at the initiative of ICAMAS, in conjonction with CNEARC and the different partners involved, could provide an indication of the road to follow.

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Notes

(1) These figures do not include certain university establishments such as the University Institutes of Technology, that grant basic degrees in technology, Masters in Sciences and Techniques (MST) and doctorates.

(2) These figures for 1985 should be seen as providing a scale of magnitude, and indications of trends (1980-85); they are based on various partial investigations conducted at the request of the Ministry of Agriculture; a comprehensive study being unavailable.

Annex

Tables, figures and map

Figure 1

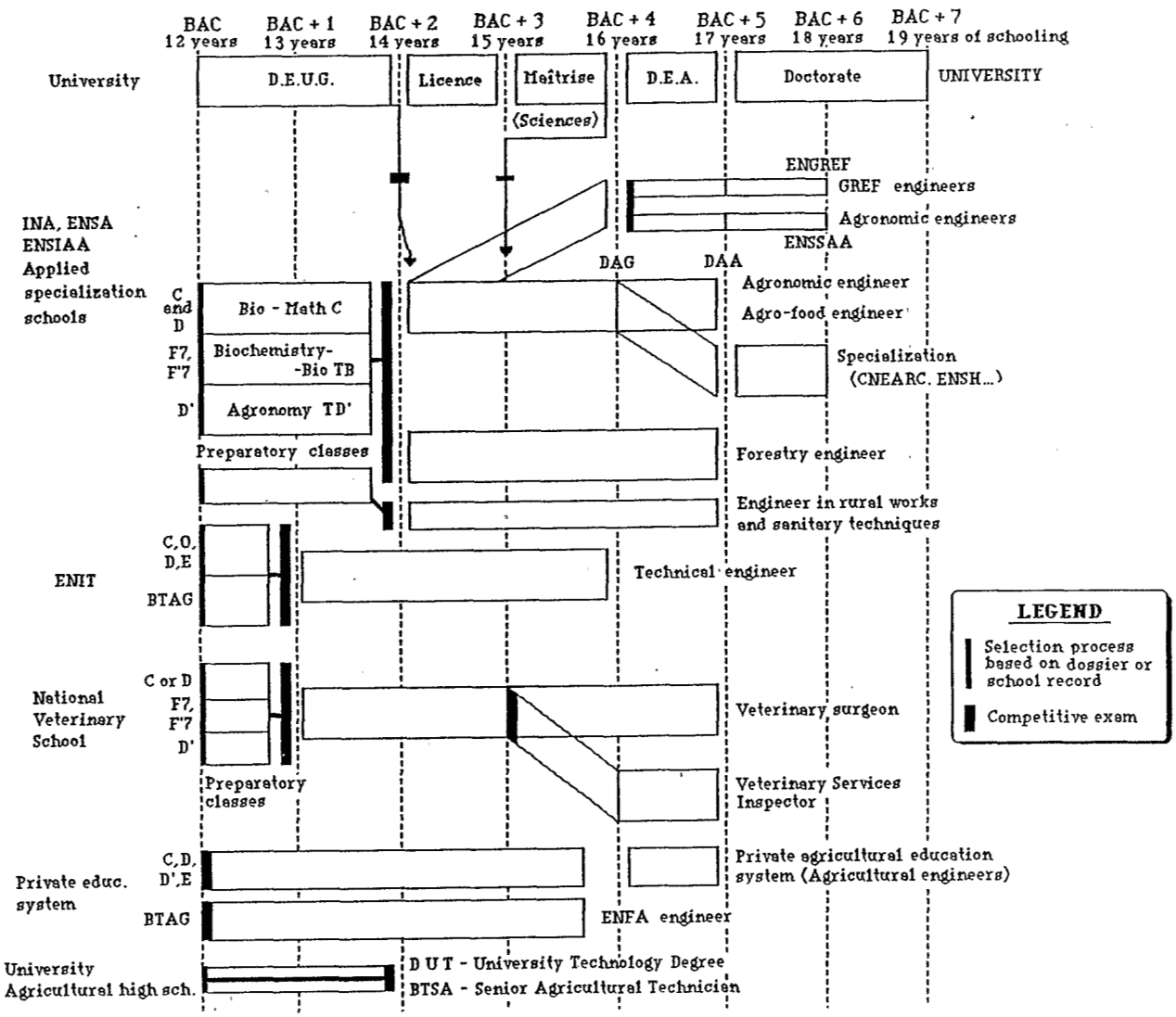


Table 1: Higher Agricultural Technician Certificates
(BTSA - *Brevets de Techniciens Supérieurs Agricoles* - Bac + 2)

There are 19 options for the BTSA, covering all of the agricultural and para-agricultural sectors:

The Agricultural Enterprise - economy and techniques (ETEA)
Agricultural techniques and company management (TAGE)
Agricultural product transformation, distribution and marketing
Plant production
Animal production
Horticultural production
Forestry production
Viticulture - Oenology
Agricultural machinery
Crop protection
Seed production
Water control in agriculture
Environmental protection
Training in equine sciences
Agricultural, biological and biotechnological analyses
Agro-food industries and biotechnologies
Manufacturing and marketing of wines and alcoholic beverages
Tropical agronomy
Development agent for warm regions

Figure 2: Number of students in technical agricultural education

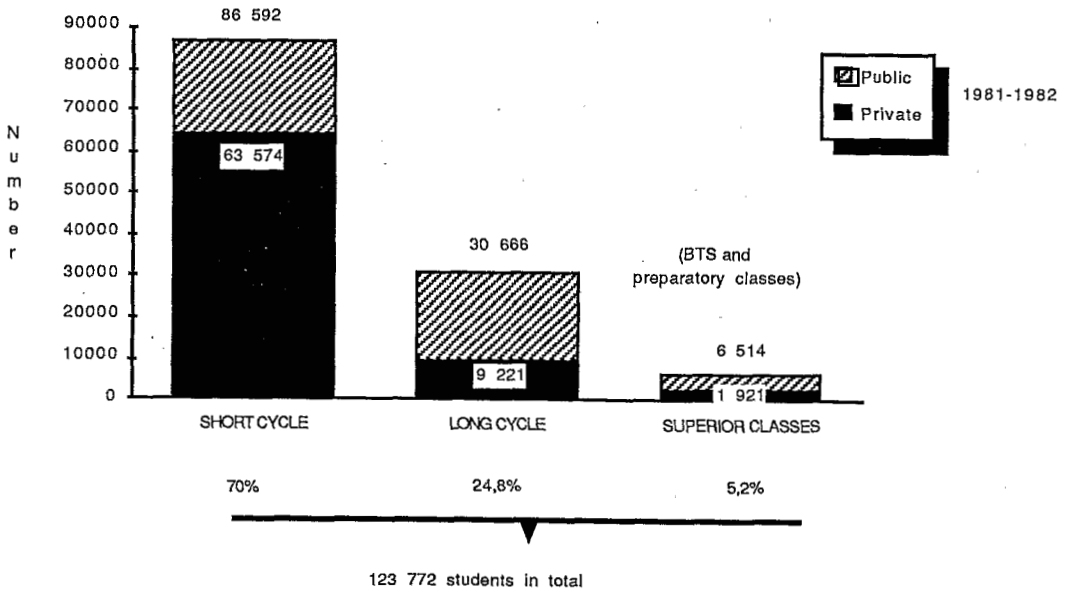
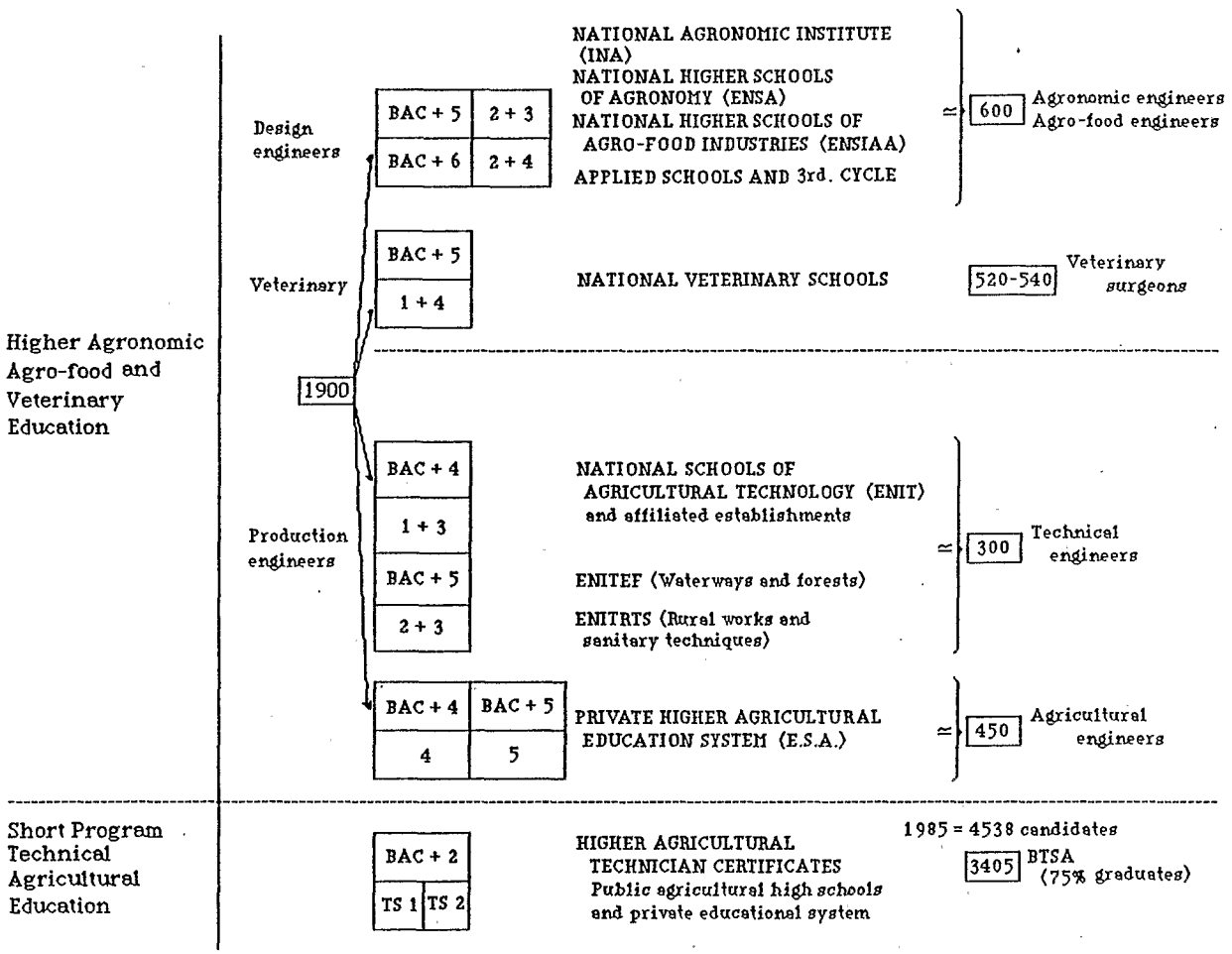
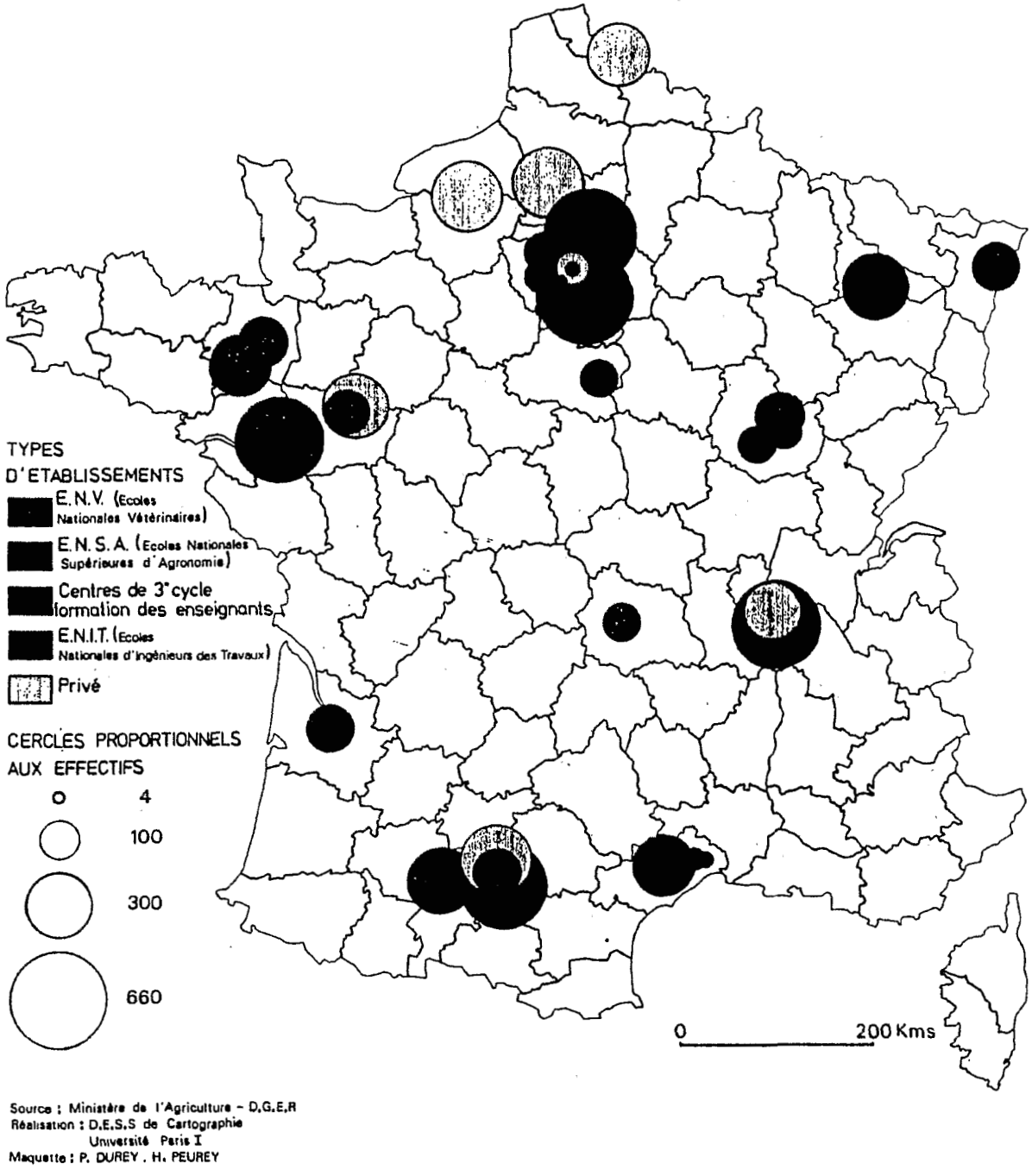


Figure 3 : The annual number of students from higher agronomic, agro-food and veterinary education



Map: Location and size of advanced educational establishments in agronomy, agro-food and veterinary sciences



Source : Ministère de l'Agriculture - D.G.E.R
Réalisation : D.E.S.S de Cartographie
Université Paris I
Maquette : P. DUREY . H. PEUREY

Type of establishment	French		Foreign	Graduates	Total %
	Civilians	Gov't service			
ENSA	1,530	-	192	1,722	23
Application or specialization schools	167	143	84	394	8
ENV	2,269	30	103	2,402	26
ENIT	723	298	32	1,053	15
Private engineering schools	2124	-	19	2,143	22
Other schools	192	76	71	339	6
Total	7,005	547	501	8,053	100

Table 2 : Students in higher education. numbers per category, 1985/1986.

Source : Ministry of Agriculture, DGER.

Type of establisment	Number of laboratories	Total budget (*)	INRA personnel			Teachers-Researchers DGER
			Researchers	Engineers	Other	
ENSA	48	32,148	170	93	328.5	161
ENV	16	4,891	8	20	126.5	101
Other schools	9	1,903	13	7	15	24
Total	73	38,942	191	120	470	286

Table 3: Laboratories in higher education establishments subsidied by INRA (1985)
(*) Not including personnel. Including contracts and other resources

Source: Ministry of Agriculture, DGER

Type of establishment	1	2	3	4	5	6	7
ENSA	269	118	169	159	238	3	956
Application or Specialization Schools and other schools	85	11	15	21	22	3	105
ENV	249	1	122	85	235	-	692
ENIT	99	60	51	76	123	12	421
Total	702	190	357	341	618	18	2,226

Table 4: Personnel of public higher education establishments (1986)
(1) teachers, (2) engineers, (3) laboratory personnel, (4) administrative and intendance,(5)maintenance and support staff, (6) other categories, (7) total

Source: Ministry of Agriculture - DGER

Type of establishment	Total budget *	Research and development budget
ENSA	70,091	8,055
Application or Specialization Schools and other schools	27,482	1,203
ENV	80,549	4,043
ENIT	33,274	2,504
Total	211,394	15,805

Table 5: Budgets of public higher education establishments
(Operation in capital), 1985, in 1,000 F. * : Excluding personnel and excluding INRA subsidies

Source: Ministry of Agriculture - DGER

Organismes internationaux	2.2
Ministère de l'agriculture	19.7
Autres sources nationales	40.4
Organismes publics régionaux	6.8
Entreprises privées	23.9
Divers	7.0

Table 6 : Funding sources (%)

Source: Ministry of Agriculture - DGER

Figure 4 : Specialized fields of post-graduate training

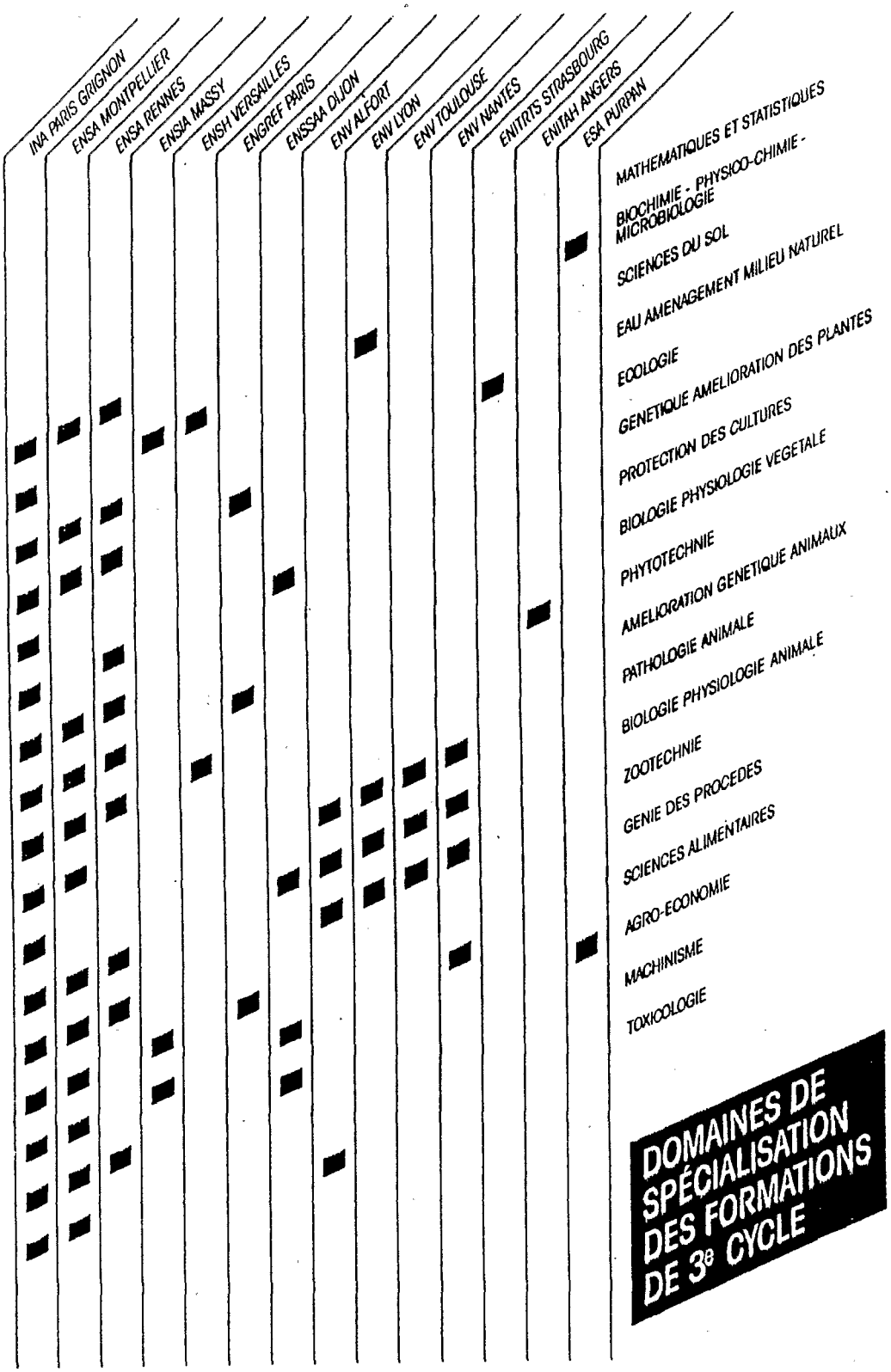


Table 7: List of higher education establishments for agronomy, agro-food, and veterinary medicine

Ministry of Agriculture:

National Advanced Schools of Agronomy and Agro-food industries

Institut National Agronomique Paris-Grignon (INAPG)
16, rue Claude Bernard - 75231 PARIS CEDEX 05
Tél. : 43.37.15.50

Ecole Nationale Supérieure Agronomique de Montpellier (ENSAM)
9, Place Pierre Viala - 34060 - MONTPELLIER CEDEX
Tél. : 67.61.22.07

Ecole Nationale Supérieure Agronomique de Rennes (ENSAR)
65, rue de Saint Brieuc - 35042 RENNES CEDEX
Tél. : 99.59.02.40

Ecole Nationale Supérieure des Industries Agricoles et Alimentaires (ENSIA)
1, avenue des Olympiades - 91305 MASSY
Tél. : 69.20.05.23

Applied Schools

Ecole Nationale du Génie Rural, des Eaux et des Forêts (ENGREF)
19, avenue du Maine - 75732 PARIS CEDEX 15

Ecole Nationale Supérieure des Sciences Agronomiques Appliquées (ENSSAA)
26, boulevard du Docteur Petitjean - 21000 DIJON
Tél. : 80.66.54.12

Specialization Schools

Centre National d'Etudes Agronomiques des Régions Chaudes de Montpellier (CNEARC)
Avenue du Val de Montferrand - BP 5098
34033 MONTPELLIER CEDEX
Tél. : 67.54.55.33

Ecole Nationale Supérieure d'Horticulture de Versailles (ENSH)
4, rue Hardy - 78000 VERSAILLES
Tél. : 39.50.60.87

National Veterinary Schools

Ecole Nationale Vétérinaire d'Alfort (ENVA)
7, avenue du Général de Gaulle - 94704 MAISONS ALFORT CEDEX
Tél. : 43.96.71.00

Ecole Nationale Vétérinaire de Lyon (ENVL)
2, route de Saint-Bel-Marcy-l'Etoile
69260 CHARBONNIERES-LES-BAINS
Tél. : 78.87.00.84

Ecole Nationale Vétérinaire de Nantes (ENVN)
La Chantrerie - Route Gachet - 44026 NANTES CEDEX
Tél. : 40.30.08.40

Ecole Nationale Vétérinaire de Toulouse (ENVT)
23, chemin des Capelles - 31076 TOULOUSE CEDEX
Tél. : 61.49.11.40

National Schools of Engineering and affiliated establishments

Ecole Nationale des Ingénieurs des Travaux des Eaux et Forêts (ENITEF)
Domaine des Barres - 45290 NOGENT-SUR-VERNISSON
Tél. : 38.97.60.20

Ecole Nationale des Ingénieurs des Travaux Ruraux et des Techniques Sanitaires (ENITRTS)
1, quai Koch - 67000 STRASBOURG
Tél. : 88.35.67.72

Ecole Nationale d'Ingénieurs des Travaux Agricoles de Bordeaux
(ENITAB)
1, cours du Général de Gaulle - 33170 GRADIGAN
Tél. : 56.04.03.03

Ecole Nationale d'Ingénieurs des Travaux Agricoles de Clermond-Ferrand (ENITACF)
MARMILHAT - 73370 LEMDES
Tél. : 73.92.52.36

Ecole Nation. d'Ingén. des Travaux Agric. de Dijon (ENITAD)
21, boulevard Olivier de Serres - 21800 QUETIGNY
Tél. : 80.46.30.01

Ecole Nationale d'Ingénieurs des Travaux Agricoles d'Angers (*Option Horticulture*) (ENITAH)
Rue le Nôtre - 49000 ANGERS
Tél. : 41.48.36.24

Ecole Nationale des Ingénieurs des Techniques des Industries Agricoles et Alimentaires de Nantes (ENITIAA)
Chemin de la Géraudière - 44072 NANTES CEDEX
Tél. : 40.40.03.00

Other schools

Ecole Nationale Supérieure du Paysage (ENSP)
6 bis, rue Hardy - 78000 VERSAILLES
Tél. : 39.53.98.89

Ecole Nationale de Formation Agronomique de Toulouse-Auzeville (ENFA)
BP 87 - 31326 CASTANET-TOLOSAN CEDEX
Tél. : 61.73.04.25

Institut National de Promotion Supérieure Agricole (ENPSA)
4, rue des Champs Prévois - 21100 DIJON
Tél. : 80.66.72.27

Institut National de Recherche et d'Application Pédagogiques (INRAP)
2, rue des Champs Prévois - 21100 DIJON
Tél. : 80.66.41.23

Ecole Nationale Supérieure Féminine d'Agronomie de Rennes (ENSFA)
65, rue de Saint Brieuc
35042 RENNES CEDEX
Tél. : 99.59.12.44

Private establishments for higher agricultural education

Ecole Supérieure d'Agriculture d'Angers (ESA)
24, rue Auguste Fonteneau
BP 748 - 49007 ANGERS CEDEX
Tél. : 41.88.58.12

Ecole Supérieure d'Agriculture de Purpan-Toulouse (ESAP)
271, avenue de Grande Bretagne - 31076 TOULOUSE CEDEX
Tél. : 61.49.23.11

Ecole Supérieure d'Ingénieurs et de Techniciens pour l'Agriculture
(ESITPA)
Rue Grande - 27100 VAL-DE-REUIL
Tél. : 32.59.14.59

Institut Supérieur Agricole de Beauvais (ISAB)
Rue Pierre Waguet - 60026 BEAUVAIS CEDEX
Tél. : 44.45.82.63

Institut Supérieur d'Agriculture de Lille (ISAL)
13, rue de Toul - 59046 LILLE CEDEX
Tél. : 20.30.83.14

Institut Supérieur d'Agriculture Rhône-Alpes (ISARA)
31, place Bellecour - 69002 LYON
Tél. : 78.42.10.78

Ecole Supérieure du Bois (ESB)
6, avenue de Saint Mandé - 75012 PARIS
Tél. : 46.28.09.33

Ministry of National Education

Ecole Nationale Supérieure Agronomique de Toulouse (ENSAT)
145, avenue de Muret - 31076 TOULOUSE CEDEX
Tél. : 61.42.83.98

Ecole Nationale Supérieure d'Agronomie et des Industries Alimentaires (ENSAIA)
2, avenue de la Forêt de Haye - 54500 VANDOEUVRE-LES-NANCY
Tél. : 83.57.48.48

Ecole Nationale Supérieure de Biologie Appliquée à la Nutrition et l'Alimentation (ENSBANA)
Campus Universitaire Montmuzard - 21000 DIJON
Tél. : 80.65.14.12