

INNOVATIONS IN THE RURAL DEVELOPMENT RESEARCH: THE CASE OF THE PRODUCTION OF HIGH VALUE TIMBER IN CHILE

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Abstract

Chilean agricultural sector has been affected by a severe crisis, which can be overcome by productive innovations. One of these innovations is high value timber production that can be produced in association with other agricultural products.

Traditional mechanics of R&D operation in the last decades considered collaboration agreements with private owners, without involving them directly in the research. This methodology meant important experimental unit losses. From 1997 on, innovative modifications were introduced (diffusion program, open competition owners selection, communication program, seminars and workshops, private sector involvement in R&D activities), and research efficiency increased considerably. In fact, experimental unit losses decreased from 43% to less than 10%, and R&D results are applied at a productive level/scale very fast after they are available.

Keywords: methodology, research, innovation and timber

Introduction

During the last two decades the Chilean forest sector has shown a sustained and recognized development, with a rising production and a diversified export that in 1999 arrived to US\$ 2.300 millions. However, this development has been geographically concentrated (76% of the plantation concentrates on only three regions). Silviculturally concentrated in fast growing species under the industrial plantation model (of a total of 1.952.288 hectares 75% is constituted by *Pinus radiata* and 18% by species of *Eucalyptus spp.*). And socially concentrated in hands of big companies, existing excluded sectors (players) of the forest development due to the little flexibility of the model based on monoculture (pure plantations in vast surfaces). These margined actors could be incorporated if there were new productive proposals and models.

The agricultural sector has been affected by a sustained crisis, given mainly by the low yields of the traditional cultures (low technology, scarce innovation). Given also by fluctuations in the national and international markets; by the incorporation of Chile to international treaties (with the consequent entrance of products at smaller costs than the Chilean ones). By the sale of lands at low prices and by the existence of important extensions of potential forest lands not used in small and medium size owners' hands. These factors have converged in a transformation process called "agricultural change" (Loewe et al, 1993).

In this context, the Government is aware of the necessity of diversifying the productive forest sector, including the quantity of cultivated species and the techniques to be applied, and it

considers that this sector can carry out an important contribution to the process of transformation of the Chilean agricultural sector.

Reasons that impel to promote diversification are elements of economy and of forest policy, because it allows limiting the biotic and abiotic risks, distributing them in space and time. Also it allows to reduce the economic risks, facing in a better way eventual market fluctuations as well as it allows to maximize the use of the sites. By the other hand, it allows to use cultures of economic interest different to those traditionally used, and it is pertinent, since Chile has a vast weather and soils range, and there is the possibility of reaching specific market niches of high value products.

A series of actions have been implemented looking for a productive innovation. Among those, new modalities of cultivating “new” species (new in the sense of being species not traditionally cultivated).

Funds for research and development (R&D) changed in the 80’s, passing from direct transfers to the institutions or technological centers, to a few funds that work on the basis of open-competition, peer-review, short term and cost sharing project basis. Private sector has had and it still has a limited role in agricultural and forest research (Loewe, 1999).

This has generated huge impacts in all the institutions linked to forest R&D, since the new requirements included pecuniary and not pecuniary contributions from the private sector. In this scenario there are several studies oriented to develop new cultural techniques, among them “arboriculture” for high value timber production, mainly hardwoods, in order to offer valid opportunities to the rural agricultural Chilean sector.

Context for r&d in Chile

Forest Institutions

The main forest institutions are the forest service called Forest National Corporation (CONAF), which belongs to the Ministry of Agriculture, and the Forest Institute (INFOR), private R&D corporation linked to the Ministry of Agriculture by means of an acting contract.

The main non-government organizations (NGOs) are the School of Forest Engineers and the Chilean Timber Corporation (CORMA), where the most important and powerful forest companies are represented. Forest R&D is carried out in universities and mainly in technological centers, being INFOR one of those who plays a recognized role in forest topics related to the whole productive cycle.

Incentives to forest development

In 1974 the Ordinance Law N°701 entered in validity with the objective of promoting forest plantations. With its application between 1976 and 1994 the country spent a total of US \$311 millions. With this mechanism 792.000 hectares were planted (INFOR, 1996). Although the O.L. N°701 was open to any owner, actually the participation of medium and small owners was scarce, due to the necessity of a previous financing to carry out the works. This prevented a high number of farmers and peasants to use the system, and it took to many to the easy solution to sell their lands to the big companies (Loewe and Ravanal, 1999).

Considering the context of the forest sector, in 1994 the Government created the National Program of Forest Diversification, located inside the forest service (CONAF). Its existence was due to the necessity of diversifying the forest production, either in quantity of cultivated species

and in the techniques to apply, since it is believed that this sector can carry out an important contribution to the process of transformation of the Chilean agricultural sector.

With regard to the productive techniques, in Chile mainly the pattern of industrial plantations is applied, based on the cultivation of big areas, production of big volumes of low price products, outline that it is not appropriate nor for the rural world neither for the small and medium companies.

In 1998 it was formed a commission at the Ministry of Agriculture formed by the forest service (CONAF), the Institute of Agricultural Development (INDAP), in charge of granting credits to the peasants and small owners; the forest institute (INFOR), in charge of developing appropriate technologies to heterogeneous situations; and organizations of peasants' base and small owners (Benedetti et al., 1999). Its work contributed to generate consensus regarding coordinated actions and to the real users demands, and to the realization of substantial modifications to the OL N°701 mainly related to forest plantation subsidies carried out by small owners/peasants in degraded lands. These modifications are at the moment effective.

Later on, and after almost 40 years of studies of species introduction (Loewe and Murillo, 2000), in 2000 it was included in the subsidy a special allowance to some selected species to diversify forest plantations. Among them chestnut (*Castanea sativa*), Blackwood (*Acacia melanoxylon*), douglas fir (*Pseudotsuga menziesii*), eucalyptus (*Eucalyptus regnans*), among the exotic ones, and among the native species, roble (*Nothofagus obliqua*), raulí (*Nothofagus alpina*) and coigüe (*Nothofagus dombeyi*).

Mechanics of the Forest Investigation

The democratic governments of the last decade have worked in promoting innovation and investigation for the country. With this goal a wide range of instruments oriented to the productive development have been created, considering also training, research initiatives and technological development funding; and also to promote new markets.

Since 1992 the financing of R&D projects was intensified by means of open competition, peer review funds, under a cost shared base that demands a participation of the private sector in the execution and financing of the projects. This private contributions depends on each fund but represents an average of 18% of the project total cost; for the most part these contributions are not pecuniary.

Companies pecuniary contribution is not relevant, because they consider that forest research has high externalities components difficulty captured by the companies (Loewe, 1999), with the exception of the applied investigation that has a direct impact in its operations. Participation of the private sector in the forest investigation in countries of Latin America is low, having a marginal participation, that is visualized as an expense and not as an investment, (FAO, 2000).

The big forest companies bound to international conglomerates have their own research centers of recognized excellence; in general they are oriented to forest plantation productivity increase (biotechnology, fertilization, genetics, etc.), with possibilities of subcontracting the best capacities at national and international level. This is one of the most important differences among public and private R&D: in the first case results are not appropriable, they are of public knowledge and property, what facilitates their diffusion and transfer. On the other hand, in the case of the private research, results are exclusive of the companies and therefore not of public access.

In spite of the above-mentioned, some cooperation initiatives have been created among the public and private sectors, such as the Cooperative of Genetic Improvement (CMG) and the Poplar National Commission (CNA).

In relation to the base organizations and small companies, although it stands out their interest in the investigation, they don't have the financial capacity to support research with pecuniary resources.

R&D funds have evolved regarding technological transfer, increasing their demands in such a way to ensure the results transfer to beneficiaries. At the moment it is indispensable for the award of a project the incorporation of clearly identified, orderly budgeted extension activities in chronological and monetary terms.

In basic investigation projects, carried out mainly by the universities, a direct result diffusion or transfer doesn't exist. The obtained results generally conclude in publications in national or international specialized magazines or journals oriented in most of the cases to the academic world, process related to the demands of the academic evaluation system.

This policy of financing investigation by means of open competition funds has generated a series of inconveniences, among those:

- Open competition funds makes compete in equality of conditions institutions of different financing structure (universities, technological centers, private development organisms, consultants, professional institutes).
- Most funds consider three years like maximum duration of the projects, seriously restrictive factor for the forest investigation. Funds don't exist for long term research.
- Some funds only finance incremental costs, what constitutes a risk for keeping the minimum investigation professional capacities.

Research organizations will make a contribution to the development goals or the solution of the social, economic and environmental problems, only if the results of the investigation communicate or arrive to the users satisfactorily. Communication between the R&D organizations and the users is facilitated by experimental units, which constitute a very useful and effective extension tool, since it allows the neighborhood to show in an immediate form the results of the investigation and the adaptation of the proposed technologies (FAO, 1994).

From 1991 on, INFOR has developed, among others, R&D projects whose goal is the development of new productive options to the forest sector. These projects have been funded by several public funds and by private contributions, those that see in forest diversification a development alternative.

The traditional mechanics of INFOR operation in the last decade contemplated the execution of collaboration agreements with private owners, mainly companies and big owners, because the institution doesn't possess lands for installing experimental units¹; generally small owners/peasant were excluded. Researchers usually cooperated with interested owners or companies, without involving them in the project, even without communicating them formally their general and specific objectives. It was notorious the lack of communication, since after the trial establishment the owners didn't know when it would be measured or when cultural operations would be executed, either the measurement results or evaluations.

In general involved owners in R&D projects felt like "doing a favor to the institute", and they didn't manifest further interest to take care of the experimental units. Many of them, or others in knowledge of the location of the experimental units, used them as seed source that later was sold

¹ Actually it possess 50 has, but it is already totally planted.

in the national market, because it was supposed of better quality by being taken into consideration in institutional experiences.

The results of the R&D described mechanics meant big loss for the Government, because many experimental units got lost for lack of care (Figure 1); it is necessary to consider that INFOR established around 13.000 experimental units up to 1988 (Loewe et al., 1995; Loewe and Murillo, 2000).

Besides the above-mentioned, none type of fertile relationship was established with the private sector. This sector perceived the institution like centered in foreign problematic, and without importance or transcendence for their activity.



Figure 1: Walnut experimental unit for genetic improvement, abandoned by the owners in spite of having carried out an investment in the irrigation system. Situations like this represent a great loss of government resources, at the same time that it shrinks the possibilities to open new productive options for the agrarian sector.

Innovations in rural development forest r&d

Projects centered in high value timber production executed by INFOR from 1991 on have studied in detail more than 30 exotic and native species, considering aspects of their complete productive cycle (from plant production, to cultivation, to wood transformation, commercialization, and other aspects of importance).

At the beginning, these projects began to operate inside the prevailing mechanics, with the exception of also incorporating peasants and small and medium owners. This modality meant bad results in terms of losses of experimental units, situation intensified by the same nature of the proposed arboriculture² techniques that considers intensive cultural cares, carried out at a level of individual tree, and that make it possible finally to produce very valuable wood³.

² Applied science that deals with the temporary cultivation of individual trees or group of trees in order to produce timber of certain characteristic. This discipline is characterized for technical interventions done suddenly, and rationally founded on economic, ecological, agronomic and/or silvicultural bases. For this reason arboriculture cannot be classified completely neither in the agrarian environment neither in the forest environment, but rather it is located in an intermediate position among both, assuming an own and unique character.

³ The so called “arboriculture of quality” has for objective to produce, in relatively brief periods, wood with certain characteristic dimensional, aesthetic and technological that allow its placement in the high and specific segments of the market. In this case the basic element of reference is each individual tree of the main specie(s) because most of

In consideration to the obtained results, and to the impact that these results could have in the diffusion and application of the technique and of the new productive options in study, gradually a series of modifications were introduced in the work mechanics, considering among the most relevant, the following ones:

1. A diffusion program was implemented for each project (objectives, involved species, benefits, development perspectives in the country, etc.) in newspapers and other massive diffusion materials.
2. An open competition call through newspapers in order to select the best owners that would participate in the projects in different ways (contributing land, manpower, fences, information or others). This operating way changed the feeling that “the institute was requesting a sort of favor to the private”, situation that was reverted, so that at the moment many of them are interested in participate and so the professionals can choose among the most suitable, interested, and with administrative capacity ones. The main new idea generated is that both parts are "partners".
3. A communication program was implemented, privileging direct contact that includes: term letters that inform about experimental units evaluations, detailed description of activities to carry out in the period either by the owners or by INFOR's technicians. At the same time they are invited to the diffusion activities programmed in the near areas (Figure 2). They are also called 1-4 times a year, and when they demonstrate further interest they are sent publications.



Figure 2: Meetings with owners, technicians and professionals carried out to diffuse the characteristics of new productive alternatives, and to analyze in combined form about their advantages, disadvantages and application difficulties, delineating integrated and practical solutions. This allows to be directly connected to the private sector.

4. Scientific seminars, workshops, field days (Figures 3 and 4), discussion meetings are organized every year, opportunities to share experiences, impressions, doubts, fears or others.
5. An increased private owners contribution to projects development have been reached, both for small, medium or big owners or managers, situation that has produced a feeling of

the economic return depends directly on the suitability and quality of each individual tree, in particular with relationship to an specific objective, in general associated to the most profitable products.

property of experimental units⁴. This is quite important because, considering the funding R&D Chilean system, it allows long-term observations, useful growth and yield parameters, among others (Zeide, 1999).

6. The work team is guided by a quarterly activity program for every unit, in such a way of having a strict control on its development, and face adequately problems, complications or accidents.
7. Interested owners are invited to participate in the new project gestation, incorporating their suggestions since the stage of ideas generation.
8. Several government instruments have been used to do (fund partially) technological trips to different countries in order to visit and understand the high value timber production dynamics. In these activities the private sector (big, small and medium) have participated actively.

⁴ It has always been considered that trees after the collaboration agreement would end would be of the owner's property, but this was not enough to incentive them to care after the plantations for harvesting them later.



Figure 3: Field-day in a mixed plantation of 4 year-old with walnut as main specie associated to bohemian olive (*Elaeagnus angustifolia*), with the objective of producing timber and nuts. The analysis that derives of these activities is great because it allows to observe practical aspects of technical and administration practices required to be successful in the undertaken of similar productive initiatives.



Figure 4: Discussion workshop on the alternative of producing high value timber in which small and medium owners, companies, technicians, professionals and farmers analyze the different aspects of the development of a new idea, and discuss how to take it to the practice in a successful form. After a work that has considered several years of activities, some of the participants have begun planting at an operational scale in agricultural lands under irrigation, with excellent perspectives.

The mentioned modifications have reached a significant improvement of the public relationships, building relationships of trust and fertile in terms of the results of many of the R&D activities developed.

Actually, using the old methodology, from 1993 to 1997 28 trials were established, from which 12 died (43%). After the methodological modifications were introduced, from 1998 to 2001, 21

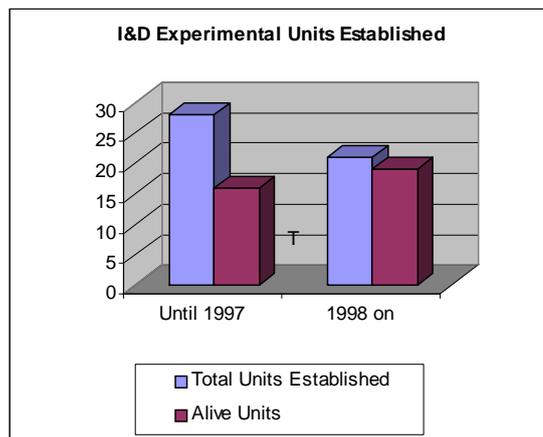


Figure 5: Total established experimental units versus alive units for the two analyzed periods.

experimental units were established, from which only 2 died (10%). Of these two lost experiences, one was affected by a fire, so the real lost rate is still lower (figures 5, 6 and 7).

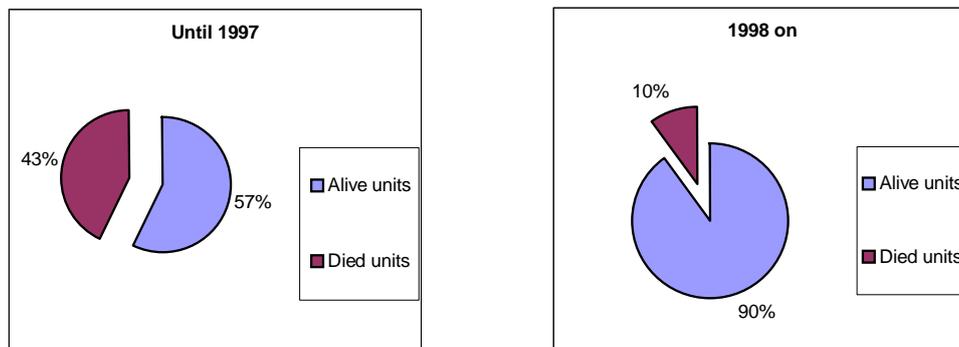


Figure 6: Comparison among alive and died experimental units obtained applying the old methodological approach

Figure 7: Comparison among alive and died experimental units obtained applying the new methodological approach

It is also remarkable the best care given to the experimental trials, compared to the ones established previously (Figures 8 and 9).



Figure 8. Five years old cherry plantation administered with the old methodology (X region).



**Figure 9: 2,5 years old cherry plantation administered with the new methodology (VII region).
Conclusions and recommendations**

- The cultivation of high value timber species represents an important potential in Chile. This is based both on the potential area to be planted, and in the promissory results that have been obtained with the experimental units' establishment, as well as in the expectations of the national and international market for high value timber products. Forest diversification represents a real productive option for small and medium size owners that are looking for new alternatives. In this sense it represents concrete possibilities for a rural development with equity.
- There are still many questions to be answered about this topic; many of these are queries that only basic and applied investigation can clarify. For this reason it is required adequate funding to develop R&D projects guided to the development of noble species cultivation.
- It exists a mechanics of R&D execution that is characterized for being done from and for the private sector, that has been proven in the last 6 years with positive results in the topic of arboriculture to produce high value timber.
- It has been accumulated experience that permits to select private participants that will have a better performance in research development, with a progressive and important decrease in experimental units' loss.
- It is recommended to apply methodologies of direct work with the private sector in activities of R&D, which have to include common and personalized activities, guaranteeing an appropriate execution of the committed tasks.
- It is considered that the application of these R&D mechanisms would be replicable with positive results to other technical areas.

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