F B V A - B E R I C H T E
Schriftenreihe der Forstlichen Bundesversuchsanstalt

Nr. 65 1992

PROCEEDINGS

of the meeting of IUFRO - WP S2.02-21 on

ACTUAL PROBLEMS OF THE LEGISLATION OF FOREST REPRODUCTIVE MATERIAL AND THE NEED FOR HARMONIZATION OF RULES AT AN INTERNATIONAL LEVEL

FDK 181.5:165.44:935.1

GMUNDEN / VIENNA - AUSTRIA
JUNE 10. - 14. 1991

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Editor

Herausgegeben
von der
Forstlichen Bundesversuchsanstalt in Wien
Kommissionsverlag: Österreichischer Agrarverlag, 1141 Wien

Herstellung und Druck:
Forstliche Bundesversuchsanstalt
A-1131 Wien

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Scenic view of the castle of Ort near Gmunden

MEETING OF WP S2.02-21 AT GMUNDEN AND VIENNA FROM JUNE 10 - 14, 1991

Theme: ACTUAL PROBLEMS OF THE LEGISLATION OF FOREST REPRODUCTIVE MATERIAL AND THE NEED FOR HARMONIZATION OF RULES AT AN INTERNATIONAL LEVEL

PROGRAMME

Tuesday, June 11

8.30 Opening of the meeting

Session 1 on "Implementation of Rules for Forest Reproductive Material"
Moderator: **B. Ditlevsen**

9.00 **Nather:** Opening address - Considerations on the theme of the meeting

9.30 **Mangold:** OECD certification issues in the United States

10.00 **Horvat-Marolt:** Quality and assortment of forest plants in legislation and practice

10.30 Coffee break

11.00 **Albrecht** and **Oloo:** Problems with forest reproductive material and the need for legal regulations in tropical (developing) countries

11.30 **Latos:** Polish standard for plant material planted outside the forest

12.00 Lunch

Session 2 on "Principle for Classification of Forest Reproductive Material"

Moderator: **P. Krutzsch**

13.30 **Fernandez:** Selected forestry reproductive materials in France: Critical analyses and result

14.00 **Rusanen:** Classification of selected seed material in Finland

14.30 Coffee break

Session 3 on "Clonal Forestry"

Moderator: **P. Krutzsch**

15.00 **Nanson:** Considerations over regulations for clonal forestry

15.30 **Venäläinen:** The Finnish regulations concerning the sale of vegetatively propagated forestation material

16.00 **Lindell:** New regulations for the use of clones in forestry in Sweden

16.30 **von Wühlisch and Muhs:** Problems in marketing clonally propagated reproductive material

17.00 Discussion on the posters presented by
Westcott and Heinze: Investigations into the genetic fidelity of plants produced via somatic embryogenesis of Norway spruce
Schmidt: Genotypic and genetic stability of micropropagation material

18.00 Dinner in the Festival Hall
hosted by **Dr. Ratzenböck,** Head of the Government of the Province of Upper Austria

Wednesday, June 12

Session 4 on "Categories of Forest Reproductive Material"

Moderator: **A. Nanson**

8.30 **Hubert:** New genetically improved reproductive material and regulations: The example of Pinus pinaster in France

9.00 **Arbez and Terrasson:** Genetic improvement and varietal risk in forest varieties: integration in european legislation

9.30 **Fletcher:** The products of tree breeding programmes and the EEC and OECD forest reproductive material regulations (read by H.-J. Muhs)

10.00 **Muhs:** Is there a need for the indroduction of a new category in both the OECD-Scheme and EEC-Directives governing the trade with forest reproductive material

10.30 Coffee break

Session 5 on "Special Problems on Seed Certification and Quality Standards"

Moderator: **A. Nanson**

11.00 **Dörflinger:** Problems of coordination concerning external quality standards of EEC and ISTA regulations

11.30 **Gorzelak:** Characterization of the Polish norm for tree plants produced in plastic tunnels for forest plantations and tree-plantings

12.00 Lunch

14.00 Visit to the seed kiln Steinkogl/Ebensee of the Austrian Federal Forests - Demonstration of improved methods of tree climbing.

17.00 Return by boat to Gmunden

18.00 Barbecue party (weather permitting)

Thursday, June 13

7.30	Departure from Ort Excursion to Vienna
9.30	Seed Orchards of the Austrian Federal Forests at Wieselburg
11.30	Rothschild Forest Estate Langau Visit to the Virgin Forest Rothwald
12.00	Lunch (picnic at Langböden hunting lodge)
16.30	Different Aspects of the Austrian Black Pine (Pinus nigra)
18.00	"Heurigenabend" in the vine tavern "Altes Zechhaus" in Gumpoldskirchen, Kirchenplatz 1, hosted by Dipl.-Ing. Dr. F. Fischler, Federal Minister for Agriculture and Forestry
21.00	Approximate arrival at Vienna

Friday, June 14

	Session 6 on "Forest Policy and Law on Forest Reproductive Material"
9.00	**Krutzsch:** Import of forest reproductive material, policy and rules
9.30	**Muhs:** Harmonization of the OECD-Scheme and the EEC-Directives needs and problems
10.00	**Muhs:** Breeder's rights affecting the trade of forest reproductive material
10.30	Coffee break
11.00	Final discussion
11.30	Technical session of the WP S2.02.21
12.00	Closing of the meeting
12.30	Farewell Luncheon with "Wiener Schnitzel" hosted by Dr. F. Natlacen on behalf of the Union of Private Forest Nurseries in Austria

OPENING ADRESS - Considerations on the Theme of the Meeting

J. NATHER, Coordinator of the Meeting

Mr. Chairman, Ladies and Gentlemen!

In Austria this week is declared the "Week of the Forest". This shows means that forests have a high priority in our life. 46 % of the total area of Austria are covered by forests. You will see its diversity during the following days.
Moreover it means that officials are very much under pressure during this time. Therefore, Ladies and Gentlemen, I have the great honour to welcome you this morning to the meeting of the IUFRO Working Party S2.02-21. I was asked to do so on behalf of Mr. PLATTNER, head of the Forest Division in the Ministry of Agriculture and Forestry, and on behalf of Mr. RUHM, Director of the Federal Forest Research Station. Both gentlemen regret very much not to be able to be here personally, but they asked me to bring their best wishes to you. Finally it gives me a great pleasure as the coordinator of this meeting to welcome you again here in Gmunden, to thank you for your coming and to wish you a successful and pleasent stay.
It is a good place to live - here in the heart of Europe - and I hope it will be a good place for discussing some problems that forestry has to overcome in the future.

At the beginning of this meeting I would like to contribute some thoughts to the actual problems which influence the legislation of forest reproductive material. And let me make an additional remark - I'll do this from the position of a silviculturist, who is often moving in the socalled "no-man's land" between genetics and silviculture.
Let me start my short considerations with the past:
After millions of years of more or less undisturbed evolution of the forest trees, people changed natural ecosystems to manmade plantations, particularly during the last 300 years.
Artificial regeneration got a very essential position in the intensive management concepts. This was followed by serious pro-

blems. I would like to quote in the first place:

- the transfer of reproductive material from the place of origin - that means from area of adaptation - to other ecological conditions.
- secondly somatic quality, assortment, classification and so on.

It was only a question of time that regulations became an urgent necessity. And indeed we find such regulations already in the first half of this century in several countries - as for instance in our country an ordinance by the ministry dating 1925. As a logical development responsible people met some 30 years ago to define the principles and to harmonize both methods and systems of qualification of forest reproductive material on an international level. As an essential step forward the world consultation of forest genetics in Stockholm 1963 has to be mentioned. But today we should consider what was the scientific state respectively the economical and political background at this time - 30 years ago.

In reports and proceedings we can find some information about it:

Experts recognized the urgent need to increase wood production to meet the growing demands of a rapidly expanding population. Their thinking was oriented towards maximizing wood production and increasing forest yield. Of course this is the most important function of forestry - but not the only one of forest ecosystems.

I would like to mention some measures that were recommended:

- the search for better growing provenances; that means preference for certain provenances, transfer and in consequence often over-representation or loss of native genotype respectively.
- another recommendation: to plant high yielding species - either to supplement or even to replace natural stands - that means again loss of genetic substance.

Moreover - a better coordination in resistance breeding.
- research on hybridization between species and races.
- recommendations for establishing research programs (for instance on tree physiology) and working groups

in IUFRO and FAO for better cooperation of researchers.

There were also several technical recommendations, such as:

- early testing should be intensified, and also research concerning interaction between genotypes and the environment. Another demand was that the management of seed orchards should be improved.

Well - but what is the situation now - 30 years later?

- You will agree that essential conditions have changed. Let me quote some of the present problems:
- The complex question of declining forests is the most emotionally biased problem. Stress from pollutants, climatic extremes, perhaps changes of properties, but also mismanagement led to reduced vitality, instability and irreversible damages in forests. In many forest regions we have incidental fellings between 20 and 40 % of the annual felling.
  In this connection the protection function of the forest should be emphasized. Settlements in a mountain region cannot exist without the protection of wooded sites.
- That means there is an urgent need for more stability which can be achieved best in unevenaged, mixed stands with well adapted sources.
- Another point to be mentioned: In renewal of forests there is a tendency towards natural regeneration and natural silvicultural systems (at least in Central Europe). That means a decreasing demand by number, but increasing concerning genetic quality. Highly qualified tested material will be requested in the future. But not only superiority of growth will be demanded for, also characteristics of adaptation.
- Moreover, genetic diversity is necessary to meet damages by stress in forests. Increasing problems in extended monocultures and with monoclonal reproductive material, particularly in developing regions, are warning examples. The necessity for preservation of native sources in full variation was recognized as one of the most important obligations of forestry in our time. It can only be realized in necessary and reasonable dimensions in cooperation of all branches of forestry (research, administration and practice).

These activities have to be done with regard to the ecological, the economical, and also the ethical point of view and they also will be a necessary basis for all breeding activities in the future.

Now - during the last 30 years there was also considerable progress in research with influence on further development.

- New methods of propagation are giving new impulse to clonal forestry.
- Biochemical methods (as enzymes for instance) open new aspects for definition of gene structures and for identification.

These few examples may outline the present situation. And I think it is time now to resume the discussion how to proceed in the future.

Summarizing we can state as follows: 3 suppositions (or conditions) will determine our considerations:

1. The silvicultural problem: Silviculture needs reproductive material of high quality. Today we understand silviculture as a multifunctional operation. That means that in future the objectives of silvicultural measures will not only be a maximum in yield but also a certain stand stability to protect the site against erosion, avalanches and torrents. In several sites this may even be the main objective. Further, shortage of drinking water may become a serious problem of mankind, if forests get lost, and with them their water storage capacity and a lot of other functions, as for instance recreation, and protection of species. And it is evident, if one function is maximized, there will be a reduction of others as a rule. Following recent statistics two third of the forested area in the world are not managed in accordance with the principle of sustainable forest management. The whole forested area decreases by 15 - 20 mill. ha per year. That means original forest ecosystems are destroyed and replaced by uniform plantations, often with highly selected or clonal material.

   Therefore a close cooperation between geneticists and silviculturists is necessary to meet this danger for mankind and - as mentioned before - to keep the indigenous gene pool as large as possible for future generations.

   Under these aspects the excursion on Thursday will take you to an original forest ecosystem.

2. The technical problem should be mentioned in the second place:

   Categories came into discussion again. Concerning categories in my opinion the discussion was never brought to final consent. Referring to the 4th category (of the OECD-Scheme): "tested", I have had some reservations from the very beginning concerning the definition and in relation with the certification.

   In the category "tested" the superiority in one or more essential characteristics should be certified in accordance with the definition. This normally needs trials in the field for many years. We will never be able to certify characteristics definitively in close connexion with a special seed lot, only under certain circumstances we can do it preliminary.

   Now - the figures of evaluation achieved by such a long-term provenance trial are more or less permanent results. They can be listed and used as a general information comparable with the description of the ecological properties of a region of provenance. What we need with reference to a special seed lot is the certificate of the genetic constitution - in other words: the identification of genetic parameters in due course. (As an example: when we have own experience with a provenance (e.g. Darrington) we don't need the superiority but the identity!)

3. Finally there is a third field of problems: the political, respectively administrative field. The division into regions of provenance as well as the control of reproductive material in trade will be influenced by the development of new economic concepts and systems.

   The harmonization within regions and the improvement of information by supplementing it with genetical parameters should be an essential and undisclaimable goal. The suitability of reproductive material (that means best adaptation to given conditions) must be always the decisive criterion, and authorties must have possibilities to control even when restrictions are not allowed for economic reasons.

Ladies and Gentlemen! I wish to emphasize.

It is really a pleasure and a concern for us to host this meeting, because we have the strong feeling that discussions on the actual problems of forest reproductive material are useful and necessary at present and because we are convinced that many colleagues concur with us.

Thank you for your attention.

O.E.C.D. Certification Issues in the U.S.

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Abstract

An overview of the certification system for forest tree seed used in the U.S. is presented. Local certifying agencies administer the Scheme through Memoranda of Understanding with the U.S. Department of Agriculture, Forest Service, which serves as the Designated Authority. In 1990, the U.S. exported approximately 4,195 kilograms to European countries. Most of the seed exported was composed of Douglas-fir (43% of total) and Sitka Spruce (20%), with about 64% originating from the State of Washington and 29% from Oregon. Several issues are raised with respect to harmonization between the local Scheme used in the Pacific Northwest and the O.E.C.D. and E.E.C. Schemes. These involve the difficulty of certifying individual forest stands, need for increased communication between all parties and clarifying requirements for testing. The U.S. strongly supports the upcoming efforts of the committee that will seek to increase harmonization between the various seed schemes currently in use in Europe and the U.S.

Problèmes de Certification O.C.D.E. aux Etats-Unis

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Résumé

Une vue générale du système de certification des semences des arbres forestiers aux Etats-Unis est présentée. Les agences locales de certification administrent le schéma grâce au Protocole d'Accord avec le Département del'Agriculture des Etats-Unis, Service Forestier, qui sert d'autorité désignée. En 1990, les Etats-Unis ont exporté approximativement 4195 kilogrammes de semence en Europe. La majorité des semences exportées était composée de Pins Douglas (43% de totale) et de Sapins Sitka (20%)-64% provenait de l'état de Washington et 29% de celui d'Oregon. Plusieurs problèmes sont soulevés quant à l'harmonisation entre le Schéma local utilisé dans le Pacific Northwest et les Schémas de l'OCDE et de la CEE. Ces problèmes comprennent: la difficulté de certifier les stocks forestiers; la nécessite d'accroître la communication entre les parties et celle de clarifier les critères de sélection. Les Etats-Unis supportent largement les efforts du comité qui permettront d'acroître l'harmonisation entre les différents Schémas actuellement en usage en Europe et aux Etats-Unis.

O.E.C.D. Certification Issues in the U.S.

Dr. Robert D. Mangold
U.S.F.S.

Overview of the O.E.C.D. Scheme in the U.S.

The U.S. Department of Agriculture, Forest Service, is the Designated Authority for administering the O.E.C.D. Scheme in the U.S. The Scheme is administered at the local level by State Certifying Agencies, through Memoranda of Understanding. Currently there are two states actively participating--Oregon and Washington. In Washington, the Washington State Crop Improvement Association is the responsible agency, while Oregon is represented by the Oregon Seed Certification Service, located at Oregon State University.

In 1990, approximately 4,195 kilograms of seed were exported to European countries. Of this, about 64% came from Washington, 29% from Oregon and 7% originated in Canada, but was shipped from the U.S.. At the species level, Pseudotsuga menziesii comprised 43% of the shipments and Tsuga sitchensis made up 20%. Other species included Pinus ponderosa (13%), Abies grandis (17%) and Abies procera (5%). Species with trace amounts shipped included Tsuga heterophylla, Abies concolor, and Abies magnifica.

In 1991, the Basic List of Approved Materials was updated and now exceeds over 150 pages in length. This List is arranged by seed zones (a circumscribed area that is relatively homogenous in ecological conditions) and 500-foot elevation bands within seed zones. In addition, two private companies have registered their seed orchards.

Harmonization between E.E.C./O.E.C.D./PNW Schemes

A committee has been formed to review the O.E.C.D. Scheme, with an eye towards making the Scheme more compatible with the E.E.C. Scheme. The U.S. is glad to participate and strongly supports this effort. In the U.S. we have the added complexity of employing an additional local Scheme, used in the Pacific Northwest (PNW), which is used in conjunction with the O.E.C.D. and E.E.C. Schemes. I would like to address one issue involving equivalency between O.E.C.D. and the local PNW scheme. In general the U.S. feels there is good agreement between the O.E.C.D. and the Pacific Northwest (PNW) Certification Schemes. One difference involves the certification of seed from specific stands of trees. The PNW Scheme is not currently able to certify seed at the stand level because the continuous nature of the forest cover in this region makes the breakdown of forests into discrete stands a difficult process to administer. Occasionally exceptions occur where collections are targeted to specific stands, but the seed is still certified "Source Identified," with the exact location optionally specified on the Certificate of Provenance. The ability to export seed may be impacted if E.E.C. rules change appreciably. In that case a system to certify certain highly desirable stands that satisfied all the relevant parties could hopefully be worked out. The U.S. welcomes any ideas from other parties regarding this concern.

We have established "Seed Production Areas" in the PNW and will certify seed derived from these stands as "Select." As of today, no seed producer in the PNW has requested the certification of any seed products from these areas.

Communication

All interested parties need to agree on a system of nomenclature to describe stands and locations in the U.S., so that reference to specific locations can be made without error. In the U.S. we use a "legal description" surveying system stemming from the Public Land Survey that is composed of Townships that are 6 miles (9.6 kilometers) on a side. Areas can be pinpointed down to approximately 20 acres (8 hectares), although further definition is possible, though cumbersome. For example we might hypothetically describe a stand in Township 3 North, Range 6 East, Section 10 (an area that is 1 mile square) (.62 kilometers on a side). Within this section we could uniquely describe an area in the northwest (NW) 1/4 of the NW 1/4 of the Section. This delineates an area 40 acres (16 hectares) in size. We recommend this system or a modified version of it be used by Europeans when specifying individual stands.

We also need to share existing information with all parties. Some individuals in the U.S. feel they are not getting all the relevant information that has been developed in Europe, with regard to a description of the desirable seed sources that Europeans seek to import seed from.

Testing

There should also be clarification on several genetic testing parameters. For example, agreement on the appropriate statistical design, number of test sites required and length of evaluation period is needed. The U.S. is very supportive of testing North American sources in Europe so that their genetic merit can be verified. From our perspective, tests that provide reliable genetic information as rapidly as possible (ie. for example, nursery tests) are highly desirable. In addition, we feel much can be gained in the efficient selection of test site locations in Europe. For example, a coordinated effort that included test sites that are representative of commonly reforested sites in Europe would provide the most inference on how U.S. sources will do in locations across Europe. Attempting to pick sites that establish the limits of transfer (very "harsh" and "mild" sites, for example) would also be very useful. We would be glad to cooperate in a coordinated effort to augment any ongoing tests. This could take the form of supplying seed and/or helping in the design of the tests.

There are some restrictions in Europe toward importing orchard seed from the U.S., unless the seed has been tested in Europe. We appreciate the reasoning for this policy and offer another view for consideration. We believe that orchards in the U.S., which are composed of parent trees originating from desirable sources (say, Darrington, Washington), may provide as much growth and adaptation (or more), as "Source Identified" lots from woods-run collections from that general area. One reason for this is that orchard seed may provide reliable performance from year-to-year because the same cone-producing trees will produce the seed crop each year (more or less). Whereas, with woods-run seed, the mother trees will vary from year-to-year and could be of uncertain genetic quality. We know the phenotypic performance is above average for the orchard trees, after observing them in their native environments. Subsequently, we have verified, through performance in progeny tests, their breeding values (at least for U.S. sites), and their levels of adaptation through genetic testing to U.S. planting sites.

Existing European provenance tests of U.S. sources have verified growth and adaptation of certain bulked seed lots from the 1966-68 I.U.F.R.O. collections. However, in each year commercial seed collections are made (woods-run seed), the genetic makeup of the seed lot will change (unless cones are collected from the same trees in each successive year) and performance of these collections in Europe, relative to the tests established from the 1966-68 I.U.F.R.O. collections from the same general provenance, are less certain. Thus, we believe from a genetic viewpoint that while "Source Identified" seed lots continue to play a big role to play in seed exports, orchard seed should increase and have much to offer European markets.

Indigenous Issue

A big concern of European buyers is that O.E.C.D. seed from the U.S. is commonly labelled "Unknown," in terms of whether seed is indigenous to the "Region of Provenance". This is done because in most cases, sufficient records do not exist or extend far back enough in time (greater than 40 years) to unequivocally establish the origin of a stand. The possible choices to fill out on the Certificate of Provenance are to indicate either "Unknown," "Indigenous," (to the specific Region of Provenance, which in the case of the U.S., is the seed zone combined with a 500-foot elevation band), or "Introduced from... ." Under these O.E.C.D. guidelines we feel the best strategy is to put "Unknown" on the Certificate, and also include under the "Optional Information," section that the seed is "Native to the Pacific Northwest." To my knowledge our approach is not hampering the marketability of the seed in Europe. We welcome any alternative views that would improve our present approach.

Conclusion

We believe the Certification Schemes are working. Control of genetic identity is being preserved and validated. We do think there are harmonization issues that need to be addressed and are optimistic the upcoming committee established to study this issue will be an important step in that direction. The U.S. will be an active member of this committee. We also believe increased communication is necessary to ensure the Schemes work effectively.

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QUALITY AND ASSORTMENT OF FOREST PLANTS IN LEGISLATION AND PRACTICE

Abstract:
The elements of an integral assessment of the quality of forest tree plants combined with the consideration of seed origin have to be built into the legislation of forest reproductive material, as real and usable as possible.

A plan of how many forest plants are needed in the next period for the afforestations has to be carefully worked out. Different methods of plant raising for different site conditions, the needs of different provenances, a satisfactory offer of plants from deciduous trees have to be considered. The production of forest plants and the needs for forest practice must be well balanced.

QUALITAET AND AUSWAHL DER FORSTPFLANZEN IN DER GESETZGEBUNG UND PRAXIS

Zusammenfassung:
Komponenten einer moeglichst komplexen Guetebeurteilung der Forstpflanzen fuer die Aufforstungen und Beachtung der Provenienzfrage muessen in die entsprechende Gesetzgebung eingebaut sein: reell, klar und brauchbar.

Die Forstpflanzenanzucht soll fuer mehrere Jahre im voraus geplant werden im Einklang mit den Beduerfnissen der Verbraucher. Dabei sind zu beruecksichtigen vor allem:

. die Anzahl der Pflanzen von verschiedenen Baumarten. Besondere Aufmerksamkeit ist dem Anteil der Laubhoelzer zu richten.
. Erziehungsart der Pflanzen fuer verschiedene Standorte, und
. ein entsprechender Angebot von verschiedenen Provenienzen.

Die Erfahrungen haben bewiesen, dass die Gesetzgebung ueber Forstpflanzgut z u l o c k e r ist und von beiden "Partnern" das heisst Forstbaumschulen und Forstdienst zu wenig beruecksichtigt ist.

INTRODUCTION

Bad planting success of the afforestation and establishment of new forests, or long suffering (to be or not to be) of plantings are an expensive burden for the forest, forestry and economy of the land in general. At the same time such failures are a very bad certificate for forestry. There are of course many reasons for the failures. Undoubtedly p l a n t q u a l i t y , s e e d o r i g i n a n d c h o i c e o f t r e e s p e c i e s are among the decisive ones. Further on the human being and unpredictable natural accurrences participate in failures. The afforestation success is no more only a t e c h n i c a l p r o b l e m, however there are known about 300 ways of planting-techniques.

For a very long time raising and handling of plant-material and seed origin were in the second plan.

In the past the criteria for characterization of plant material was improved very slowly - up to this day criteria are still uncompleted. The same we can say for the legislation of plant material:

- the legislation of forest reproductive material is too flabby, not exact enough. The control is not present enough.
- the criteria of plant quality are not represented as a whole. Above all some morphological characteristics are emphasized.
- planting stock for extreme sites, for example high altitudes etc. is not considered.
- uniform standards at an international level, for characterization of forest plants should be worked out in order to facilitate the international market.

We are discussing the q u a l i t y and a s s o r t - m e n t o f f o r e s t p l a n t s! The development of forest plants depends on inheritance an environment. In the nursery the surrounding of plants is artificially performed at a high level.

A complete estimation of plant quality has to consider the following parameters and there interactions:

Quality of Plants

ORIGIN OF SEED:
- growth energy
- shape of growth
- resistance
- root shape and developement
- branchlessness
- branch angle etc.

MORPHOLOGY:
- height
- stoutness
- root-collar diameter
- root performance etc.

PHYSIOLOGY:
- plant nutrition
- plant freshness
- functioning of Mycorrhiza
- stress tolerance etc.

ASSESMENT IN THE PAST:	AND TODAY:
1. morphology	1. ORIGIN OF SEED
2. physiology	2. physiology
3. ORIGIN OF SEED	3. morfology

PROVENANCE OF PLANTS

Already at the beginning of this century Engler, as the result of his provenance trials declares: for the afforestations seed from indigenous (spontaneous) or perfectly adapted tree species have to be used from the region for which they will be used. This very important statement can be widened. By establishing a densely net of provenances a better provenance then the original one in the biological and economical sence can be found and used. This kind of searching a better site-race can be recommended especially for those areas, from which indigenous races already completely disappeared or they were forced out and displaced by uncontrolled unknown provenances.

So the provenance is the trade mark of the planting material

Quite a number of morphological and physiological characteristics are determined by provenance.

Because of unknowingness or even ignorance of seed origin, the forest service "committed" in the past numerous expensive mistakes. The consequences are longlasting, difficult to improve, and can not be hidden.

Examples of unsuitable use of provenances can be found all over Europe. We prefer, of course to expose the neighbors failures:

. at the beginning of this century seed of Pinus silvestris of unknown provenance from Germany was used in domestic pine forests of a good quality in central France. Scotch pine stands from "imported" seed developed bad-formed, short stemed trees with thick branches. The introduces "german" race deteriorated in time the better domestic race.

. a similar example is known from Sweden. In 1912 Wibecke focused attention on huge economic losses, caused by using Pine-seed of German provenance. Scotch pine which has in Germany a longer vegetation period, was in Sweden more exposed to frost damages, heavy snow and pine needlecost fungus, then the domestic swedish forests. In the years after transplanting the "german-pine" grew faster, but soon the pine-trees performed a very bad shape. The "guest-stands" vegetated, many of them died off. The area of those badly developed stands was estimated on round 20.000 ha.

. looking for errors, we can compare the high resistance of subalpine spruce forest against storm damages and snow pressures on one hand, and on the other hand, the great catastrophes in spruce forests on high altitudes, where the large crowned provenance from lowland was used. The high resistance against storm and snow must be paid by a lower grow increment.

Speculations with plants from unsuitable provenances are expensive and natur's revenge mercyless.

The provenance itself is not responsible for the afforestation success. But there exist a close relationship between provenance, growth development, shape of trees and other features. Different provenances from the same tree species will demonstrate their peculiarities in a different way.

PHYSIOLOGICAL PROPERTIES OF FOREST PLANTS

The legislation and regulations of forest plant quality include the physiological properties of planting stock v e r y f l a b b y, by describing them. Consideration and "checking" of physiological properties of forest plants for afforestation are carried out mostly ocularly, examining the average impression.

The customer is usually satisfied with:the prescribed plant-height, a good developed overground-plant-part, green colour of the needles and, a good impression of root-system.

Such kind of ocular evaluation of plant quality can sometimes be satisfying, but it can be costly too. Bad planting success or bad development of plantations in the next period. They are both guilty: the nursery man and the customer (forest service).

Comparison of minimum standards for nursed planting stock in EEC and Slovenia for some tree species

	height cm		root collar diameter mm	
	EEC	Slovenia	EEC	Slovenia
Picea abies	15-25 25-40 40-55 55-65 65-80		4 5 6 7 9	4 6 8 9 11
Abies alba	10-15 15-25 25-35 35-45 45-60		4 5 5 6 8	4 5 5 7 9
Larix sp.	15-25 25-40 40-55 55-65 65-80 80	 20-35 35-50 50-65 65-80 80-90	4 5 6 7 8 10	 5 7 10 12 13

In the internal regulations for forest plants in Slovenia there is a number of plant criteria "prescribed" in a telegraphic style, such as:
- the plants have to be healthy and undamaged
- they must have a normal developed and lignified shoot
- the terminal bud shall be well developed and ripe
- and a regular root system is desirable.

T h i s k i n d o f r e g u l a t i o n i s i n- s u f f i c i e n t! Description of individual parameters must be more exact although we do not have yet adequate remedies and methods to measure the properties of the plants.

For example due to shoot length, the plants belong to the first class, but the two-stored-root-system which is developed in only one direction, without micorrhyza,and a weak root-coolar diameter is definitely wrong decision.

ASSORTMENT OF PLANTS

In the nurseries in general, the assortment of forest plants due to forest tree species and way of raising is poor.

I have in mind above all the cultivation of plants for demanding and extreme sites:

- for mountain-regions, for dry and poor sites, for afforestations on eroded areas, s m a l l e r p l a n t s w i t h b e t t e r d e v e l o p e d r o o t s are more suitable. Young trees have to grow throught a bigger soil-space, to get enough water and nutrition. Such plants can be achieved by using additional fertiliser with components, which accelerate the root-growth, not the shoot lenght (P and K fertilizers).
- especially neglected in the past were spruce p l a n t s f o r h i g h a l t i t u d e s. This plants grow slower than the plants from lowland. According to legal regulation of the past, the plants for high mountain region provenances were placed into the lowest "pay class". Sometimes in the nurseries smaller plants were eliminated for the same reason. And yet, especially from those plants we expect the best resistance against the heavy snow and frost damages.
- on fresh sites with severe weed competition the planting will be more successfull with t a l l a n d s t u r d y p l a n t s, though the selection of tall plants from the genetic point of view is not faultless.
- a special care should be given to the standards of plants for extreme sites, where the nutrition supply is insufficient. Here a presence of micorrhyza can help. Micorrhyza can be inoculated into the root or on the area, where the plantation will take place.
- for the sites with deep ground water, or where the soil layer is waterlogged, plants with deeper developed roots will grow better.

It is to consider:

Deep planting is not a substitution for shallow developed roots.

Further the offer of plants from different tree species in general hasn't been satisfying so for. The valuable broad-leaved trees are natural allies of many forests in Slovenia from lowland to high altitudes.They are not represented enought in the nurseries. Besides the mentioned tree species and also Quercus robur, Quercus pedunculata, Alnus glutinosa and Fagus silvatica have in slovenian forests its optimum and maximum. The same situation may exist in the neighbouring countries too.

Special attention should be payed to the nursing of those allochtonous tree species, which already were examined in our woods. Foreign tree species also have to be regulated. They musn't pass the borders without control.

And finally there is a number of secondary tree species and pioneer species. In the legislation, the majority of these tree species are not considered.

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PROBLEMS WITH FOREST REPRODUCTIVE MATERIAL AND THE NEED FOR LEGAL REGULATIONS IN TROPICAL (DEVELOPING) COUNTRIES

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Abstract

Efforts to increase tree planting in tropical countries raised the demand for forest reproductive material. Plantations of widely distributed exotic tree species frequently lack genetic diversity jeopardizing stability, yield and sustainability. Indigenous species were widely displaced and consequently adequate knowledge could not be created. The procurement of forest reproductive material is frequently done without the necessary expertise which results in detrimental developments in forestry and agroforestry. The reasons for this situation are the eco-political and socio-economical pressure on tropical countries to present quick results, the non-existence of legal regulations for forest reproductive material and the lack of expertise and authority in this field.

The sustainability and success of forestry and agroforestry depend on site-appropriate, high quality material. Its procurement and provision must be ensured by legal regulations and expert control.

Kenya tries to improve the situation by the establishment of a national tree seed centre, by drafting legal regulations on forest reproductive material and by adopting the relevant international rules (OECD, ISTA).

An information campaign for tropical developing countries on forest reproductive material is recommended.

Zusammenfassung

Die Versorgung tropischer Entwicklungsländer mit forstlichem Vermehrungsgut weist hinsichtlich genetischer Vielfalt und Qualität schwere Mängel auf. Als Gründe werden das Fehlen von gesetzlichen Regelungen und von qualifizierten Institutionen (Saatgutzentren) sowie der große politische Druck zur Erreichung schneller, vorzeigbarer Ergebnisse erläutert. Am Beispiel Kenias werden Lösungsmöglichkeiten dargestellt, die den Aufbau eines nationalen Saatgutzentrums, den Beitritt zur OECD sowie die Schaffung eines forstlichen Saatgutgesetzes beinhalten. Die Empfehlung einer Informationskampagne für tropische Entwicklungsländer wird ausgesprochen.

INTRODUCTION

Forestry in tropical developing countries is determined by the exploitation of their natural forests on the one hand and by efforts to compensate this loss through industrial plantations on the other hand. In order to remedy only the fuelwood shortage of 925 million m^3 forecast for the turn of the millenium, it is necessary to plant 200 - 350 billion trees.

At present, approx. 5,5 million hectares of forest tree species are planted annually in the tropics including trees in agroforestry systems and shelterbelts, for fuelwood, soil protection, erosion control, habitat improvement and for ornamental and cultural purposes.

The notable increase of plantations in the past years is characterized by the use of exotic tree species. Pines and eucalypts originating mainly from Central America and Australia respectively are widely being planted throughout the tropics. Azadirachta indica, Calliandra calothyrsus, Cassia siamea, Casuarina equisetifolia, Cupressus lusitanica, Gmelina arborea, Grevillea robusta, Leucaena species, Paulownia tomentosa, Prosopis species and Tectona grandis are only a few other examples for species of which fast growth, high yields and/or multiple uses are expected in many countries other than their natural distribution area.

In most cases the exotic species started their triumphant advance at the end of the last century, but in more recent times the development and propagation of agroforestry systems brought a second wave.

A negative side-effect of the frequent, unquestionable success of exotics is that the indegenous species are neglected and displaced.

Furthermore, failures, sometimes on a catastrophical scale, occur:

- Pinus radiata was nearly completely wiped out in Eastern Africa by the needle blight Dothistroma pini.
- Cupressus lusitanica is currently threatened in Central and Eastern Africa by the aphid Cinara cupressi.
- Gmelina arborea failed to be the expected resource species for the Jari paper mills in the Brazilian Amazon forest.
- Some Acacia, Leucaena and Prosopis species ran out of control and turned into weed.

This list could be continued.

CURRENT SITUATION AS REGARDS THE PROVISION WITH FOREST REPRODUCTIVE MATERIAL IN TROPICAL DEVELOPING COUNTRIES

The a.m. figures for plants necessary to meet the demand on forest products in tropical countries highlight the importance of the provision with forest reproductive material.

E x o t i c T r e e S p e c i e s

In tropical countries, many of the vast man-made forests of exotic species were started from a handfull of seeds of unknown provenance. It is not wrong to assume a very narrow genetic diversity.
Cupressus lusitanica in East Africa, which forms the majority of the industrial plantations (in Kenya 45% = 70.000 ha), derives from only 13 originally introduced trees.
Since their introduction, selection programmes were carried out and plus tree orchards were established, most probably further narrowing down the genetic diversity. The seedlot of Hevea brasiliensis which was smuggled from Brazil to Asia in a stuffed crocodile is surely another example of insufficient diversity to be found in industrial plantations. For Grevillea robusta it has been proven by the Australian Tree Seed Centre that the genetic basis of the East African populations is narrow. This probably applies to pines and eucalypts as well.

Collecting seeds from such populations bears a certain risk, furthermore, they are hardly suitable as original material for a vegetative propagation and are unsuitable for further selection and breeding programmes.

The need for tree planting puts pressure on foresters, agroforesters and communities. Uncontrolled importation of reproductive material, mainly seeds, of doubtful origin and quality or procurement from the nearest available source determine the situation. Even donor-supported projects succumb to the seemingly quick success of "miracle species" using seeds of exotics without prior species and provenance trials, sometimes not even knowing the source.
Many actors play in the field of seed provision, using so-called seed orchards - which frequently consist of less than 100 trees originally collected from a few if not one outstanding tree - as a basis for distribution and trade.
Basic principles of seed collection, seed provision and establishment of seed production areas are hardly being observed.

Indigenous Tree Species

In many tropical countries the indigenous tree species are neglected in plantations or regeneration. This refers mainly to the timber species of the natural rain or other high-potential forests where adequate management methods have not been developed or are not being applied due to general problems in the forestry sectors.

Hence, appropriate methods for seed handling, processing and storage have not been developed.

Only recently, in view of the worldwide attention for the problems of the tropical forests, efforts have been started in the fields of protection, maintenance and reproduction.

Despite the lack of information on the indigenous species and due to the public pressure to achieve presentable results, activities in seed collection and distribution have been started. The result is a arbitrary seed collection, which is due to the non-availability of biological and physiological information. Moreover, seeds are frequently collected from the nearest available source but distributed beyond the locality with complete disregard for ecological conditions. Furthermore, inadequate processing, handling and storage information cause failures and revive the interest in exotic tree species.

Vegetatively Propagated Material

The enthusiasm for vegetative, especially biotechnological propagation methods, seized tropical developing countries as well.
Young, well-trained ambitious scientists recognized the chance to overcome shortages in the conventional seed provision and to increase the yields of tree products by selecting high-yield clones.
Many developing countries have established the respective laboratories, mostly with the support of industrial donor countries.
Research is done mainly on species in high demand. The possibilities of using this method for genetic conservation has not yet been sufficiently explored. Due to time pressure and the high costs for the development of the propagation method, the temptation to rely on a limited number of high-yield clones is high.

REASONS FOR THE CURRENT SITUATION

Due to the eco-political and socio-economical pressure on most of the tropical (developing) countries, attempts are made to show practical results in forestry and agroforestry as quickly as possible. Furthermore, the non-existence of legal regulations leads to the described uncontrolled situation in procurement, provision, use of and trade in forest reproductive material.

The disregard for

- genetic identity and diversity,
- physiological quality,
- pest and disease risks and
- necessary considerations in international trade

in forest reproductive material is also due to the fact that for decades tropical forestry has concentrated on exotic tree species which has created backlogs in the research on indigenous species and consequently gaps in the knowledge of scientists and foresters.
Moreover, many foresters and administrators do not comprehend the necessity of legal regulations, following the motto "Geruhsam lebt die Forstpartie, die Bäume wachsen ohne sie" (Peaceful live the foresters, the trees keep on growing anyhow).
Finally and as a result of the above, most of the tropical countries have not established authorities staffed with experts and vested with powers for control and legal action.

NEEDS AND POSSIBLE SOLUTIONS

The procurement of and provision with forest reproductive material is the first and decisive step on the way to stability and yield of forests and agroforestry systems. Moreover, they determine the impact on the environment.

The ecological and economic success and the sustainability depend on site-appropriate, high quality forest reproductive material, adequate handling techniques and only later on the appropriate management.

The procurement of <u>site appropriate</u> material on a national level depends on a system of provenances, seed or ecological zone delineation and on a responsible distribution. It is based on the profound understanding of eco-genetic processes within tree plantations.

On the international level, i.e. as regards exotic species, it depends largely on comprehensive species and provenance screening or at least on species and provenance matching carried out in a responsible and expert manner.

The procurement of high quality forest reproductive material, which includes healthiness, viability and a wide genetic diversity, starts with the selection of seed sources followed by the consideration of collection criteria. It is followed by the application of appropriate handling, processing and storage methods.
Finally, the physiological quality is approved by various tests.

The national and international trade requires regulations and control mechanisms to ensure site-appropriation and quality. To conduct and control the provision of forest reproductive material in the sense of this paper, legal regulations and a designated authority are necessary.

Kenya may serve as an example to show ways for improving the described detrimental and dangerous situation of forestry and agroforestry.

a) The establishment of a national tree seed centre creates and concentrates expertise and authority. The Seed Centre fulfills a number of important functions:

   - The development of a seed zoning system ensures the provision with site-appropriate forest reproductive material.

   - The selection and establishment of seed sources according to the OECD-scheme together with seed collection criteria, appropriate handling, processing and storage ensures genetic diversity and quality.

   - Testing according to ISTA rules ensures physiological quality.

   - Training of forestry and agroforestry personnel and the involvement in developing curricula of Forestry College and University as well as in education ensures the transformation of the knowledge into practice.

   - Research on indigenous species and publication of the findings contribute to increased use and conservation.

b) Kenya is a member of the OECD, which ensures that other countries are provided with certified reproductive material.

c) In recognition of its expertise, the Seed Centre has been entrusted by the Kenyan Government with drafting legal regulations for forest reproductive material aiming at controlling trade and use and at basing them on principles of a site-oriented diversified forestry.

It is of outstanding importance that legal regulations and their control do not collide with the efforts and goodwill of a tropical developing country to increase tree planting. On the other hand, necessary criteria should not be watered down.
Thus, the enforcement of legal regulations for forest reproductive material has to go along with adequate information and education.

RECOMMENDATIONS

An information and educational campaign on the importance of legal regulations for the development of the forestry sectors of tropical developing countries should be intensified. This includes donor agencies and projects. FAO, IUFRO and OECD could be possible implementors.
Relevant workshops should be held in Africa, Asia and South America.
Tropical developing countries should be supported and encouraged to establish national or regional tree seed centres for ensuring provision of forest reproductive material in sufficient quantities at high qualities.

POLISH STANDARD FOR PLANT MATERIAL PLANTED OUTSIDE THE FOREST

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Résumé.

Le rapport contient information sur le standard polonais sur le matériel végétatif de régénération des arbres et arbustes, qui est procédé spécialement pour les buts de plantations d'alignement.

L'auteur explique pourquoi, malgré existence des standards sur le matériel de régénération destiné pour les cultures silvicoles et plantations, ainsi que sur des arbres et arbustes ornamentaux, il est nécessaire un fonctionnement d'un standard séparé sur le matériel de régénération pour plantation des arbres au-déhors de la forêt.

Les différences dans les exigences des standards individuels sont illustrés par les fragments de ces standards inclus au rapport.

Summary

The paper contains an information upon Polish standard for woody plant material produced in nurseries especially for planting outside the forest. Author gives an explanation , why a separate standard for plant material planted outside the forest is necessery in spite of the existence of a standard for ornamental plant material and for plant material for forest plantations and intensive plantation-Especially poor condition of existence of young trees and shrubs and their quite different functions in natural and human environmant in comparison with forest and ornamental plants can explain this necessity.

The differences in requirements imposed by particular standards are ilustrated here by fragments of those standards cited.The differences concern both parameters and attributes of plant material.

The paper mentions also the present research of Seed Science and Selection Section of the Forest Research Institute in Warsaw concerning the subject discused here.

In Poland we distinguish three types of tree and shrub plant material depending on their destination:
1. plants for forest plantations and intensive plantations - aimed to forest plantations , afforestations, introduction of undergrowth, and intensive plantation,
2. ornamental plants - aimed to plant them in urban green,
3. plants for planting outside the forest - aimed for planting in the open landscape.

Requirements determined by the standards for each of the three types mentioned are different because of different aims to achieve and of growth conditions after planting in their destination places.

For the same reason the lists of species for each of the standards mentioned above are different too. A list of trees and shrubs for forest plantations and intensive plantation contains 95 species and botanical varieties, for ornamental plants- 561, and for planting outside the forest- 110.

A specifically Polish kind of plant material is that for planting outside the forest. These plants grow in open landscape , outside the forest and cities.Their main function is an ecological stability in landscape (Zajączkowski 1982).

There is neither care nor cultivation (pruning, weed control, crown forming, soil cultivation and so on) in the open landscape , contrary to urban areas. That is why tree and shrub plant material for planting outside the forest should be stronger and more viable then that for urban areas.Here the ornamental atributes, like the number of shoots in tree crowns, are not so important . It is commonly acknowledged that trees and shrubs for plant material planted outside the forest ought to have a natural crown. Therefore in the course of nursery production a stem reduction in the aim of obtaining multishooted crown is never used.The shortening of the stem gives an excessive bigger growing of lower branches. The result of that is troublesome of wound hoaling after pruning those branches later.

In Poland the plant material for planting outside the forest is used in the open landscape in form of single row of trees and shrubs or in wide spacing. That is why it is more exposed to total damage by weeds, cattle, game animals and even people , than the plants for forest plantation that are introduced in greater number and in a conspicuous closeness. The resistance to threats mentioned above increases with increasing the size of plants. Therefore we generally use plant material for planting outside the forest bigger than that for forest plantations.

The first standard in Poland for plant material for planting outside the forest , for all the species used in the open landscape was issued in 1967. The standard valid up-today , elaborated in 1976 is BN-76/9212-02;"Plant Material. Planting stock of Trees and Shrubs for Forest Plantation, Intensive Plantation and Planting Outside the Fo-

The particular requirements are presented in tables. Examples of these are given here for Norway spruce- Picea excelsa Link. (Tab. 1),Small-leaved lime- Tilia cordata Mill. (Tab. 2) and Dwarf elder - Sambucus nigra L. (Tab.3). It is possible to find each of the species in all the stan-Trees and Shrubs".

The standard for plant material for planting outside the forest refers to plants storage, packing, transport and examination of them. This is standing from January 1 , 1977.

All plant material in the standards is divided into several forms. The coniferous ones are divided into three forms:

M- juvenile plants, N- natural plants, K- shrubby plants.

The deciduous plant material is divided into four forms:

M- juvenile plants, N- natural' plants , P- standard plants, K- shrubby plants.

The forms of plant material are defined as below.

Juvenile plants (M)- tree plant material for planting outside the forest showing the growth corresponding with morfological properties of the species.

Natural plants (N) - plants higher than juvenile ones , in coniferous species - with unpruned stem and in deciduous species -pruned up to the height of 30-100 cm.

Standard plants (P) - deciduous tree plants for planting outside the forest, with 180-220 cm high stem, with distinct not shortened stem, and natural crown.

Shrubby plants (K) - plant material typical for shrubs or tree forms prepared in the nursery in the way of stem reduction for multiplication of shoots.

Each of the forms mentioned above (beside standard plants) of plant material embraces two classes of quality. The main part of the standard contains the chapter entitled "Requirements", including both general and particular requirements,as described below.

All plants should meet a general requirements as follows:

- the terminal bud of the plant stem should be healthy and well-formed, a stem reduction being admissible for deciduous shrubby plants (dimension of the height is shown in particular requirements),
- injuries, bark necroses, as well as wilt and bark wrinkle, are not allowed,
- the stem of plants above 0,5 m ought to be practically straight (a curvature may be maximum 3 cm per 1 m of stem height),
- forked plants or plants with many shoots are not admissible in juvenile, natural and standard plants of trees,
- in shrubby plants the shoots may not be older than three years,
- the shoots of coniferous trees may not be pruned, and in deciduous trees a half of shoots in the crown may be pruned at any length,

- the root system should be dense , the principal roots may be smoothly pruned at a distance determined in the standard,
- in plants of coniferous trees and shrubs the root ball should be protected against crumbling.

The particular requirements are presented in tables. Examples of these are given here for Norway spruce- Picea excelsa Link. (Tab. 1),Small-leaved lime- Tilia cordata Mill. (Tab. 2) and Dwarf elder - Sambucus nigra L. (Tab.3). It is possible to find each of the species in all the standards mentioned in this paper.It enables comparison of requirements for the same species from different standards.

At a customer request a certificate of origin is drown up for each portion of plant material prepared to dispatch. Each of 100 plants should have a label tied to one of them. There are written information about kind, species,botanical varieties (cultivars), form and class of quality on the label.The standard for plant material for planting outside the forest determines the rules of plant storage, describes a manner of pitting, dimensions of pits and the manner of packing and transporting of plants.

All requirements shown in standard BN-76/9212-02 are results of scientific investigation on a small part only. That is why after 1976 The Section of Seed Science and Selection of Forest Research Institute in Warsaw has conducted research on vitality and growth after plant transplantation in the open landscape. The plant material used in investigation is differentiated in age, dimensions, way of pruning and root system forming included to examination.

The results of this work prove that it is necessary to change many of the requirements in the present standard. The necessity of age limitation of plant material seems to be especially important (Zajączkowski 1986).Since 1987 investigations on possibility to shorten the time needed for plant production has been carrying out. Among the others the overgrown seedlings for forest plantation are tested as initial plant material for production of plant material planted outside the forest.

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Table 1. Norway spruce (Picea abies (L.) Kerst.)

Standard	Destination of plants	Production symbol or form symbol of plant	Quality class	Size class	Height of over-ground portion minimum or interval cm	Diameter at root collar minimum mm	Diameter of root ball minimum cm	Root length minimu cm	Number of whorls minimum assortment I	Number of whorls minimum assortment II	Number of transplantation	Other requirements
BN-76/ 9112-02	for forest plantation and intensive plantation	1/0	I	-	6	-	-	8	-	-	-	
			II		3			6				
		2/0	I		12	3		10				
			II		8	2		7				
		3/0	I		25	4		20				
			II		15	3		15				1 undercuting of roots after the second year
		1/1	I		12	3		10				
			II		8	2		7				
		2/1, 1/2 1,5/1,5	I		25	4		20				
			II		15	3		15				
		1/3 2/2	I		30	5		25				
			II		20	4		20				
	for planting outside the forest	M	I		31-50	5		20			1	
			II		21-30	4		20				
		N	I		81	not determined	20	not determined			1	
			II		61-80							
BN-73/ 9125-03	coniferous ornamental trees and shrubs			1	60-80		25		5	4	2	
				2	81-100		25		5	4	3	
				3	101-125		25		7	5	3	
				4	126-150		30		8	7	4	

Table 2. Small-leaved lime (Tilia cordata Mill.)

Standard	Destination of plants	Production symbo or form symbo	Quality class	Assortment	Size class	Height of over-ground portion minimum or interval cm	Height of stem part without branches cm	Diameter at 1 m height above ground mm	Number of shoots minimum	Root length minimum cm	Number of roots minimum	Number of transplantation	Other requirements
BN-76/ 9112-02	for forest plantation and intensiv plantation	1/0	I			15	-	-	-	15			
			II			8				10			
		2/0	I			25				20			
		1/1	II			15				15			
		2/1	I			40				25			
		1/2	II			20				20			
	for planting outside the forest	M	I			71				25		1	
			II			51-70				20			
		N	I			161	60-70	15	10	25		1	
			II			121-160	30-40	-	6	20			
		P	-			260	200-220	22	5	25		2	
BN-73/ 9125-02	deciduous ornamental trees and shrubs	N	-	I	1	80-100	-	-	8	15	4	2	admissible is curvature 5 cm on 1 m height of stem and irregular arrangement of branches along stem
		N		I	2	101-125	-	-	12	20	5		
		N		II	1	80-100	-	-	6	12	3	2	
		N		II	2	101-125	-	-	10	15	4		
		P		I	1	-	180	25	5	25	5		
		P		II	1	-	180	25	4	10	5		

Table 3. Dwarf elder (Sambucus nigra L.)

Standard	Destination of plants	Production symbol or form symbol	Quality class	Assortment	Size class	Height of over-ground portion minimum or interval cm	Number of shoots minimum	Age of shoots maximum	Number of roots minimum	Root length minimum cm	Other requirements
BN-76/ 9112-02	for forest plantation and intensive plantation	1/0	I			25				20	
			II			10				15	
		2/0	I			40				20	
			II			25				20	
	for planting outside the forest	K	I			81	5			20	plant from seed or from woody cutting 1 transplantation if from seed
			II			61-80	3			15	
BN-73/ 9125-02	Deciduous ornamental trees and shrubs	K		I	1	80-100	5	1	4	15	
					2	101-125	5	1	4	15	
				II	1	80-100	3	1	3	10	
					2	101-125	3	1	3	10	

SELECTED FORESTRY REPRODUCTIVE MATERIALS IN FRANCE : CRITICAL ANALYSIS AND RESULTS

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SUMMARY

The classification of seed stands (selected category) is done according to genetic criteria (purity and variability), phenotypical ones (stand homogeneity and individual characters of form) and practical criteria concerning fructification and collection.

The regions of provenance are defined according to an original concept which is special to France : a region is made of a group of stands (associative conception) and is not a part of a fixed zone (zonal conception). These unities are defined according to genetic, phenotypical, ecological and/or climatical criteria.

Applied since 1973, selection has conveyed the classification of 73 000 ha of stands (21 species) from which nearly all the seeds used have been collected ; the use of materials is not regulated : France prefers to offer advice concerning these uses, according to the forested area.

RESUME

Le classement des peuplements porte-graines (catégorie sélectionnée) sont effectués en fonction de critères génétiques (pureté et variabilité), phénotypiques (homogénéité du peuplement et caractères individuels de forme) et des critères pratiques de fructification et de récolte.

Les régions de provenance sont définies suivant un concept original et propre à la France : une région est constituée d'un ensemble de peuplements (conception associative) et non d'une portion de territoire fixe (conception partitionniste). Ces unités sont définies selon des critères génétiques, phénotypiques, écologiques et/ou climatiques.

En vigueur depuis 1973, la sélection a entrainé le classement de 73000 ha de peuplements (21 essences) dont la presque totalité des graines utilisées sont issues ; mais l'utilisation des matériels n'est pas réglementée : seuls des conseils sont apportés au forestier en fonction de la région du boisement.

1 - CLASSIFICATION CRITERIA

From the very beginning, classification criteria have been defined in a very large way for the needs of the forest managers who suggest stands that are to be classified.

These criteria, however, have rarely been analysed and organized into a hierarchy in a precise way. The only studies deal with Pedunculate Oak and Sessile Oak (R. Fernandez, 1990) and Red Oak (R. Fernandez and G. Steinmetz, to be published soon).

Thanks to the experience obtained after having visited more than 110 000 hectares of stands (among the 15 million ha of the French forest) it now seems possible to begin an exhaustive analysis.

CRITERIA

It is possible to form three groups without nevertheless organizing them into a hierarchy but simply by presenting them in a logical order :

- genotypical criteria ;
- phenotypical criteria ;
- fructification and collection criteria.

The genetic criteria deal with - besides the indigenous character of the stand - the purity and the genetic variability which are the very corner stone of the selection. Obviously it is necessary to have stands deprived of any species that can be hybridized (Larches, European Firs...) or can be mixed up (especially native Oaks) either within or next to the stand.

But one must also pay attention to :

- the absence of bad quality stands close to selected ones ;
- the genetic variability due to the importance of the stand (area and number of seed bearing trees). As a general rule the number of seed bearing trees must not be inferior to 30 except the Wild Cherry (for which one can accept to go down to between 15 to 20) ; that threshold is in fact largely surpassed by important species such as beech or Silver Fir (at least 100 seed-bearing trees) ;
- the pollination conditions (panmixy and limitation of autofecondation) hence the elimination of tree rows and strip stands. One must nevertheless underline the fact that this aspect is not taken into account in all the EC countries.

For the indigenous species, the search for natural stands is a priority : any stand liable to have been introduced in France is usually eliminated except if the region of provenance is not indigenous. This, nevertheless, creates a problem for some species amongst which the Sessile Oak is to be found since it has often been introduced in the huge forests of Centre France.

Nowadays, only indigenous Oak stands (Pedunculate and Sessile) create real problems due to the frequency of the mixture stem-by-stem. At present, it has been at present decided better to consider the Common Ash is not to be submitted to E.C. rules and that because of hybridation risks.

As far as the genetic aspects are concerned, they - on the contrary - do not bring any difficulties to the fore for the other species since the occupied areas are important enough to leave wide choice possibilities. The problem can nevertheless arise when the classification is extended to species which are less represented as the Nordmann's and Bornmüller's Firs.

The selection of the seed stands rests essentially on phenotypical criteria. Here we are faced with a selection of populations and not that of individuals - which brings a great importance to homogeneity. The phenotypical selection is based on a somewhat subjective judgment since it's roughly impossible to measure objectively each of the criteria : thus this task is always undertaken by a single person for all species and throughout the national territory.

As a consequence this warrants a certain homogeneity in the estimation of the chosen stands.

The main phenotypical criteria are :

■ as far as the stand is concerned : homogeneity which is vital ; the variability of the individual characters must be weak ;

■ as far as the trees are concerned :

- form : stem (straightness, torse fibred), branching (forking, especially repetitive forking, size and insertion angle of the branches, natural pruning, branching pattern on the stem) ;

- growth and wood quality difficult to estimate thus badly taken into account and phytosanitary conditions usually deprived of any problems.

The fructification and collection criteria are essentialy practical ones. They allow the elimination of any stand - even one corresponding to the assessments mentioned above - which may not be able to produce a great amount of seeds easy to collect (fructification difficulties due to old age, to stem density or to a microclimate, to access and collection problems).

LEVEL OF SELECTION

The estimation of each criterion and the level of selection depends, of course, on four factors :

■ the species : each criterion is estimated according to the proper qualities of the species concerned : hence the straightness of the stem will be judged more severely as far as the Douglas Fir (and coniferous trees in general) is concerned than the Beech. Moreover the selection will be all the more stringent than the widespread distribution of the species : hence the requirements are more important for the Sessile Oak (1,6 million ha) than for the Red Oak (a few thousand ha) ;

■ the region of provenance : the selection level reflects the average value of the stands belonging to the zone ;

■ station conditions : one of the risks due to phenotypical selection is to pay only attention to stands situated in favourable conditions (outstanding dimensions) and to eliminate those growing in more difficult conditions which have a less interesting form. The dimensions (height and diameter) are only indicative and the form is appreciated according to the station.

Thus the Douglas Fir growing at high altitude (region 07 - Massif Central highlands) has a form which is less satisfying, than those of the Beaujolais which grow at a lower altitude (region 04 - Eastern Massif Central) ;

■ the treatment applied to the stand implies a very different form, more satisfying in even-aged stand than in uneven-aged stand and also mainly in coppice with high standards ; in that last case one accepts stands of lower value as far as the branching and the pruning system are concerned.

2 - REGIONS OF PROVENANCE

France has since the beginning adopted an original conception although it is perfectly in accordance with the definition adopted by the OECD and the EC and which is adapted to the ecological diversity of the country. It is an associative conception opposed to the zonal conception, adopted in most European countries (*i.e.* territory division into fixed areas). A region of provenance is defined as the sum of selected stands which are considered close enough from one another on a morphological and ecological basis so as to be grouped in a common unity.

Hence we only have regions of provenance for stands which are officially selected whereas most of the French territory is considered beyond region of provenance.

Within this associative conception, a region of provenance is thus not stable :

▪ in time : it can be created or suppressed if all the stands belonging to a marginal region are to be suppressed ;

▪ in space : it varies according to the stands which composed it throughout classification and suppressions. It can only be materialized on a map by a cloud of dots representing the stands.

Contrary to this, a region of provenance belonging to a zonal conception is very stable since it is a part of territory already defined on which stands are inserted or not.

Our notion of region of provenance is completely justified for the indigenous stands but more questionable as far as introduced stands are concerned, mainly for those of a first generation which have certainly undergone a weak selection pressure. Hence for the latter the regions of provenance are wider and less numerous (for instance 4 for the Austrian Pine which was introduced, versus 19 for the Norway Spruce indigenous species).

This conception is satisfying thanks to its adaptation to the ecologial diversity and to the various species existing in France.

It however leads one to define a certain number of regions of provenance (158 all species together). As a result it is somewhat complicated to deal with them as well as it is an impediment to collect stands with yellow labels (OECD category, material considered as having reduced requirements) since outside a selected stand one is necessarily outside a region of provenance.

DEFINITION METHODS

The definition of regions of provenance is thus proprer to each species. It can be achieved according to several criteria :

▪ **Genotype** : this case - the most favourable - one only exists for the Maritime Pine for which biochemical studies from terpenes (P. Baradat et A. Marpeau, 1988) have allowed one to identify geographical races. Thus two regions of provenance with indigenous species have been defined (01 - Corsican highlands and 02 - Landes and surroundings) as well as a region without any indigenous stands (03 - Central and west), whose materials, born from region 02, justify it by a selection pressure for the cold. After a ground selection, the stand approval depends on a terpene analysis which confirms it belongs to the suitable race.

▪ **Phenotype** : some ecotypes, based on a different phenotype were able to be differenciated, essentially some coniferous trees in mountainous regions where the relief has conveyed the individualization of small homogeneous populations especially the Scots Pine in the Vosges (04 - Wangenbourg, 05 - Saint-Dié) and in the Massif central (06 - Saint-Bonnet-le-Château).

▪ **Ecological factors** : as far as the Wild Cherry is concerned iso enzymatical studies led on a group of clones collected throughout France have not enable to put to the fore the geographical variability (F. Santi, 1988).

On the other hand, the performances in clonal tests reveal a strong interaction between the strength of some ecological factors like the pH and the texture without any doubt. The regions of provenance are thus exclusively defined according to the pH (01 - France - calcareous and 02 - France - acid).

In a lesser measure, the acidity factor of the soil was taken into account to differentiate the regions of provenance of the Beech in the North-East of the country (04 - North-East - calcareous and 05 - North-East - acid) because we have good reasons to believe that this species is very sensitive to that factor.

▪ **But in most cases, no precise knowledge** has enabled us to define objective unities.

Thus the demarcations come from geographical unities (at climatical or geological levels) which are the finest in order to define at best the supposed variability of the species mentioned, although having only a reduced number of regions suitable to a good implementation of the reglementation. In practice, one never goes beyond 25 regions for a given species (the extreme case being the Silver Fir with 23 regions).

The creation of a region or its removal is sometimes guided by practical considerations (such as the importance of the material use deriving from it).

For instance for the Sessile Oak, 15 regions have been individualized : they correspond to "intuitive unities" at somewhat subtile ecological and morphological levels (for instance 05 - Southern central and 06 - Allier). It has however seemed desirable to go the farthest possible into this individualization so as not to take the risk of avoiding some possible variations.

▪ Besides, in the particular case of **some untested seed orchards**, regions of provenance have been created, each of them composed of only one orchard of mono provenance basic materials for the Douglas Fir (08 - Darrington - seed orchard and for the Norway Spruce (20 - Rachovo - seed orchard) according to paragraph B of annex 1 in the directive 66/404/CEE.

VALIDITY

The validity of the regions thus defined (distinction and homogeneity) has not been checked until now. It would nevertheless be difficult to consider for the following reasons :

▪ there are not enough scientific bases to justify the choice of the regions (the study of the enzymatical variability is only beginning) ;

▪ the financial means are not important enough and it would take too long to achieve such studies ;

■ there is a fluctuation in time as far as the regions are concerned.

Two different points of view allow an external analysis of the existing regions : **the daily use** by both professionals and users enable a first approach and **the evolution of the studies of enzymatical variability** permits an estimation which is more objective in some cases.

After almost 20 years of practising such a system, it has not been called into question but some special cases lead or will lead to localised new definitions :

■ for the Norway Spruce and the Silver Fir in the Jura plateaux if some experiments reveal maladjustments (regions which must have been badly defined for the Norway Spruce, only one region, which is too big, for the Fir). Hence a study - which is alas only phenotypical - is being done at the present time to bring a change ;

■ the region 01 - Mediterranean region of the Atlas Cedar seems too vast and heterogenous although it is an introduced species : it seems desirable to put this into question.

Parallel to the usage, research on intraspecific variability mainly led by INRA - especially for the Sessile Oak and the Red Oak - help to question some unities. For the latter species (which is not indigenous) the existence of four regions of provenance is little justified after performing an enzymatical study (J.B. Daubrée, 1990) and the questionning of at least two regions is to be considered.

On the contrary, the first studies of the enzymatical polymorphism of the Sessile Oak (A. Zanetto, 1989) put to the fore big unities but do not invalidate the present divisions of the regions of provenance however it is still too early to draw practical conclusions.

3- USE OF MATERIALS

Both the EC and the national regulation impose some constraints as far as the forestry propagation materials are concerned. However, up to now, there is none to make obligatory the use of such or such a provenance well adapted to the region where it is to be planted.

For this choice we have three possibilities :

■ an absolute liberty left to the user,

■ the obligation to use certain materials according to the region of plantation (and banning the use of certain materials),

■ advice of use - intermediate solution.

The EC reglementation (article 13 in the directive 66/404/CEE) anticipates the free circulation of materials officially admitted by each member but it also considers the exclusion of some materials likely to have an unfavourable influence on the silviculture of a member state (enforcement of the procedure scheduled in article 17). It has never been used before but the elaboration of a common catalogue will certainly convey a limit to the marketing of certain provenances by several EC countries.

One can however ask oneself about the necessity or the legitimacy of such a limitation in the marketing of forestry reproductive materials especially less than two years before the single market.

It seems difficult to justify objectively the ban on the importation of a given region of provenance. The provenance comparative testings are rare and slow in revealing things, thus such a ban can only be laid on similarities or differences as far as the macroclimatic and ecological levels are concerned. As such they can be unconfirmed - an action which has already been attempted by some EC states.

However this limitation of the intra EC marketing - besides its contradictory attitude with that of a single market - offers an important obstacle : that of a control by the designated authority concerning the legitimacy of importations. To the extent that this control can not be done by the customs it will be only done in the "home" of professionals 'seed merchants and nursery men) this stage comes a bit too late to be really efficient, as a consequence, this procedure does not seem to be the most suitable one.

Since 1982, France has been enacting **use recommendations** of the reproductive materials according to the region in which they are used : a national document with a general validity (new edition to be published soon) is being elaborated by the CEMAGREF in accordance with both geneticists and professionals. Besides, a more precise regional document for special cases has also been published. These documents are widely distributed to all the authorities and users concerned they give a greater importance to :

- the materials of local provenance of the highest genetic value, as far as the indigenous species are concerned ;

- for the other species, the materials with the highest genetic value adopted to the conditions of the stations. Thus for the Douglas Fir we recommend - after the French regions of provenances - the American stands which have been chosen by EC missions in 1981,1988 and 1989.

This recommendations solution seems favourable since it is not an obstacle to the principle of free circulation and it is also a valuable guide for the forest manager.

The French position is thus a pragmatical one. It is reduced to pieces of advice as far as use is concerned, however :

- for the EC materials (blue and green labels only), the importation remains free ;

- for the materials from outside the EC (OECD *et altri*) the importation is limited to the recommended materials mentioned before.

4- RESULTS

The selection of the first seed stands started at the beginning of the 1960 and has been put into practice after the implementation of the directive 66/404/CEE thanks to the first list of selected stands in 1973.

Nearly 20 years after the implementation of the EC regulation, France owns about 73 000 ha of selected stands (among which 50 ha are seed orchards) for 21 species submitted to the reglementation (among which 6 are voluntarily submitted).

All these are divided into 158 regions of provenance which are specific to each species : the area per species varies from 1 ha for the Calabrian Pine (one stand) to 13 400 ha for the Silver Fir (120 stands).

This group of selected stands comes from a selection done between more than 110 000 ha of pre-selected stands by the forest managers, hence an average selection rate of 67 % compared to that of the propositions (but this rate can go down to 26 % as far as the Wild Cherry is concerned).

The collection and use of seed has been forming the object of yearly statistics by the CEMAGREF since 1986/1987. The yearly collection varies from 5 to 700 tonnes for the broadleaved trees, 40 tonnes for the coniferous trees (with 25-30 tonnes for the Maritime Pine). These statistics also reveal that the seeds collected and used essentially come from the selected category. This has been time for more than a decade for the coniferous trees, but only for two to three years for the broadleaved trees : actually for a long time period the collection with dispensation (white label) have composed an important part of the supplies for the indigenous Oaks and the Beech.

However, the supply - as far as certain deficit species are concerned - depends for a large part on importing from the EC (Netherlands and West Germany : Red Oak) or from the United States (Douglas Fir) whereas exportations are noticeable (mainly for seedlings) for the Pedunculate and Sessile Oaks and for the Beech, the Spruces and the Douglas Fir.

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CLASSIFICATION OF SELECTED SEED MATERIAL IN FINLAND

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ABSTRACT

The decree controlling the sale of forestation material issued by the Ministry of Agriculture and Forestry defines 10 categories of origin for reproductive material. The forestation material must meet the requirements of one of these categories in order to be fit for sale. The Finnish Forest Research Institute is responsible for maintaining the registers for each category.

From the practical point of view the most important categories are those which apply to young and mature seed orchards. The most important species is Scots pine. Measurements of pollen production are carried out as a routine measure in order to define the proportion of background pollination in a seed orchard. As there is some evidence to suggest that this method does not give a reliable estimate of mating patterns in a seed orchard, the effectivity of the present system needs to be evaluated.

Key words: legislation, forestation material, seed orchards

RESUME: CLASSIFICATION DES MATERIELS SEMENCES FORESTIERES SELECTIONNEES EN FINLANDE

Le décret du Ministère de l'Agriculture et de la Forêt réglementant la commercialisation des matériels forestiers de reproduction définit, d'après l'origine, dix (10) catégories. Pour être admis à la vente, les matériels forestiers de reproduction doivent satisfaire aux exigences d'une de ces dix catégories. L'Institut National de la Recherche Forestière tient les registres relatifs à chaque catégorie.

Les principales catégories, du point de vue pratique, sont les matériels produits dans les vergers à graines jeunes et adultes (parvenus à maturation). L'espèce la plus importante est le Pin sylvestre. Pour définir la proportion des pollinisations exogènes dans les vergers à graines, des mesures de routine de la floraison mâle sont effectuées. Cependant, quelques observations récentes indiquent que cette méthode ne permet pas d'estimer, de manière fiable, cette proportion. Il en resulte que la méthode appliquée aujourd'hui doit être réévaluée.

INTRODUCTION

The sale of forestation material in Finland is controlled at three levels.

The law on the sale of forestation material (Laki metsänviljelyaineiston...) lists the organizations that are responsible for controlling the sale of forestation material. The Ministry of Agriculture and Forestry is responsible for ensuring that this law is observed. It is worth noting that in Finland only the sale, not the production or use of forestation material, is controlled by the authorities.

The decree covering the sale of forestation material (Maa- ja Metsätalousministeriön...) issued by the Ministry of Agriculture and Forestry lists the approximate requirements concerning health, size and origin of plants or seed.

The decree defines ten categories according to the origin and genetical background of the reproductive material. They are as follows:

- A1 tested seed material
- A2 material from untested (mature) seed orchards
- A3 material from young seed orchards

- B1 material from highly selected seed stands
- B2 material from selected seed stands
- B3 material from a known stand
- B4 material from a known region

- C1 tested clonal material
- C2 preliminarily tested clonal material
- C3 selected clonal material

Categories B2 and B1 fall under the category 'Source-Identified Reproductive Material' in the OECD Scheme (OECD Scheme for...). The relationship between category A3 and the OECD-rules is somewhat unclear. Category A2 is about the same as the OECD-category 'Reproductive Material from Untested Seed Orchards', whereas category A1 corresponds to the OECD-category 'Tested Reproductive Material'.

In this report the term 'selected seed material' referes to material from seed orchards as well as from selected seed stands. Material from a known stand or region is of minor importance in Finland.

According to the decree, material falls within a certain category if it is registered by the Forest Research Institute. Hence, the third level of control comprises the directives concerning the categories of origin issued by the Forest Research Institute.

These directives are primarily leaflets prepared for the Institute's own use or merely an established usage. This has made it possible to improve the rules in a flexible fashion. However, this practice has some disadvantages in making the resolutions rather arbitrary. In the future it would be desirable to have more detailed directives published.

SELECTED SEED STANDS

Selected seed stands have principally been selected and registered by the Forest Research Institute in the late 60's. Most of them belong to the category 'selected seed stands' (B2), since the removal of unselected trees in a stand, which is a requirement of the category 'highly selected stands' (B1), would be rather costly measure compared to the benefits to be gained. Selected stands are of most importance in the case of spruce and temporarily in the case of birch. Some figures of seed stands and seed orchards is presented in the appendix.

SCOTS PINE SEED ORCHARDS

General

As far as seed material is concerned, the most important directive is 'Minimum requirements for Seed Orchards of Scots pine in Finland' (Koski 1980), which is published in Finnish with an English summary. About three-quarters of artificial forestation in Finland is done with Scots pine (Pinus sylvestris), and about 90 % of the seed orchards comprise Scots pine. The minimum requirements for an untested (category A2) Scots pine seed orchard include:

1. The seed orchard must be in good physical condition and all documentation must be up to date

2. The range of the plus trees must be limited

3. The number of clones must be at least 30.

4. The ramets of each clone must be distributed so that the probability of self pollination is below 20 %.

5. Pollen production should be at least 20 kg per hectare.

6. The area of the seed orchard sould be at least 5 hectares, and the shortest diameter across the orchard at least 150 meters.

7. The proportion of background pollen in effective pollination should be below 20 %.

The requirements are the same for young seed orchards with the exception that in a young seed orchard there is no limit on the amount of background pollination. There are no precise requirements for the category 'tested seed orchards'. However, they will be needed when the establishment of second generation seed orchards starts.

The most important task in classifying seed material in Finland is to distinguish between categories A2 and A3. In practice this means estimating the proportion of background pollination in an orchard. This is necessary in order to determine the improved value of the material, but is even more urgent in determining the utilization areas for each seed crop.

Of the total of 3000 hectares of Scots pine seed orchards established in Finland, more than two thirds are located out of the region of origin. Such transfers have been done on purpose because seed ripens only during exceptionally warm years in the climatic conditions prevailing in North Finland. As a result of the transfer, the utilization area of the seed is highly dependent on the amount of southern background pollination.

The seed of nothern plus trees growing in young seed orchards in Central Finland can be used in forestation sites located between the seed orchard and the origin of the trees. However, when northern plustrees in a seed orchard cross with each other (mature seed orchard), the seed can be used in the north, where there is an urgent need for seed material.

Estimation of background pollination

The amount of mating inside a seed orchard on the one hand, and between the plustrees and surrounding forests on the other hand, is commonly estimated on the basis of the amount of pollen produced by a seed orchard. In practice this is done by measuring the total length of male inflorescences on sample trees. This can be done either during the short flowering period, when it is easy to count the flowers themselves, or by measuring the gaps that are left when the male flowers are shed. A pollen production level of 20 kg per hectare is set as the threshold value between young and mature seed orchards. This value is derived from observations made on pollination levels in normal Scots pine stands (Sarvas 1962). Owing to the high year-to-year variation in flowering, separate measurements have to be made for each crop. The owner of a seed orchard is responsible for such measurements, and the Forest Research Institute checks the work.

Isoenzymes have been used in studying the mating patterns in seed orchards but not in the practical control of seed orchards and the classification of seed. The latest isoenzyme studies carried out by the Foundation for Forest Tree Breeding in Finland indicate that pollen production is not an accurate enough measure of the mating probabilities (Pakkanen et al 1991). Furthermore, the preliminary results suggest that there is no positive correlation between the amount of pollen production in a seed orchard and the proportion of male gametes of seed orchard origin found in the seed. If this is the case, then it will be extremely difficult to control the difference between young and mature seed orchards.

The estimated percentages of background pollination presented by Pakkanen et al. (1991) make the situation even more alarming. Their estimates of background pollination, derived from three old Scots pine seed orchards, range from 50 to 70 %. Such high values would push seed production for Northern Finland into great difficulties.

Preliminary results of this sort are rather alarming for registration work. In this case they suggest that the criteria for the category 'mature seed orchards' would have to be changed completely. In addition, the present prohibition on the sale of so-called puberty seed may be based on false grounds. The situation is especially difficult for the registration authorities because the preliminary results are debatable but cannot be fully ignored.

Seed orchards between the young and operational stages

There is a state of development in between the young seed orchard (A2) and the mature seed orchard (A3) stages where roughly one half of the seed is background pollinated, and the other half originates from mating among plustrees. In Finland this seed is often called puberty seed. As far as northern seed orchards are concerned, it is impossible to define the utilization region for a seed crop of this sort. The situation is rather problematic, and at present the sale of puberty seed is not permitted at all. One solution to this intricate problem would be direct seeding in the same region where the totally background pollinated seed can be used, although this would cause some loss of genetic gain. Another possibility could be to sort the plants in the nursery according to climatic hardiness. However, the sorting methods still need to be improved.

Second generation seed orchards should be established in good microclimatic conditions in the north where background pollination does not decrease the adaptibility of the progeny. Another possibility would be to make long- distance transfers of the orchards to the south of the coniferous forest belt (Koski 1987).

SPRUCE AND BIRCH SEED ORCHARDS

The minimum requirements for pine also apply to spruce (Picea abies) and birch (Betula pendula or Betula pubescens) seed orchards with some exceptions. Spruce seed orchards can be planted in rows, because self pollination appears to result in an empty seed probability of over 90 %. The greatest problem in spruce seed orchards is in management. Finnish spruce seed orchards have had only one good seed year so far, and all of them will continue to belong to the category 'young seed orchards' as long as there is no exact knowledge about the proportions of inside or background pollination in a seed orchard.

Birch seed orchards have no minimum requirement as regards area, since they are all situated in greenhouses. Furthermore, the minimum number of clones can be less than thirty. The extreme case is a two-clone seed orchard which produces a lot of seed for which there is steady demand. We should consider whether it should be set a maximum on the amount of seedlings that a two-clone seed orchard can produce. For the time being there is no limit on the total amount of production in any seed orchard. On the contrary, the clonal categories will contain strict limits on the number of copies per clone.

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APPENDIX

1. THE NUMBER AND THE AREA OF SELECTED SEED STANDS REGISTERED BY THE FOREST RESEARCH INSTITUTE 1.1.1991.

Tree species	Number of stands	Area, ha
Pine	605	3 997
Spruce	270	1 558
Birch (B.pendula)	66	147
Birch (B.pubescens)	44	104
Larch	3	8
Other	23	56
Total	1 011	5 839

2. FOREST TREE SEED ORCHARDS IN FINLAND 3.5.1991

Tree species	Number of seed orchards	Number of clones	Number of grafts	Area, ha
Pine	185	6 056	850 543	2 865
Spruce	19	597	68 825	222
Birch 1)	9	196	589	1
Larch	7	121	13 113	49
Total	220	6 970	933 070	3 137

1) Plastic-covered seed orchards: B.pendula 0,19 ha
B.pubescens 0,10 ha
B pendula var. carelica 0,04 ha

3. THE PRODUCTION OF SEED ORCHARD SEED IN KILOGRAMMES

Tree species	Production 1989			Total production 1980-1989		
	A2	A3	Total	A2	A3	Total
Pine	79	221	300	6 138	15 991	22 129
Spruce	-	1 407	1 407	-	1 421	1 421
Birch(B.pendula)	26	-	26	108	-	108
Birch(B.pubescens)	55	-	55	128	-	128
Larch	40	-	40	890	-	890
Total	200	1 628	1 828	7 264	17 412	24 676

Category: A2 = Material from mature untested seed orchards
A3 = Material from young orchards (pollen production less than 20 kg/ha/year)

CONSIDERATIONS OVER REGULATIONS FOR CLONAL FORESTRY

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ABSTRACT

Present possible procedures for production and afforestation with vegetative material are presented in the frame of the new concept of "clonal forestry".

"**Clonal mixtures**" as opposed to "**Distinct clones**" (poplar) are considered.

Within clonal mixtures, "**Bulk varieties**" are distinguished from "**Multiclonal varieties**" which themselves are subdivided into:

- "**Plus multiclonal varieties**" with clones from plus-plants selected at the nursery stage;
- "**Elite multiclonal varieties**" with best clones from clonal tests at the forest stage;
- "**Sub-elite multiclonal varieties**" with best clones from clonal tests at the nursery stage.

A **philosophy** for possible regulations is proposed.

To prevent most pathological and genetic risks, a sufficient number of unrelated clones, in connection with the rotation period, should be used in clonal mixtures: a **minimum of 50 clones** seems necessary while a number of **50-100** seems resonnable and **sufficent**.

New proposals of **regulations** should stay compatible with existing regulations of **EEC** and **OECD** and could be presented in the form of an additional **appendix**.

Modifications of OECD or EEC regulations should be made in close coordination, with attempts to **unifie** these two similar systems.

"**Category**" and "**type**" of materials should be clearly distinguished and mentioned **on certificates**.

The **category** of the vegetative reproductive material should be that **of the generative basic material** from which it derives.

Examples of application of these proposed rules are given.

I.- INTRODUCTION

Prior to considering possible regulations on vegetative propagation, it seems necessary to get an idea as clear as possible on the present different possible procedures for production and afforestation with vegetative material in the frame of the new concept of "clonal forestry".

After the basic findings and realizations of KLEINSCHMIT (1973) with Norway Spruce (*Picea abies*) in Germany, followed by similar works in Scandinavia, France (AFOCEL), California (LIBBY, 1983), New Zealand with *Pinus radiata*, Congo-Brazzaville (CTFT) and Brazil with Eucalypts, and others in increasing number, it became clear that direct large scale afforestation with plants produced through vegetative propagation (cuttings and possibly tissue culture) was technically feasible for an increasing number of species.

LIBBY (1983) has the strongly held opinion that this clonal forestry will be the serious forestry of the future, particularly as producer of renewable ressources.

However, possible reduction of the genetic diversity and linked risks as sanitary problems or danger of inbreeding have to be considered. Likewise, the higher costs involved with vegetative propagation have to be compensated by a much higher genotypic gain in order to make clonal forestry economically feasible too.

On another hand, the forester-customer is liable to be very reluctant to pay much more for plants from vegetative propagation if these are sold with no control as in the present situation.

Therefore, it seem rather urgent that relevant national and international organizations try to settle regulations which could be at the same time sure, realistic and compatible between themselves.

II.- CLASSIFICATION OF VEGETATIVE REPRODUCTIVE MATERIALS

An attempt is made at classification of the different reproductive materials which can be the most commonly found in the present development programmes.

II.1.- Distinct clones

Plantations are monoclonal, i.e. trees of the same plantation are ramets (copies) of the same clone.

Poplar plantations are a typical example of distinct clones. This could be however extended to other species with the drawbacks linked to it...

A particular form is represented by "mosaïc plantations" made of the juxtaposition of very small monoclonal plantations.

Advantages of distinct clones are mainly:
- existing regulations, actually applied (EEC, OECD);
- easy to control;
- easy to produce and handle.

Disadvantages are mainly:
- disease risks threatening whole plantations and even whole regions;
- inadaptability risks for certain sites (interactions);
- absolute necessity of testing every clone in all respects for a long time before releasing it in practice; but then for most species, the tested clones are too "aged" to be multiplied any more (except in poplars and willows);
- severe inbreeding in the offspring (e.g. unavoidable natural seeding in *Prunus avium*).

II.2.- Clonal mixtures

II.2.1.- "Bulk varieties"

The basic material is "bulked", seed coming either from good:
- seed orchards (seed lots separated per orchard),
- families (seed lots of families mixed) from:
    * open pollination ("half sibs"),
    * controlled pollination ("full sibs").

After thorough mixing (bulking) of possible component seed lots, the resulting seed lot is sown and all seedlings are possibly forced in a greenhouse to produce rapidly large plants. All these last are then cut into cuttings for vegetative propagation e.g. in greenhouses. They so give rise to cuttings-plants raised in nursery.

In order to increase the multiplication factor i.e. the number of final cutting-plants per original seed, a second or even other additional cycles may be used.

"Somatic embryogenesis" could be an alternative to cutting propagation in so far no dangerous somaclonal mutants could occur and costs be inferior.

Advantages of "bulk" are mainly very reduced pathological and genetic risks since:

- the number of clones (though partly related when the number of families is small) is as large as the number of successful seed (thousands or tens of thousands);

- furthermore, these clones are used only during one set of propagation.

Disadvantages are mainly:

- cost of vegetative propagation as compared to the generative one;

- no additional genotypic gain with regard to the basic bulked seed (e.g. bulk cuttings-plants from a seed orchard are genetically equal, and not better, than seed-plants from this orchard);

- no existing regulation.

II.2.2.- "Multiclonal varieties"

In this process, "superplants" (ortets of "infantiles clones") are selected in nursery at a high intensity (1/100 to 1/10 000) among plants of good provenances or families, preferably within comparative tests.

These ortets, or derived ramets, are:
- either placed into a "clone park of stock plants" delivering every year cuttings for propagation,
- or submitted to "serial propagation" i.e. cut into cuttings giving rise to cutting-plants, themselves cut into cuttings and so an, over some cycles, prior to be used for afforestation.

II.2.2.1.- "**Plus multiclonal varieties**"

This is the case described above, the only selection made being the selection of "plus" plants on a phenotypical basis, but usually from an already strongly selected basic material.

II.2.2.2.- "**Elite multiclonal varieties**"

In order to improve this selection, clonal tests are settled to detect the best (elite) clones and to give rise to "Elite multiclonal varieties".
However with many species, it can happen that when the best clones are detected (after some 10-15 years) they are no more able to be propagated because of the "ageing" phenomenon. This type of variety though quite rational can stay unfeasible until "ageing" problems are solved.

II.2.2.3.- "**Sub-elite multiclonal varieties**"

To turn to a certain extend around this problem, an intermediate solution is to limit the clonal test to the nursery stage (some 5 years); so "sub-elite" clones are detected to build up this type of variety.

Advantages of multiclonal varieties are mainly:
- increased expected genotypic gain as compared to the basic material from which they derive (e.g.: 10-20% in the long term production) as a result of the very intense selection at nursery stage, possibly supplemented by the selection at the level of the clonal tests;
- pathological and genetic risks limited to a very reasonable level if the number of unrelated clones is sufficient (e.g. 50-100 per variety).

Disadvantages are mainly:
- costs of production;
- possible clonal differences for the optimum methods of vegetative propagation;
- pathological and genetic risks, if clones are related and in small number (5-10?) as proned by some propagating agencies;
- no existing regulation.

III.- PHILOSOPHY FOR POSSIBLE REGULATIONS

To prevent most pathological and genetic risks, **a sufficient number of unrelated clones** should be used in clonal mixtures. To reduce pathological and adaptation risks, the number of clones should be in relation with rotation age, for example equal to it. To reduce genetic risks (inbreeding principally), the number of unrelated clones should not fall under a **minimum** of some **50**. As a matter of facts, NAMKOONG, BARNES and BURLEY (1980) consider that the minimum number of unrelated **effective** parents in a forest tree population which is necessary to prevent most inbreeding in further generations lies around 20-50.

Practically, on the average, a number of **50-100** seems reasonable in many respects.

To prevent dramatic revisions and discussions longing over years, **new proposals** of regulations on vegetative materials should as far as possible stay **compatible with existing regulations of EEC and OECD**. The new proposals could preferably take the form of a **distinct additional appendix** to the existing regulations.

Any **modification of OECD or EEC regulations** should be made in close and synchronous **coordination**; furthermore, attempts should be made to **unifie** these two similar systems.

The concept of "**category**" of reproductive material (Identified, Selected, From Untested Seed Orchard, Tested) should be clearly distinguished from the concept of "**type**" of basic material (Seed Stands, Seed Orchards, Bulk Varieties, diverse kinds of Multiclonal Varieties) giving rise to these reproductive materials as showed in table 1.

Accordingly, this **type** should be mentioned **on the certificate**.

The **category of the vegetative reproductive material** should be **that of the generative basic material from which it derives**, except if it can be proven by the procedure of Appendix II of OECD (and EEC) that it is of a higher category.

In case of **mixtures** of material from different categories, the retained **category** is **the least**, except if it can be proven by the same procedure that it is of a higher one.

Similarly to what is accepted with stands, **"Plus" trees** and **"Elite" trees** should be considered as giving rise respectively to "**selected**" and "**tested**" materials.

For every vegetatively propagated **variety** (Distinct Clone, Bulk Variety, diverse kinds of Multiclonal Varieties), its brief **description** with official number and name, name of the breeding institution, its general composition including the number of clones and the generative basic materials from which it derives, the method of clone selection, the range of environments of expected utilization, qualities and defects,... should be published and deposited at the relevant "Designated Authority".

IV.- **Examples** (check with table 1)

1) A "Bulk variety" vegetatively propagated from seed from an "Untested seed orchard" belongs to the same category as the seed of this seed orchard (*pink label*). Mention that it is a "bulk variety" is however mentionned on the certificate and thus distinguishes it clearly from seed-plants of this seed orchard.

Similarly, the same is true with a "Tested seed orchard" (*blue label*).

2) A "Plus multiclonal variety" originating from the same seed belongs also to the category of the seed orchard (*pink label*) in spite of the fact that an additional genotypic gain is expected (but not yet proven by clonal tests); however mention that it is a "Plus multiclonal variety" is mentionned on the certificate.

On the contrary, an "Elite multiclonal variety", all component clones of which have been proven superior to adequate standards according to Appendix II of OECD-EEC, belongs to the "Tested" category (*blue label*), even if clones are coming from diverse categories.

In the same conditions, a "Sub-elite multiclonal variety" belongs too to the "Tested" category with conditional approval, if Art. 8 of Appendix II is fulfilled i.e. early tests are proven to be valid.

3) A "Bulk variety" originating from a mixture of seed of families which have been found superior to adequate standards according Appendix II of OECD-EEC, pertains to the "Tested" category (*blue label*).

4) Plus-plants of Infantile Clones are selected in a nursery replicated experiment among families from "plus trees" open pollinated in normal stands, selected seed stands, plus seed orchards and elite seed orchards. "Multiclonal varieties" thereof pertain to the least category i.e. that of the original "plus trees" considered as "selected" (*green label*); the "type" of material is mentioned on the certificate.

When selection of infantile clones is restricted to families which can be proven according to Appendix II to be equal to families of the "Elite seed orchard", then the derived multiclonal variety pertains to the "tested" category of this last (*blue label*), the type of this multiclonal variety being once again mentioned on the certificate.

A example of rules applying these principles has been presented in the form of a compatible appendix to existing regulations in Belgium (NANSON, 1985). Administrative problems linked to the regionalization of the country are however delaying its implementation.

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RESUME

Les procédures actuellement possibles pour la production et l'afforestation avec du matériel multiplié végétativement sont présentées dans le cadre du nouveau concept de la "foresterie clonale".

Les "**mélanges clonaux**", par opposition aux "**clones distincts**" (peuplier), sont considérés.

Au sein des mélanges clonaux, les "**variétés en vrac**" sont distinguées des "**Variétés multiclonales**" qui elles-mêmes sont subdivisées en:

- "**Variétés multiclonales plus**" avec des clones issus de plants-plus sélectionnés au stade de la pépinière,
- "**Variétés multiclonales d'élite**" avec les meilleurs clones des tests de clones établis au stade forestier,
- "**Variétés multiclonales sub-élite**" avec les meilleurs clones de tests de clones établis en pépinière.

Une **philosophie** des réglementations possibles est proposée.

Pour éviter la plupart des risques pathologiques et génétiques, un nombre suffisant de clones non apparentés, en fonction de la durée de la révolution, devrait être utilisé dans les mélanges clonaux: un **minimum de 50 clones** paraît nécessaire tandis qu'un nombre de **50-100** paraît raisonnable et **suffisant**.

Les **nouvelles** propositions de **réglementations** devraient rester **compatibles** avec les réglementations actuelles de la **CEE** et de l'**OCDE**, avec des tentatives d'**unification** de ces deux systèmes similaires.

La "**catégorie**" et le "**type**" de matériel devraient être clairement distingués et mentionnés **sur les certificats**.

La **catégorie** du matériel de reproduction végétatif devrait être celle **du matériel de base génératif** dont elle provient.

Des **exemples** d'application de ces règles proposées sont données.

Table 1

Possible combinations between "categories" and "types" of materials in the OECD (O) and EEC (E) systems.

	Types								
	Generative reproduction				Vegetative reproduction				
Category	Stand	Select. Stand	Seed Orchard Plus	Seed Orchard Elite	Dist. Clone	Bulk Var	Multiclonal Var Plus	Multiclonal Var Elit	Multiclonal Var Selit
1) **Identified** (yellow)	**O**	–	–	–	–	–	–	–	–
2) **Selected** (green)	–	**O+E**	E	E[1]?	–	O+E	O+E	–	–
3) **From Un-tested S.O.** (pink)	–	–	**O**	O[1]?	–	O	O	–	–
4) **Tested** (blue)	(O+E)	O+E	(O+E)	**O+E**	**O+E**	O+E	(O+E)	O+E	O+E
	(----present regulations-------)				(-----proposals-----)				

Legend: – = non-existent;
O = OECD System; bold-faced type = most usual cases;
E = EEC System; idem;
()= unusual but may happen;
S.O. = Seed Orchard;

([1]) When the additive values of mother clones are tested (Progeny tests), but the whole descent of the S.O. (Variety test) is not yet.

THE FINNISH REGULATIONS CONCERNING THE SALE OF VEGETATIVELY PROPAGATED FORESTATION MATERIAL

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ABSTRACT

The contents of the general legislation and the drafts of detailed directives covering birch and spruce especially are explained.
The sale of clonal material in 3 testing categories is permitted: selected, preliminarily tested and tested. Multiclonal mixtures only are approved for the 2 lower categories. The sale of single clones is also allowed in the highest category. The minimum number of clones per mixture is, depending on the category, 33, 11 and 4 (or 1). The maximum number of copies per clone is respectively 100 000, 700 000 and 1 200 000. Preliminary testing takes 5-7 years at 2 locations the unit to be tested being a single clone. Final testing takes 12-15 years at 3 locations. The testing work is done by the breeder under the supervision of the Finnish Forest Research Institute, which also approves and registers the clones and mixtures.
The bulk propagation of seed-orchard and stand seedlings is allowed up to 1000 copies.
Key words: legislation, reproductive material, clonal mixtures, *Picea abies*, *Betula pendula*, *Betula pubescens*

IN FINNLAND GÜLTIGE RICHTLINIEN FÜR DEN VERTRIEB VON VEGETATIV VERMEHRTEM PFLANZGUT

ZUSAMMENFASSUNG

Es wird der Inhalt der allgemeinen Vorschriften sowie insbesondere der detaillierten Richtlinien für Fichten und Birken beschrieben.
Das zum Verkauf stehende Klonmaterial muß einer der drei Testklassen, ausgewähltes, preliminär getestetes oder getestetes Klonmaterial, angehören. Für die beiden unteren Klassen werden ausschließlich Klonmischungen akzeptiert. In der oberen Klasse sind auch einzelne Klone gestattet. Die Mindestmenge der Klonen in der Klonmischungen beträgt je nach Testklasse 33, 11 und 4 (oder 1). Die Höchstmengen der klonspezifischen Kopien betragen entsprechend 100 000, 700 000 und 1 200 000. Die Klone werden einzeln, nicht als Mischungen, getestet. Ein preliminärer Test dauert 5-7 Jahre an mindestens zwei Testorten. Der endgültiger Test dauert 12-15 Jahren an drei Testorten. Jeder Züchter testet seine Klone selbst. Die Teste werden vom Finnischen Institut für Waldforschung überwacht, das auch die Klassifizierung der Klone und Klonmischungen vornimmt. Die Massenvermehrung von Samenplantagen- und Bestandjungpflanzen ist zulässig bis zu 1000 Kopien.

INTRODUCTION

In Finland the Law on the Sale of Forestation Material was passed in 1979 (Laki metsänviljelyaineiston kaupasta ...). The general orders in the law cover both sexually and vegetatively propagated material which is sold for forestation purposes.

The preparation of more detailed directives for the sale of clonal spruce material began in 1986. These drafts were never issued, mainly because the number of spruce cuttings on the market remained low.

In 1987 the Decree Covering the Sale of Forestation Material, issued by the Ministry of Agriculture and Forestry (denoted later as the Decree) set out the present framework for the most detailed directives (Maa- ja metsätalousministeriön päätös ...). The Decree states that there are three different categories for clonal material:

selected (= untested) (C3),
preliminarily tested (C2), and
tested (C1) clonal material

(later denoted as C3, C2 and C1). The sale of clonal forestation material which does not conform with any of these categories is prohibited. The decree also states that only multiclonal mixtures can be sold in the two lower categories, C3 and C2. The sale of single clones is only permitted in the highest testing category. It also states that the Finnish Forest Research Institute is responsible for issuing detailed directives covering the terms on what clones and clonal mixtures can be approved and registered in the categories. The National Board of Forestry should also issue detailed directives concerning the sale of the registered material. In 1991, together with other re-organization measures, the later authorization was returned to the Ministry of Agriculture and Forestry.

The need for detailed directives became urgent when the micro-propagation of birch expanded to commercial scale at the end of 1980's.

The Directive Concerning the Registration of Vegetatively Propagated Forestation Material (denoted later as the Directive), which will be issued by the Finnish Forest Research Institute later this year, and the corresponding directive of the Ministry of Agriculture and Forestry concerning the sale of such material, are still in draftform. These two authorities have cooperated in drawing up their drafts in order to ensure that the directives form a consistent whole. The opinions of the representatives of the material producers and forest owners have been taken into account during the composition of the drafts. Later on in this text, some attention is paid to explaining which authority is behind each point. Stress is laid on the combined contents of both directives. The analysis technique resembles that used by MUHS (1986) in his synopsis.

In order to gain a better understanding of the Finnish directives two more points need to be mentioned. Firstly, the basic aim of the directives is to protect forest owners against the supposed risks of clonal forestry in cases where the forest owners themselves do not know or do not care about the risks they are taking compared with forestation with sexually propagated material. Secondly, in Finland the authorities only can regulate the sale of forestation material. The possibilities of regulating the activities of forest owners in forestation work are very limited. Thus the undesired use of material should be prevented as effectively as possible before the material is delivered to the forest owner. The second point is one of the main differences between the Swedish and Finnish regulations.

DESCRIPTION OF THE DETAILED DIRECTIVES

The species covered and a summarizing table

So far, the detailed directives only cover European white birch and pubescent birch (*Betula pendula, B. pubescens*) and Norway spruce (*Picea abies*). There was no need to include other species because the micropropagation of pine is still under development and the sale of species like willows and poplars for forestation is of minor importance in Finland.

The most important figures in the directives are presented in Table 1.

Table 1. The main figures in directives concerning the registration and sale of vegetatively propagated forestation material in Finland.

	Category			
	C3	C2	C1	
Unit to be registered	Mixture	Mixture	Mixture	Single
Min. number of clones	33	11	4	1
Max. number of copies/clone (x1000)	100	700	1200	
Testing procedure				
- number of controls	-	4	4	
- min. number of sites	-	2	3	
- duration (in growing seasons)	-	5-7	12	15
- risk (%)	-	20	10	5

The number of clones and copies

The decision about allowing the use of single clones was already made in the Decree dating from 1987, and was not reconsidered when preparing the Directive. The minimum number of clones per mixtures in different categories as well as the other figures given here are based on careful considerations alone. No experimental results obtained under Finnish conditions have been available. In directives of this sort the number of clones and other limitations and requirements make a unit that should be judged as a whole simultaneously from both practical and theoretical points of view. However, the minimum number of clones, which appears to be the most debated point in these regulations, is in good agreement with recent publications in category C3 at least (HÜHN 1988).

We could ask why mixtures of 2 or 3 clones are not allowed in category C1. The answer is: if a forest grower really wants to buy a tested multiclonal *mixture*, then would it not be wrong to sell him less than four clones. Of course there is no intention to prohibit the mixing of 2 or 3 clones that are approved for sale as single clones.

In order to illustrate the consequences of the maximum number of copies per clone, let us take a realistic example. A birch breeder gets his multi-clonal mixture of 33 clones registered as category C3 in year n. At the same time he establishes 3 field tests according to the directives explained later on in this text. In the year n+5 he gets the best 11 clones registered as category C2 and finally, in the year n+15 he gets the very best clone registered as category C1.

Let the whole area where the use of this mixture is recommended be 50 000 km² (2/3 of Austria). Of this area 4 000 ha are forested each year with birch, the average continuous forestation area being 1.5 ha. The common planting density for birch is 1 600 plants per hectare, which means that 6 400 000 plants/year are needed in the area.

The production scheme of the breeder is as follows:

	years	clones	copies/clone in a year
	n+1 - n+5	33	20 000
	n+6 - n+15	11	70 000
	n+16 - n+21	1	200 000
total	21 years		2 000 000 copies / the best clone

Several interesting results can be calculated from these figures. Here are some examples:

- in the year n+22 the best clone will be growing in more than 5 000 stands, in 500 of them as the only clone
- during the years n+16 - n+21 the use of the best clone will be 3.13 % of the total usage of birch plants in that area
- during the 21-year period the best clone has occupied 1 250 ha (0.025 %) of forest land, 750 ha as the only clone

The example demonstrates that, even though 2 million copies of the same individual is a huge amount, it will spread rather well in time and space. A good clone is thus given the opportunity to express its producing potency with reasonable risk. An amount of this sort might also be economically encouraging for the breeder to invest in his breeding programme.

Selection procedure

The selection of clones for the category C3 is based on the phenotype of individuals. The Directive requires the breeder to declare the selection criterion(-a) as well as the measurements made on the individuals and the means of the base populations from which the selection has been made.

The terms for the approval of a C3 mixture are simple: every individual has merely to be better than its base populations. If the selected tree has not been registered earlier, it will be given an identification number. The clonal mixture is also given an identification code which will be used to provide the exact information about the origin on the market and later on in the file of the stand's history.

The breeder is also supposed to propose the geographical region where the mixture can be used for forestation. This utilization area is confirmed by the Forest Research Institute at the same time as the mixture is approved.

The proportion of related clones in a mixture is limited in order to keep the effective size of the mixture near the apparent number of clones. The number of full-sibs is limited so that no more than 20 % of the clones can be pairs of full-sibs (e.g. in the case of a mixture of 40 clones 4 pairs of full-sibs may be included, 2 x 4 = 8 = 20 %). Respectively the proportion of pairs of half-sibs has been limited to 40 %. Other possible combinations of relatives will be considered equal to these two specified combinations. (In the higher testing categories where the clone numbers are lower, half-sibs or closer related clones are prohibited.)

There is also a limit of 35 % on the number of clones whose father is unknown and which originate from same seed orchard or stand.

Testing procedure

The aim of testing in this context is to identify those clones which are performing better than the controls with respect to the trait for which they have been selected. Besides the tested trait, the survival and susceptibility performance of the clone is also monitored. If a clone appears to be somewhat doubtful, it is rejected. However, the testing does not guarantee the safety of the large scale use of the clone. This question has been discussed especially in Sweden (Klonskogsbruk 1989).

The testing is done by the breeder or material producer under the supervision of the Forest Research Institute. Each clone is tested as a single clone and the mixtures are composed afterwards using approved clones. The other possibility, i.e. the testing of all possible combinations as mixtures is considered to be impractical.

The 'technical' requirements for a trial are as follows:

1) It is a field or test-orchard trial in the area where the forestation material is to be used.
2) There are at least four controls included. These can be seedlings or bulk propagated plants originating from special standard stands or registered seed collection stands in the same area.
3) There are at least 12 copies of each clone in each trail.
4) The trial design has to be generally acceptable and suitable for this purpose.

The requirements for a clone to be included in clonal mixtures approvable as category C2 are as follows:

1) The minimum testing time for a birch clone is 5 years and for spruce 7 years.

2) There has to be at least 2 trials where the clone has been better than the controls. The comparison can be made with the mean of the controls by using any acceptable statistical test, the risk of committing a Type I error (e.g to claim that the clone is better than the controls although it is not true) being no more than 20 %.

The corresponding requirements for category C1 are:
1) The minimum testing time for both spruce and birch clones is 12 years, but 15 years if the clone is to be used as a single clone.
2) At least 3 trials are required and the risk may not be more than 10 % or in the case of a single clone 5 %.

Nothing is said about the extent to which the clone must be superior. This decision has been left to the customers who can compare the price of the plants and the expectable gain.

Making up a plant lot for sale

When a plant lot is being made up for sale, then at least 90 % of the clones belonging to the registered multiclonal mixture have to be included. The deviation between the proportions of different clones may not be more than 5 %-units in category C3 and 10 %-units in categories C2 and C1. For example, if there is a C3 mixture with minimum number of clones, 30 of the 33 clones have to be included in the selling lot, the proportions of different clones deviating by 2 to 7 %.

The plants of different clones have to be mixed before delivery, except if the customer specifies that the clones are to be separated. It is thus possible to grow the clones in rows or in blocks, if that is preferred.

The information that must be given to the buyer about the material is specified in the directives. This includes the code that identifies the origin and the confirmed proposal for the region of utilization. The requirements for the physiological quality of the plants are also specified, and are about the same as for seedlings.

Bulk propagation

According to the Decree, bulk propagation is allowed and plants belong to the same category as the basic material. Thus there is no special C category for bulk in the directives.

The limitations on bulking seed orchard or stand seedlings are roughly as follows:
1) The basic material has to consist of at least 200 seedlings.
2) If the basic material is taken from a larger lot of seedlings it has to be a random sample.
3) If the basic material consists of separate families, at least 20 families have to be included, the proportion of one family being no more than 10 %.

4) A single seedling may not be propagated to more than 1000 copies.

When the available seed material will be tested, the limits on bulk propagation will be wider. Perhaps the only limitation needed is the limit on the copies per seedling, which could be for example 5000.

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NEW REGULATIONS FOR THE USE OF CLONES IN FORESTRY IN SWEDEN

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Abstract

New regulations for the use of clones in forestry were issued in January 1991. The new rules are based on an investigation made by the Swedish University of Agricultural Sciences (including the faculty of forestry). Important points in the investigation was;

- there are reasons to restrict the use of a single clone
- there are reasons to restrict the volume of cuttings in forestry
- clone tests should be regarded as a part of the breeding process, not a way to reduce risks or increase security
- long term testing gives a noteable risk for clone aging?

The new rules on clonal forestry apply to regeneration areas with more than 300 cuttings per hectare.

Reforestations larger than 3 hectares, with cuttings, must be reported. Single clones may be used as a maximum percentage of the plants on each hectare depending on test level. The percentages are 1,5 (untested), 2,5 (test level 1) and 3,5 (test level 2).

A maximum of 1 million cuttings from a single clone may be released. In order to release the maximum number, tests must be done. The legislation stipulates nothing about test results. It stipulates what the tests shall reveal and the factors to be registered. Test level 1 includes a six-year-test or when the material has reached an average height of two meters. Test level 2 includes test results from test level 1 after 9 years and a renewal of test level 1 (may be started 3 years after test level 1).

Zusammenfassung

Die zweite Fassung der schwedischen Regeln für die Verwendung von Klonen im Waldbau ist seit Januar 1991 in Kraft. Die Regeln bauen auf die nun etwa 15-jährigen wissenschaftlichen und praktischen Erfahrungen mit Fichtenklonen in Schweden auf:

Es besteht Anlass die Vermehrungsrate einzelner Klone zu begrenzen. Es besteht Anlass das Gesamtvolumen des Anbaus von Stecklingen überhaupt zu begrenzen.

Klonprüfung sollte als ein Teil der Zuchtungsarbeit betrieben werden und nicht als Mittel zur Minderung von Gefahren.

Dem Wunsch nach langfristiger Prüfung steht die Frage der Klonalterung entgegen.

BACKGROUND

The Swedish production of spruce cuttings for forestry is approximately 5 millions pro year. An estimate of 20 millions has been planted so far. The use of cuttings is concentrated to southern Sweden. Use and marketing of cuttings are regulated in the forestry act since 1983. In 1988, it was decided to revise the rules and therefore the Swedish University of Agricultural Sciences was asked to produce a report investigating risks and possibilities. The report was delivered in december 1989. Further discussions resulted in a new regulation which was issued in January 1991.

THE INVESTIGATION FROM THE UNIVERSITY OF AGRICULTURAL SCIENCES

The investigation (1) brings forward the fact that there are many advantages and a large potential with clonal forestry.

The use of cuttings in Sweden is fairly large in an international perspecive but small in comparision to Sweden's total plant production.

There are very few mediumaged to old stands established with cuttings. This lack of empirical experience and suitable stands for an analysis of consequence are strong arguments for a limitation of cuttings in forestry. There is also lack of a good experimental foundation for an analysis of ecological consequences.

In spite of lack of information from older cuttings there are substantial knowledge concerning juvenile, young cuttings.

Since noxious organisms can adapt to specific clones at the time beeing one should use many clones and also limit the use over large areas.

Tests should be regarded as a part of the breeding program rather than a way to reduce risks. Long term testing may result in fewer tested clones (quite contrary to what is said above) and an increased risk for problems with clone aging.

The investigation recommends

- <u>restriction of the total volume of cuttings in Swedish forestry</u>
  As a suggestion for discussion to maximise the total use to 30 millions and maximum to 35 % of all spruce seedlings in a region.

- restriction of the use of single clones
  If single clones are used in a large scale they ought to be tested and selected.

- trial of models connected with great risk
  Monoclone plantings of different size should be tried to give better knowledge for future decisions.

- some regeneration areas should be registered
  To gain more information.

- longtime trials and tests
  The test should be regarded as part of the breeding program not a way to reduce risks.

  Special efforts should be put in research dealing with consequences of clonal forestry.

- test period
  It is desirable with tests shorter than 7 years or to 1.5 m height.

- use of clones in stands
  It is desirable that single clones are used so that single clones represent not more than 3-4 % of the plants in a regeneration. For untested clones the frequency should be lower.

- statistics
  It is advisable to keep track of the use of cuttings and different types of clonal forestry.

- administration and regulation
  Cuttings ought to be accompanied by an informative label covering recommendations for use, identification and so on.

- consideration of nature conservation
  The recommendations are aiming at a large variation in the stands (from brodleaves naturally regenerated) and a high intensity of light Clonal forestry in specially protected nature conservation areas and other simular sensitive areas should be prohibited.

RULES

The act (2) regulates use and marketing of coniferous cuttings. In connection to marketing it is also stipulated what the tests require if cuttings are marketed as tested. The rules only apply to regeneration areas with 300 cuttings or more on each hectare.

USE

Reforestations with cuttings on areas larger than 3 ha must be reported to the County Forestry Boards. Some of the reported areas are registered for future evaluations. Connecting areas, reforested with cuttings, must not exceed a total of 20 hectars per holding. It is prohibited to use cuttings in nature reserves or in biotopes of special interest.

Figure 1 shows the minimum number of clones allowed on each hectare. The figure also contains the numbers from the old rules.

	untested	test level 1	test level 2	test level 3
new rules	67 (1.5%)	40 (2.5%)	29 (3.5%)	does not exist
old rules	not allowed	120	60	0

Fig 1 Minimum number of clones on each hectare. In brackets the largest procentages of a single clone allowed on each hectare.

The act itself does not actually stipulate the certain numbers but the largest percentages of single clones in a plantation.

TESTS

If clones are traded as tested, certain requirements have to be fulfilled. However the new rules do not stipulate any testing about superiority.

All tests must contain comparisons with seedlings suitable for the area and should be situated in areas representative for the future areas where the clones are planned to be used.

The following variables/factors must always be registered. Control seedlings, plant height, increment, time for bud burst and bud set, damage and survival.

There are two test levels

Level 1:

Six years of field test or until two meters in average height have been reached. At least 2 sites should be uesed, with at least 3 copies per clone and site and a total of at least 8 copies per clone.

Level 2:

A renewal of level 1 on two new sites (start at the earliest 3 years after the original level 1 test). Furhtermore, it is required that the original level 1 test is continued for at least another 3 years.

TRADE

A trade permit from the National Board of Forestry is needed. Each year the trader shall send certain trade statistics to the Board.

It is also compulsory with a marketing declaration covering identity, recommendation of use, type of material and test level.

The number of copies per clone may as a maximum not exceed one million (the old rules had 1.5 million as a maximum). Fig 2 below shows how the number of copies are divided into the different test levels. Also the old rules limits are shown.

	untested	test level 1	test level 2	test level 3
New rules	50 000	250 000	700 000	--
Old rules	0	250 000	500 000	750 000

Fig 2 Allowed number of copies per clone.

Bulk propagation is limited to 200 copies per seedling or not identified cutting.

EXEMPTIONS

It is desirable to gain more information about the use of clones (as an example mono clone plantations) that are not allowed in the regulation. Therefore, the rules make it possible to make exemptions for trials and research.

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PROBLEMS IN MARKETING CLONALLY PROPAGATED REPRODUCTIVE MATERIAL

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ABSTRACT

15 items are described of which some contain major requirements to be fulfilled for marketing clones or clonal mixtures in Germany. Problems in the fulfillment of the requirements arise from different circumstances which are either specific to the species or the propagation method employed. Examples are given for some major problems.

Different approval procedures and control systems are necessary for identified respective unidentified clonal material. Identified clones are derived vegetatively from an ortet resulting in ramets, while unidentified clonal material is often bulked up. Aging effects which occur in most species after a certain period of time, are a major reason to stop vegetative propagation when the basic material has reached the critical age. If rejuvenation is not or only partly achieveable, the basic material has to be replaced.

In vitro propagated material, especially from organ culture is relatively stable and involves minimal genetic risk. However, material derived from long term callus cultures and especially from genetic engineering may not be stable genetically. Therefore the material should be tested to ensure that it is stable and true-to-type. Above that, genetically engineered plant material has to meet the requirements for the release of genetically modified organisms first, before it is approved according to the applicable rules and regulations for the marketing of forest reproductive material.

The question of the numbers of clones to be included in clonal mixtures is discussed controversely. Most important is to clarify how much genetic diversity is necessary in a clonal mixture. Solutions to these problems are proposed.

1 INTRODUCTION

Regulations on the use of clones in forestry exist already since 1957 in the Federal Republic of Germany which at that time applied only to poplar clones. However, since then vegetative mass propagation was developed also for main tree species like Norway spruce, the major tree species in Germany. In the course of the amendment of the national law on forest reproductive material 1979, regulations for the use of clones in forestry were enacted. A more detailed set of rules were laid down in the General Administrative Regulation from 1985 which applies to forest reproductive material of all forest tree species. It aims mainly at regulating the marketing of clonal mixtures and not their practical use (Muhs, 1988, 1991).

2 NATIONAL REGULATIONS ON THE USE OF CLONES IN FORESTRY

In Table 1 some of the relevant regulations on the use of clones in forestry in the Federal Republic of Germany are summarized. A major rule is that, except for poplar, the marketing of clones is allowed only in certain mixtures. The minimum number of clones per mixture depends on the species. In main species used for large area afforestation the number is 500 clones and 100 clones for minor species used for small area afforestation. For clonal mixtures to be used in special sites, the minimum numbers are 100 respective 20 clones depending if it is a main species or one of less importance.

Each clone of a clonal mixture has to be identified. This means that each clone has to be labeled by some designation and be described by its characters in order to be separable from other clones. Consequently bulk propagation is not permitted because it allows no clone identification. Also informations on origin of the clone, provenance, descent, if it is a breeding product, and additional items are to be given. In order to be able to control this, the clones must be kept separate during the propagation cycles and are only allowed to be mixed just before planting them for afforestation.

All clones of a clonal mixture have to be tested single-clone-wise which is to be done by the producer of the clonal mixture. The testing procedure has to follow special rules comprising duration of the test, number of test sites, traits to be analysed, standard clones to be included, evaluation of the results, etc. (Table 1).

Table 1: Rules governing the marketing of clonal material in Germany

1. Legal status of the rules	Law since 1979, details regulated by a general administrative regulation amended in 1985
2. Selection of basic material	Not regulated
3. Deployment	Multiclonal mixtures, no mosaics or single clones for species other than poplars
4. Forest tree species governed	All 19 species under the law, for the genus Populus also śingle clones are allowed
5. Minimum number of clones	500 (100) for main species used for large area reforestation, 100 (20) for minor species used for small area reforestation. The number in brackets gives the minimum number for special sites for which special clones have been tested
6. Description of clone identity	Description of each clone according to provenance or origin or, if it is a breeding product, descent and some additional informations.
7. Use of untested clones	Not allowed
8. Testing procedure	
- single or in mixture	Single
- duration of test	species dependent, 10-30 years, time commonly used in progeny testing, (minimum testing time not given)
- number of test sites	at least 3 sites
- traites to be analysed	identification, adaptation, growth performance, resistance traits
- test control (standard)	detailed specification for each species in a list of standards
- evaluation of test results	procedure has to follow special rules, superiority must be significant at 5%

Table 1 continued

10. Mixing procedure	Clone identity is maintained in all propagation cycles and lost when the material is mixed before marketing
11. Restrictions for use	Mixing of clones is to be done only directly before sale; if tested for special sites, this shall be specified on the label
12. Approval	By the authorities of the Federal Land as "tested reproductive material"
13. Limitation of approval	10 years, prolongation for further 10 years possible
14. Registration of clones	To be done by the responsible authority
15. Control of marketing	To be done by the responsible authority

The approval for a clonal mixture is given by the authorities of the Federal Lands as "tested reproductive material" for a period of only 10 years. This can be prolonged for another 10 year period. The registration of the clones and the control over proper handling according to the rules is also carried out by the respective authorities.

From the above it can be concluded that the national rules enforced for the marketing of clones are very restrictive. In fact, with the exception of one late flushing Norway spruce clone, no clones or clonal mixtures have been approved for marketing in Germany, other than poplar, for which there are exceptions which allow the use of single clones. The rules for marketing clonal mixtures create several severe problems which will be presented in the following.

3 PROBLEMS IN MARKETING CLONAL MIXTURES

3.1 Permission of bulk propagation

The present regulations allow only identified clones to be included in clonal mixtures. This means that each clone is first of all designated by either a name, letters, a number, or a combination of those, like the hybrid poplar clone "I 214". Secondly, the clone is characterized by a set of certain traits. The implementation of bulk propagation which is usually a combination of sexual and vegetative propagation is not permitted according to this rule. The characteristic of bulk propagation is, as the name says, that from reproductive material, usually seedlings, propagules are multiplied without keeping track of each single clone. Therefore the clones in bulked up material are unidentified which does not comply to the rule which prescribes that each clone has to be identified.

As a solution to the problem, it is proposed not to change the rules for clonal mixtures but to add a new category of forest reproductive material instead. Because of the testing procedure, clonal mixtures belong into the category "tested material". Since, however, bulked up material does not meet up to this category, it can be looked upon as "improved reproductive material" where no rules for testing are prescribed. Therefore, material derived by bulk propagation should be permitted to be marketed in a new category "improved reproductive material" which would have to be introduced and requirements have to be laid down to give evidence of the improvement.

3.2 Aging

Topophysis is the retention of the habitus of an organ of a certain place (place = topo) the cutting originated from on the mother plant before it was cut. For instance, if a cutting remains plagiotropic instead of growing orthotropically, this would be a topophysis effect. Cyclophysis is a similar effect which pertains to the ontogenetic development (cyclo = time) of the mother plant. For instance, if a tree derived by vegetative propagation flowers although it is still small, this would be a cyclophysis effect (Fortanier and Jonkers, 1976).

Such a tree might not grow straight (topophysis effect) or put its vigor not into vegetative growth for wood production but rather into producing seeds (= cyclophysis effect). This might not be the aim of selecting fast growing clones. Therefore effects caused by topophysis and cyclophysis might ruin the advantages of selecting superior clones after a testing period of for instance 20 years because at that age these effects might already be pronounced. Also the ability to root decreases significantly until an age of about ten years in many species. However, not all species show these aging affects. Whereas for instance poplars show little or no aging effects do many coniferous and deciduous tree species show strong effects of this kind.

Thus aging might severely restrict the use of tested clones in most species after the material has passed a certain testing period. This problem has not been solved so far and there seems to be no solution in changing regulations because it is widely accepted that testing results become more reliable with increasing testing periods. Instead, rejuvenation of the material, for instance by induction of embryoides or by keeping the material juvenile by cryopreservation are possible solutions to the problem. Before rejuvenating clonal material it would be worthwhile to be able to determine its ontogenetic stage (von Wuehlisch and Muhs, 1986).

3.3 Approving in vitro cultured material

There are a number of techniques to manipulate plant material by in vitro culture, for example by embryo culture, clonal micropropagation, utilisation of somaclonal variation, haploid culture, cultures of polyploids, induction of cybrids, and finally by genetic engineering. Most of these techniques involve a step of mass propagation, which these methods have in common with conventional macro vegetative propagation methods. But before that in most in vitro techniques there is a step where genetic information may be changed, resulting in reproductive material which is different from the basic material. This conflicts with the rule which says that the basic material has to be identical with the reproductive material produced vegetatively.

For this reason it is generally difficult to market plant material derived by in vitro culture except it can be shown that the reproductive material is identical with the basic material. However, some regulations should be introduced into the OECD-Scheme and the EEC-Directive to be able market such reproductive material.

A solution to the problem could be to distinguish between two stages of in vitro culture. A first stage of breeding and a second stage of mass propagation. The breeding stage has nothing to do with the marketing. Therefore it should not be governed by these rules. The mass propagation stage on the other hand is comparable to hitherto existing mass propagation methods. Subsequently the basic material can be split into a period where it serves breeding purposes and a period where it is mass propagated and falls under the law. The basic material of the first period can be named basic material of the breeding term (basic material b.t.), and the second, basic material of the legal term (basic material l.t.).

During the breeding term the basic material (b.t.) will be treated by the in vitro culture methods resulting in a product which can be regenerated to a plant. After having tested the regenerated plants, they can serve as basic material (l.t.). During the mass propagation phase plants are produced using the basic material (l.t.). The result is an approved clone (Muhs, 1988).

Except for embryo-cultured material, all in vitro cultured plants can be marketed as clones because they are mass propagated by vegetative means. Therefore reproductive material of the basic material (l.t.) must fulfill the requirements of tested material as outlined above and be marketed as clonal mixtures. Further they must prove their stability and trueness-to-type.

3.4 Stability and expression of genetically engineered material

Tissue culture technology does not always produce true-to-type plants. Whereas plants produced by organ culture, for instance bud meristems, are relatively stable and involve minimum genetic risks, long term callus cultures derived from cells or protoplasts may be prone to genetic variability by somaclonal variation. Also plants produced by genetic engineering, for example by gene transfers involving foreign genes, may not be genetically stable.

With regard to genetically engineered plant material, the United States Department of Agriculture (USDA) has set up proposals for introduction to field testing (Purchase and Mackenzie, 1990) in the United States of America. The Federal Republic of Germany enacted in 1990 a law on the release of genetically engineered and biotechnologically produced plant material. Similar proposals on conducting safe experiments outside the laboratory on genetically engineered micro-organisms and plant materials are under discussion in Europe and by 1992 EEC-Directives on research on genetically modified organisms are expected to be released.

Should forest plant material which is permitted to be marketed according to the rules for release of genetically modified organisms, automatically be permitted for use in practical forestry? No, of course not, because a new forest plant variety, which has been safely produced by genetic engineering and is released to the market, does not necessarily meet the requirements laid down in the rules for the marketing of forest reproductive material as shown above. It has to be tested as clone or multiclonal mixture first before marketing. Thus, genetically modified forest plant material has to meet the requirements of two rules, first for the release of genetically modified organisms and second for the marketing of forest reproductive material.

3.5 Maintaining genetic diversity in clonal forestry

From catastrophic experiences with monoclonal plantings in agriculture and also in forestry, mankind has learnt that these are highly risky. Therefore multiclonal mixtures are preferred instead of single clones. On the other hand the returns on investment might be higher if only the very best clone is used. From this it follows that determination of the number of clones to be used is an optimization between reduction of risks to a minimum and increasing the genetic gain to a maximum.

Estimates of safe numbers of clones in a clonal mixtures have been presented by Libby (1982, 1987) and Libby and Rauter (1984) who suggest monoclonal plantations for special situations or numbers between 7 and 25 clones. Krusche (1982) arrived at minimum clone numbers between 25 and over 300 depending on the underlying presumptions. Using a comprehensive model Hühn (1987) concludes that the necessary number of clones are in the tens than just a few clones and rather than in the hundreds. Thus the optimal numbers of clones in clonal mixtures are still under discussion for establishing international legal guidelines.

Three general guidelines can be applied to solve the problem (Libby, 1988): a) a mixture of large numbers of clones are about as safe as a similar mixture of genetically diverse seedlings, b) mixtures or regional deployment of very small numbers of clones is not safe and commitment to 2-4 clones is often worse than monoclonal plantations; c) regional deployment of modest numbers (ranging from 7-99 clones) is about as safe as deployment of large numbers of clones and offers substantial advantages as well.

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NEW GENETICALLY IMPROVED REPRODUCTIVE MATERIAL AND REGULATIONS : THE EXAMPLE OF PINUS PINASTER IN FRANCE

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ABSTRACT

Pinus pinaster covers more than one million ha of forest in France. The first results of the breeding work about this species have a real impact on sylviculture in the Landes of Gascogne. So, as the advisory services are very efficient, any progress in the quality of the seeds distributed may induce a significative change on the wood production of this forest.

The forest research institutes are now able to propose the distribution on a commercial scale of :

- cuttings of young seedlings grown from high breeding value seedlots (bulk propagation)
- seeds obtained by controlled-crosses

The present regulations do not recognize the genetic value of these varieties and sometimes forbide their marketing.

This example points out the main items of the regulations that should be modified in order to allow a rapid transfer of the breeding progress, keeping in mind that risks should be well evaluated.

RESUME

Pinus pinaster est une espèce majeure en France. Grâce à des services de développement efficaces, toute amélioration de la qualité génétique des graines commercialisées a un impact sur la production à terme du massif forestier. Les organismes de recherches forestières sont à même de proposer la diffusion à l'échelle commerciale de nouvelles variétés : multiplication en vrac de jeunes semis, graines issues de croisements contrôlés, ...

Le cadre réglementaire actuel ne permet pas de reconnaître la valeur de ces variétés et, parfois même, interdit leur commercialisation.

Cet exemple met en évidence les points de la réglementation qui devraient être modifiés, pour permettre, après une évaluation correcte des risques, au progrès génétique d'être rapidement utile à la sylviculture.

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INTRODUCTION

Breeding forest trees requires very long lasting programs. When the results come up, it is necessary to pay a particular attention to the extension of the results.

Pinus pinaster covers more than 1,3 million hectares of forest in France. 896,000 ha are located in the Landes of Gascogne in South West of France. Approximatively 18,000 ha are afforested each year. Afforestation areas are usually directly sown but a great increase of the plantation happened during the last few years, mostly because the advisory services recommend it as a good way to value the seeds from the seed orchards. In 1990 about 35 % of the areas were planted

As Pinus pinaster is of great economic value in South West France, a very important breeding program is developped by INRA and AFOCEL. INRA began in the early 60's by selecting 500 plus trees constituting the F0 generation. The main criteria for selection are the vigour and the straightness of the stem. At the present day, F2 and the beginning of F3 generation are being tested.

This paper will not go into details about that program for which reliable information can be found in the bibliography. Besides the breeding population, the varietal outputs may be of different kinds.

More than 200 ha of open pollination seed orchards (clonal or family seed orchards) are now producing a big amount of seed approximatively 1,700 kg in 1990 for a total need of seed evaluated to 30,000 kg.

Some new generation of seed orchard "equivalent clones" have been planted in the past few years. They may produce seeds in 5 or 10 years. Then if the breeders want their high value seed to be recognized by foresters, they will have to wait till the seed orchards are tested. This means some more 8 years to get temporary admitted in the "tested category".

In order to quickly valorize the effort done since 30 years, the research institutes of the Landes of Gascogne i.e. both INRA and AFOCEL are able to propose the distribution on a commercial scale of two new types of varieties :

- cuttings of young seedlings grown from high genetic value seed lots usually called "bulk varieties" ;
- seed obtained by controlled crosses.

The genetic value of these varieties will not be discussed in this paper which will focus on the characteristics of these varieties and the possibilities of marketing with regards to the current regulation in France.

The marketing of reproductive material of Pinus pinaster is regulated by the "Code Forestier" in France since 1987. This means that, in fact, EEC regulations applies to Pinus pinaster in France even if it is not the case throughout the EEC countries.

I - MARKETING PLANTLETS VEGETATIVELY PROPAGATED FROM YOUNG SEEDLINGS : "Bulk varieties"

The bulk propagation allows to distribute and at a bigger scale, small amounts of seeds. This technique, usually applies to high value seed lots. The french regulations applied to Pinus pinaster recovers exactly the EEC regulations (66/404 CEE and 75/445 CEE) to generative reproductive material.

So the vegetative reproductive materials of Pinus pinaster are not submitted to any regulations in France except the law of 1905 about "repressions of frauds". This law requires that the species of the trees have to be mentionned on the invoice. As a consequence, the marketing of bulk varieties is allowed in France but no specific labels at all should be attached to the plant.

It seems paradoxal to commercialize plantlets of high genetic value without any sign of recognition. It is also very suprising that with this technique, any nursery may commercialize "bulk plantlets" from completly unknown origin ... And during that time, lots of effort are developped in the Landes of Gascogne to incite foresters to use good genetic material !

If these bulk varieties could be sold with a label which should it be ?

CASES WHICH THE LAW MADE PROVISION FOR

Basic material	Stand or seed orchard	Identified clones
"initial" reproductive material	seeds	cuttings (stool beds)
reproductive material of the same category than the "initial" reproductive material	plantlet one seed = one plant	identified cuttings

THE BULK CASE FOR PINUS PINASTER

Basic material	Stand or seed orchard
"initial" reproductive material	seeds
category of the reproductive material ?	cuttings 1 seed = 5 cuttings

In fact the bulk propagation does not inscribe in a clonal propagation multiplication scheme. There is no utilization of clone, at a basic meaning because each stool-bed cannot be identified separatly (there is also no interest to do so). The only possible identification of the plantlets is the global origin (and genetic value) of the stool-beds themselves. The present regulation explains that the reproductive material category is defined by the material from which it derives that is to say the basic material.

So it could be considered that the category of the bulk material should be the same as the one of the seed lots from which it is originated.

This can only be possible if there is no or few changes between the characteristics of the seedlings and those of the cuttings from bulk.

In fact these variations appear, for young stool-beds (one year old) not bigger than those that can be shown from seedlots cropped on the same stands in different years (differences in the flowering and pollination conditions ...).

As a conclusion, it could be suggested that the label of the plantlets propagated by bulk should be the label of the seed lot from which they originated ...

II - SEEDS OBTAINED BY CONTROLLED CROSSES

The controlled pollination allows better improved varieties because of a possible severe selection of both parents, the reduced pollination pollution, the absence of related crosses, ... This also can give a greater flexibility in order to create specialized varieties. Foresters can use the exact variety corresponding to the station and the intensivity of the sylviculture they intend to have.

The intensive management of these orchards especially for a very floriferous specy as Pinus pinaster can allow the production of controlled pollinated seeds at a very competitive cost (see P. ALAZARD).

The controlled pollination seed orchards have some specificities compared to open pollination ones. First of all, the design is of no importance. The pollen can be collected in the seed orchard or somewhere else. Identification of fathers and mothers must be sure and the crop of each clones can be kept isolated and/or some standard mixtures can be done. So at the same place, very different varieties may be produced.

The regulations have made no provision for the marketing of controlled-crosses seeds. In case of tested material, the basic reproductive material should be tested in a good year of flowering. Stand and seed orchard are intended to be selected or tested as a whole (EEC directive 66/404 article 2). Artificial pollination in seed orchard may be done but no pratical condition has been given neither in the EEC directive 66/404 Annex 2 4-2 nor in the french legislation.

The evidence is that the legislator had no intention to regulate controlled crosses. One could imagine to allow in the same category as the original seed-orchard, seeds from a seed orchard where a sufficient number of mothers have been pollinated by a polycross of non related fathers present in the seed orchard ! This could be assimilated to a sort of "genetic thinning" and a complementary pollination. But this is fairly difficult to accept. It will not give a solution to many cases !

A much more realistic suggestion should be to create a new category of reproductive material in order to be able to market the good varieties obtained with these techniques and others.

This new category should be an opportunity, for non tested material but high presumed genetic quality material, to be marketed.

Another suggestion has to be done to allow controlled crosses to get into the "tested category". It is to define a new basic material (66/404 CEE, article 3, point B) which should include individual trees or sets of trees.

SUGGESTIONS FOR A NEW CATEGORY OF REPRODUCTIVE MATERIAL

Few conditions must be taken into account for such a new category :

- there is an evidence that the techniques themselves (bulk, control crosses, ...), do not lead to a "good variety". The real genetic content of the variety or of the basic material must be shown by the breeder.

- it is important to encourage foresters to go further in the improvement of their techniques. A difference has to be made between "ordinary" material and "high genetic value" material. These differences have to be recognized when the reproductive material is marketed. The label is the easiest (if not the only) way to do so.

- the breeders are doing efficient work. A better knowledge of the breeding population will make, of the controlled crosses, a very interesting technique for many species ... Other multiplication techniques are arising for other species than Pinus pinaster. So the problem to solve is not limited to the example of Pinus pinaster.

- The advisory services have had many difficulties to teach foresters the present regulations and the additions to the regulation that could be done have to remain rather simple.

The suggestion to create a new category, should be matched with few conditions :

- in order to limit the diversity of labels, this new category should cover different varieties. The calculated or experimental superiority of these varieties proposed by the breeders, have to be clearly pointed out to the administrative authority.

- in order to evaluate the risks inherent to the distribution of any varieties, a very detailed description of the variety should be presented by the breeders to the administrative authority. Conditions for the number of parents, the selection and crossing rules could be edicted.

- in order to limit the extension of varieties that show evident disadvantages in the forest, the administrative authority should be able to forbid at any time, the marketing of a variety.

Other administrative and control conditions should be made but this is not the subject of this paper.

A name also has to be found for the new category !

CONCLUSION

Genetic research and multiplication techniques improve very fast and it is important that these progress have an impact on the sylviculture as soon as possible.

The risks must be well evaluated but there must be some confidence in the breeder's work. Breeders must also take more responsability.

Today, the problem is very acute and research institutes claim for changes in the regulations. The main difficulty is the diversity of the questions that may appear for various species in different countries. Administrative questions about control and regulations must not be under-evaluated but should not let regulations changes go slower than the growth of the forest.

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GENETIC IMPROVEMENT AND VARIETAL RISK IN FOREST VARIETIES : INTEGRATION IN EUROPEAN LEGISLATION

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ABSTRACT

The legislator's part consists in facilitating the diffusion of more productive varieties, combined with a protection of user against novelty risk. The varietal risk depends on choice of parents and obtention methods. In general, it is increased in relation with the improvement level. The european rules give preference to user's protection, but cost and duration of certification tests needed for tested category, can bridle varietal creation. Therefore, it seems necessary to set up a new category susceptible to reduce these disadvantages, and which could be provisionally called "predictable improved variety". The registration will be done on the basis of technical documents, for a strictly limited duration, and should be a transitional status for the tested category. Technical documents prepared by the breeder for registration must allow an appreciation of novelty, and a control of methods used for calculation of genetic gain. It must include detailed informations on number, origin and pedigree of parents, breeding pattern and production methods, localisation, tending and results of any tests achieved by the breeder.

INTRODUCTION

Above a certain level and in any field of technology, increase of performance is never reached without any return. It is often obtained in compensation of a decrease in reliability as one can see in racing yatchs or cars. This can even concern the general state of health or some fundamental physiologic function, and examples are not missing in animal breeding : susceptibility to diseases of some pure-bred dogs, uneasy calving of charolais cows...

This correlative increment of risk with the level of performance, can be put down to two main factors :

- overspecialization
- insufficient knowledge of behaviour in the long term, or at the time of an uncommon event.

Forest species do not escape the rule, although the level of selection is still limited. We will try here to define varietal risk, to analyse how it is taken into account in E.C. regulation (Directive 606/404/CEE and subsequent amendments ; MÜHS, 1986 ; SAINT AUBIN, 1986), and which are the consequences.

SELECTION AND MANAGEMENT OF RISKS

Components of the varietal risk.

Firstly, the risk depends upon the genetic diversity of the variety itself, which results from the number of non-related parents used to create the variety, as well as from the mating pattern and its control (open pollination more or less close to panmixy, controlled pollination according to a given mating design, protoplast fusion...) and "in fine" from the genetic diversity and the mean level of heterozygosity of the genotype mixture which is propagated. It is in fact accepted, and commonly verified that genetic diversity is the safest caution against uncertainty of the future which increases with time.

Even imprecise, the prediction of the risk is usable, if it does not vary with time. For that it is necessary that the variety remains stable and identical to its "original genetic standard", and identifiable from other varieties (to be able to detect and fight against counterfactings). That fact explains the importance of criteria of Distinction, Homogeneity and Stability (D.H.S.) used in the field of varietal creation in cultivated plants.

The method of propagation is an important factor in reproducibility and, in fact, the stability of the variety. It can modify the risk corresponding to a given genetic formula.

For example, the genetic composition of a larch interspecific hybrid variety will change according to the flowering conditions when it is produced by open pollination. The inbreeding rate and the value for use will have then to largely change from on year to another year (FAULKNER, 1986). The vegetative propagation use can also modify the proportions of the different individual genotypes within the variety, if all these genotypes have not the same rooting ability and if the final composition is not controlled (bulk propagation).

When it is not perfectly controlled, the vegetative propagation can also increase the risks evaluated from the starting material, because propagation of virus diseases is easier and production of cuttings with root systems of poorer quality than with seedlings becomes possible. We are not yet able to measure the consequences of some advanced biotechnologies like micropropagation or somatic embryogenesis on large scale production of plants for reforestation.

The ecological risk increases with the mean duration of the revolution (probability of exceptional climatic or phytosanitary events, like winter frosts, drought, storm, disastrous diseases or introduction of an injurious insect).

The risk also increases with the acreage of the reforestation area authorized with one variety (multiplication of the annual reforestation area by the number of years during which the variety is used). Beside the economical risk, the component also expresses the risk of "genetic monotony" resulting from a long and major use of a variety, independently of its own value for use.

Finally, the risk depends upon the conditions of use of the variety, especially the level of heterogeneïty of the ecological conditions of the area reforested and the local frequency of sanitary and climatic adversities. It results also from the level of adequation between ecological and sylvicultural conditions and the type of variety which is used.

The role of the regulation

It is usually thought that the State and the Legislator must favor the general interest rather than the private ones and to prefer a long term benefit to short term advantages. Regarding the choice of forest reproductive material, the problem is mainly to manage the possible contradictions between expected benefits from use of improved varieties and their risks. Compared to the observed situation for annual cultivated plants, the long life of forest trees and the ecological importance of the forest give a particular importance to our own problem.

How, on what principles and by what criterias, is the State able to measure the risk taken by the community when using a given variety ? The answers follow logically from the analysis of the components of the varietal risk made just before. The decision of the "designated authority" to allow trade and use of this given variety depends upon the comparison between the predicted risks (difficult to quantify and to express in probability), and the expected advantages (for a given mean soil and climatic conditions).

Finally, the regulation must effectively allow the users to quickly access to the most performing varieties (OBST, 1986). Two main objectives will be favored by the regulation :

- to increase the diffusion of the performing varieties ;
- to protect the user against the varietal risk.

EUROPEAN COMMUNITY LEGISLATION

Fundamental philosophy

Overall, E.C. legislation aims to offer state protection to users. The state guarantee can be supplied at two levels :

- For selected material, State vouch for the absence of unfavourable characters for silviculture, and its original region of provenance. This guarantee enables the user to avoid two risks : material unsuitable for production purposes, and absence of adaptation to ecological conditions of the corresponding region of provenance (ENESCU, 1986). This category is mainly assigned to generative reproductive material, coming from natural or well acclimated stands. They have therefore, a strong genetic diversity, and a low risk potentiality. Registration needs only rather smooth procedures.

- For tested material, State vouch for the level of superiority in comparison with well-known standards. Although this category can concern superior natural stands, it is mainly of interest for improved varieties bred by Research Institutes. In general, these varieties offer highest performances but also highest risks. State guarantee needs therefore heavier procedure, necessarily longer and more expensive. Guarantee deals with the conditions in which superiority has been observed, and the level for each character.

Consequences

This scheme is well suited with natural stands having a long production period, and capable to move up from one category to another one according to experimental results.

On another hand, breeding works on forest species, achieved during last decades, allow Research Institutes to propagate new varieties, at an increased rhythm for the next coming years.

These improved varieties should be registered as tested materials. However prescribed time which has to be added to a long breeding period, leads to about ten years of delay before commercialization. Consequences for national economy cannot be neglected.

It is sometimes possible to commercialize the reproductive material in "selected" category, waiting for ending of homologation procedures. It is done in France for untested seed orchards. This solution is acceptable for orchards established with trees selected in the same region of provenance. It becomes more and more questionable for latest developments in which genetic gains are calculated on the basis of selection index coming from progeny tests. Moreover it leads to a lack of understanding for users who are inclined to establish a relation between legal category and improvement level.

Furthermore this solution cannot be applied for varieties produced by vegetative propagation or by controlled crosses They cannot be related to the notion of stand, especially when male and female parents are not planted in the same location (some hybrid larch orchards for example).

E.C. directives are consequently well adapted to the protection of user against varietal risk, but to the detriment of a quick propagation of new varieties.

WHAT MODIFICATIONS TO BE SUGGESTED ?

Creation of a transition category

First, it is necessary to strongly declare that user'protection provided by E.C. rules have to be preserved. Therefore, existing categories have not to be called in question, but regulation must be completed to achieve the second objective.

Therefore, it seems necessary to create a third category devoted to receive new varieties for a temporary period.

This category would include for a part, the idea of "untested seed-orchard" which is already existing in OECD scheme. But it would have a wider meaning in order to incorporate any untested improved variety produced by whatever method (sexual, vegetative, or a mixture in bulk propagation). It would be provisionnaly called" predictably improved variety", and characterized by the two following features :

- State is no more in position to provide alone its guarantee, as superiority is not established under its complete control. Varieties are therefore commercialized under common responsability of breeder and national authority. State keeps only a censor right.

- Registration is decided by national authority upon the basis of a technical document. It must include propagation methods, proofs and calculation used to predict superiority, estimation of risks.

In this condition, risk is declared by breeder, evaluated by national authority, then taken by user in the hope of a better productivity.

Regarding the risk taken by users, one has to remember that some forest varieties registered as tested can sometimes give an illusory safety when selection concerns : only one a single trait, a very limited number of traits, an early evaluation, or in most of the case a comparative test in single location (RAU, 1986 ; WÜHLISCH and MÜHS, 1986). In comparison, registration in the new category "predictably improved variety" could bring other guarantees regarding more large scale evaluations and various ecological conditions for each evaluation.

Conditions for the stability of legislative regulations

Creation of this third category could be capable to brake the balance of existing rules. Precautionary measures must be taken, to avoid two difficulties :

Firstly, facilities provided to breeders for commercialization of new varieties insufficiently tested, must not lead to a too heavy risk for users.

It is therefore necessary that administrative authority must be in position to keep the same severity as for tested varieties. Since it is not an objective test, the authority could be subject to diverse pressures. But it is also necessary that authority could base its opinion on irrefutable proofs. Therefore it is necessary that superiority could be really predictable and not only assumed.

Secondly, it is possible to fear a progressive decline of tested category, because breeders will have the opportunity to commercialized their varieties without long and expensive tests. But protection of users suppose that performances of varieties have been evaluated and not only predicted, with numerous possible errors. Therefore it is necessary that the third category be only a transition.

Two supplementary barriers have to be established :

- Registration is only for a limited duration. It could be for five years, with a possibility of extension when waiting for the results of certification tests.

- A variety must be new. Otherwise breeders could be tempted to modify slightly their varieties every 5 years, in order to avoid certification tests. There is nevertheless a difficulty on this point : to have an objective definition of the "novelty" for a variety.

Legislative rules versus improvement level

In E.C. rules there is no link between legal status and improvement level. The difference between the two categories lies only in the level of control applied by national authority. Such a scheme is easily understandable for a jurist, but remains quite hermetic for most users. And so, it leads to an ambiguity between the two notions.

The introduction of a third category could help to clarify the whole situation :

- selected category, would be reserved for natural stands. The notion of "region of provenance" would have no more to be interpreted, as is actually the case, for the registration of seed orchards. This category would include only materials coming from stands well-adapted to defined ecological conditions, with a wide genetic diversity and an acceptable production regarding volume and quality. Such material will present average performances but low risk.

- Predictably improved category, would gather all varieties, still untested by national authority. It would be often characterized by narrower genetic bases, hope for genetic gain and heavy risks.

- Tested category would offer, under state guarantee, a well known improvement level and better controlled risks.

CONCLUSION

Notions of improvement level and risk cannot be disconnected. It is the legislator's responsability to follow the evolution of breeding and to take both notions into account. When legislative rules begin to bridle varieties'creation, legislator has to move in his turn, and to take his own risk. He cannot be only satisfied by the mere user'protection, and he needs to consider that this one is responsible. The user has to appreciate his own policy for weighting performance and risk. The legislator's part is then to provide objective criteria for their evaluation

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THE PRODUCTS OF TREE BREEDING PROGRAMMES AND THE EEC AND OECD FOREST REPRODUCTIVE MATERIAL REGULATIONS

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1. Background

1.1. Tree breeding programmes in Britain for three of our main conifer species Sitka spruce (*Picea sitchensis*), Scots pine (*Pinus sylvestris*) and larch species (*Larix spp*) commenced between 1950 and 1963. These programmes are now advanced to the stage in Sitka spruce and Scots pine where all the 'Candidate Plus Trees' from our original selections are established in progeny trials. A large proportion of these trials are of an age where final selections of clones to be included in our breeding populations have been made on the basis of the superior performance of their families over commercial 'controls' in field tests. A small number of the most superior clones, at any one time, from our Production Population are used to produce commercial quantities of genetically improved material.

1.2. Seed orchards have been established with progeny tested clones of both Sitka spruce and Scots pine. In the case of Scots pine the oldest of the 'progeny-tested seed orchards' was planted in 1977 and is now in full production; the last two seed crops have produced over 25 kg per hectare and the orchard is producing on an annual basis sufficient seed for all the plants required for general planting of Scots pine in Britain. The total yields, individual clone yields and isoenzyme monitoring have been undertaken in the orchard. The calculated genetic gain in volume based on 15 year old progeny trials is 8 % and the form and straightness is 5 %. This genetically improved seed should now be widely used in commercial forestry.

1.3. The Sitka spruce breeding programme is not so advanced, so that the 'progeny tested seed orchards' are only now coming into production. One of these orchards, due to favourable climatic conditions in 1989, flowered well in 1990 with all 45 component clones producing both male and female flowers. Seed production was 7 kg per hectare. The orchard was 6 years old but predictions are that without flowers stimulation Sitka spruce seed orchards will not be in full production until they are between 10 and 15 years of age.

1.4. The calculated genetic gain in volume for that Sitka spruce seed orchard based on 15 year old progeny trials is 15% and the seed should therefore be extensively used in commercial forestry. However the amount of seed will be limited until the grafts have produced sufficiently large crowns to support greater cone crops. Tree breeding programmes are now being evaluated on the basis of genetic gain per unit of time and it is therefore important to find alternative strategies which might enhance the gain per unit of time.

1.5. In the case of Sitka spruce in Britain there are two strategies which are being actively considered or persued. Firstly artificial controlled pollination is being carried out on the most superior genotypes in seed orchards or clone archives using pollen mixtures of 15 to 20 'tested' males. The pollinations provide limited quantities of seed but by intensive raising of plants and two cycles of vegetative propagation by cuttings each seed can produce at least 400 plants. The time between identification of superior genotypes and their use in commercial forestry can be reduced from 15 - 20 years to 8 years. Currently between 3 and 4 million cuttings of genetically improved Sitka spruce are being planted in Britain. A second strategy involves moving away from conventional seed orchards and establishing container-based seed orchards in polythene houses where the constitution of the orchard can be altered as new superior genotypes become available. This type of seed orchard will probably never produce sufficient quantities of open or supplemental pollinated seed for them to be economically viable without resorting to vegetative multiplication. These orchards are very flexible and allow 'bulked family mixtures' to be constructed to meet varying requirements of volume production, stem and crown form and wood quality.

1.6. The larch breeding programme was developed to produce the hybrid between European and Japanese larch. Currently seed orchards have been established with a mixture of European larch and Japanese larch based on at least 20 clones of each species which have relatively well matched flowering times. Flowering times were studied in a clonal archive at one site but when the same clones were assessed in a seed orchard site some 7 degrees in latitude to the south the relative overlap in flowering had changed. The seed orchards are producing seed which is a mixture of pure European larch, pure Japanese larch and an unknown percentage of Hybrid larch. The demand in commercial forestry is for Hybrid larch due to its supposed superior growth rate and reduced susceptibility to larch canker. In order to overcome these problems controlled artificial pollinations are undertaken in either container-based seed orchards in polythene/glasshouses or in conventional seed orchards to produce 'bulk family mixtures' but not all the constituents have been progeny tested. The seed produced is multiplied by vegetative propagation and 1 million cuttings are being produced annually. The cuttings are taken from stock plants which are in 'hedges' with the family mixture changing from year to year.

2. The problem

2.1. The basis for the majority of tree breeding programmes around the world is to produce superior genotypes, for whatever trait, for use in commercial forestry. It has always been assumed that the genetically improved seed or plants will cost more in order to offset some of the costs of production. The EEC and OECD schemes were devised in the 1960s aimed at protecting the consumer or forester planting the material so that they had accurate descriptions of the material which was available. At the time the schemes were drawn up most tree breeding programmes were producing only small quantities of genetically improved seed, if any, and many of the technological advances which have taken place in the last 10 years were not foreseen.

2.2 The EEC Directive 404 only permits the use of vegetative reproductive material derived from Populus spp ; the remaining 13 species only reproductive material produced by sexual means. The Directive has only 2 categories:

a. 'SELECTED' covers open pollinated seed from a phenotypically superior stand (no genetic testing) and by implication, seed from an orchard based on components which have not been progeny-tested;

b. 'TESTED' covers the open pollinated seed from a stand or orchard which has a relatively fixed constitution and from which the commercial seed product has been evaluated in comparative tests.

2.3. The OECD scheme has two additional categories 'SOURCE IDENTIFIED' and 'UNTESTED SEED ORCHARD' The latter category is an intermediate to be used while the 'product' of the seed orchard ist being tested. It does not cover 'supplemental' or 'artificial controlled pollinations' within the seed orchard.

2.4. So far as the United Kingdom is concerned we are anxious to utilise the genetically improved material produced from the tree breeding programme in commercial forestry as soon after they become available as possible. The current

Directives and schemes put some constraint on the marketing of the types of material already mentioned and certainly do not accord any indication of genetic superiority to the material.

3. Discussion

3.1. The majority of the material which has been discussed above can be marketed under both the EEC and OECD schemes if vegetatively reproduced material is accepted and not just sexually reproduced. However, the designated category could only be SELECTED and therefore it does not indicate any SUPERIORITY over unimproved material. Under the EEC Directive the system of derogation could be utilized to market this material but would have to be granted annually or for a slightly extended period. This is not satisfactory in the longer term so in the United Kingdom we see the need to consider changes to both schemes to accommodate the genetically improved material from breeding programmes.

3.2. It is essential that the whole range of 'products' which are not adequately accounted for by the present EEC and OECD schemes are considered and not one or two isolated cases. So far as the United Kingdom is concerned we currently have two different products which we wish to have considered. Firstly there is the product from 'progeny tested seed orchards' which as yet has not itself been tested. We know that this genetically improved material should be SUPERIOR to seed from seed stands and orchards where no progeny testing has been undertaken of the individual constituents. We can make estimates of genetic gain for these orchards based on results of progeny tests and the seed from these orchards should be accorded a category other than SELECTED or UNTESTED SEED ORCHARDS. The current policy regarding the establishment of new seed orchards in the United Kingdom is that they will be of the 'progeny tested type' if all the individual clones will have been evaluated prior to establishing the orchard. It is estimated that these orchards could not be considered for the

TESTED category until at least 25 years after being planted. In the interim the orchards will have produced large quantities of seed which could only be marketed as either SELECTED under EEC or UNTESTED SEED ORCHARD under OECD. This will apply so far as the UK is concerned to *Picea sitchensis*, *Pinus sylvestris* and *Pinus nigra var. maritima*. It is essential that the products from these orchards are widely used in commercial forestry and although this could be done by publicity, their use would be enhanced by considering a new category for 'progeny tested seed orchards'.

3.3 The second type of material concerns the mass vegetative propagation of 'bulked family mixtures'. In the UK the basic material used in the 'bulked family mixtures' is of two types. In the case of Sitka spruce it is 'bulked' seed produced by controlled pollination of progeny tested clones. Only limited quantities of this genetically improved seed is available hence the need to use vegetative multiplication to rapidly increase the number of plants. It could be argued that since the individual clones have been tested, then the basic material could be included in the TESTED category and hence the vegetatively multiplied 'bulked family mixture' could be classified as TESTED. It is the category of the basic material which determines the category of the vegetatively propagated product. The other type of vegetatively propagated material in use in the UK is material from controlled pollinations to produce, 'bulked family mixtures' of hybrid larch. At present no genetical superiority is involved just the production of known hybrid larch. Vegetative multiplication is used purely because there is a shortage of hybrid larch seed. This material would only come into the SELECTED category.

3.4. In the UK clonal forestry is not practised apart for *Populus spp* but in the future 'multiclonal varieties' or 'elite multiclonal varieties' may be utilized. Advances in biotechnology indicate that it will not be long before there will be a range of new products available from tree breeding programmes. It is essential that all the genetically improved material, whether it is produced by sexual or asexual methods, can be readily used in commercial forestry after it has been suitably tested.

3.5. When considering changes in either the EEC or OECD schemes it is necessary to consider whether they are really necessary. In many cases it may be that the Designated Authorities can adapt the Regulations to take account of a national problem, eg by the use of derogation. The advances made in genetical information and in tree breeding programmes since the drafting of the two schemes indicates that the 'genetic quality' of the material being marketed should have a greater emphasis.

We therefore feel that it is necessary to re-evaluate both the EEC and OECD schemes and that any changes should be incorporated into both schemes in order to bring them closer together.

AMF2/3

IS THERE A NEED FOR THE INTRODUCTION OF A NEW CATEGORY IN BOTH THE OECD-SCHEME AND THE EEC-DIRECTIVE GOVERNING THE TRADE WITH FOREST REPRODUCTIVE MATERIAL?

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1. Abstract

The OECD-Scheme for the control of forest reproductive material moving in international trade distinguishes between four categories: source identified, selected, untested seed orchard, and tested reproductive material, while the EEC-Directive comprises only two, selected and tested, and an additional one, which should not be called a category, namely reproductive material with less stringent requirements. The meaning of the categories is explained. Reproductive material is produced using different reproduction methods (sexual, asexual) and different basic material (populations, clones) at different breeding levels. Thus a set of different kinds of reproductive materials is waiting to be released to the market. The question is, are there approval procedures and categories suitable for all the different kinds of reproductive material produced by breeding? In case the question has to be denied, another category is proposed, which could be denoted "predictably genetically improved". This category then contains reproductive material derived from advanced breeding activities, of which genetic gains can be calculated (predicted). The breeder has to test the parent material, which serves as basic material (breeding term) in the breeding programme, but does not simultaneously serve as basic material (legal term) for the production of reproductive material moving into the market. The characteristics of the new category have to be outlined.

In this context a very important problem shall be addressed, which is the maintenance of the genetic diversity in managed forest ecosystems and the risk of genetic contamination by introducing hybrids or genetically modified reproductive material. Arguments are given to restrict the deployment of risky reproductive material by dividing the forest ecosystems into 3 types of differently managed forests.

2. Introduction

Both international rules the OECD-Scheme for the control of forest reproductive material moving in international trade and the EEC-Directive on the marketing of forest reproductive material have three main objectives. They should
- facilitate international trade
- protect consumer s interest
- not govern the deployment of forest reproductive material in practice.

While the OECD-Scheme distinguishes between four categories, which are denoted "source identified", "selected", "untested seed orchard", and "tested" reproductive material, the EEC-Directive comprises only two, "selected" and "tested", and an additional one, which is in fact not a category in its strict sense but a denomination for all reproductive material not satisfying the EEC-Directive. This is called reproductive material "with less stringent requirements."

Differences between both rules can be explained by historical development. While the EEC set up their standards in the mid of the 60ies aiming at the improvement of the genetic quality of forest reproductive material, which is marketed in the member states of the EEC, the OECD would like to have standards, which could be adopted by all countries. Thus the category of source identified reproductive material was introduced, which worldwide is the most important category. It will be shown later that this category often acts as the least common level of agreement, if two countries involved in the trade follow different rules. The question in the past years has been, is it necessary to stay with the four categories or can they be reduced to two categories like in the EEC-Directive. Recently the question arose, whether there is a need for the introduction of an additional category instead of reducing the number of categories, which has been supported by the breeders. In the following some thoughts will be discussed, which may help to focus on the problem more precisely but cannot present solutions.

3. Categories of forest reproductive material and their meaning

The classification into distinct categories of seed, parts of plants and plants being marketed as reproductive material, informs the user about the basic material, from which the reproductive material is derived. Thus the category corresponds to the basic material (Muhs, 1988, see also the contribution on the "harmonization of the OECD-Scheme and the EEC-Directives ruling the trade with forest reproductive material, needs and problems" in these proceedings).

Accordingly, reproductive material of the category "selected" means that its basic material was selected. Consequently, the term "selected reproductive material" is not correct, it should read "reproductive material derived from selected basic material" and the term "tested reproductive material" accordingly, "reproductive material derived from tested basic material."

The approval of the basic material and the classification into a category is done in accordance with the specifications laid down in the rules (OECD-Scheme, Appendix I and II; EEC-Directive, Annex I and II). Thus the category is the result of the approval. In the annexes of the OECD-Scheme and the EEC-Directive, which have main features in common, nothing is said about the ranking of the categories. This is especially true in respect of the genetic quality of the reproductive material. It can be established that there are no reasons to rank for instance reproductive material of the category "selected" higher than "source identified" and less than "from untested seed orchards" or "tested". Let us assume, for example, a seed stand as basic material, which has been categorized one after the other as

- "source identified" by mere declaration and certification without checking of any minimum requirements for the approval except that for regions of provenance
- "selected" after approval satisfying the minimum requirements set up in Appendix I of the OECD-Scheme resp. Annex I of the EEC-Directive, which are dealing with the origin, isolation, uniformity, volume production, wood quality, form or growth habit, health and resistance, effective size of the population, and the age and development, but in such a way that the inheritance of the characters is not considered;
- "tested" after approval satisfying the minimum requirements set up in Appendix II of the OECD-Scheme resp. Annex II of the EEC-Directive, which among other things say that the genetic gain relative to the standard or the superiority in comparison to a standard has to be shown.

The seed stand, which has gone through three categories, is still the same except it has got older when waiting for test results. Assuming that during that period the genotypic composition of the stand did not change considerably, the seed harvested is from the same genetic quality. This example shows that differences between the categories cannot be explained by differences in genetic quality of the reproductive material. But there is a difference in knowledge and confidence to what the reproductive material may be useful for. When marketing it as "source identified" almost nothing is known about phenotypic and genetic characters, the confidence in the genetic quality is very low. After approval as "selected", some phenotypic characters have been assessed and proven to be satisfactory, the probability that the reproductive material performs better than average is high, thus the confidence has increased. After approval as "tested", test results demonstrate the superiority compared to a standard, the confidence has reached a high level.

This example shows that the knowledge and confidence has improved when changing the category, but not the genetic quality. The requirement for getting approval as "tested" by demonstrating the superiority or the genetic gain relative to a standard cannot be interpreted as a genetic superiority of the category "tested" over "category "selected". In this case superiority or genetic gain is compared to a pre-chosen standard and not to the basic material of the category "selected" in general.

If we look at the three categories from another viewpoint, we may observe that reproductive material of the category "tested" grows better on average than that of the category "selected" or "source identified". The reason for this is the elimination of inferior seed stands after assessing the characters according to the requirements for the next category.

It may be expected that reproductive material of the category "source identified" performs averagely, if all stands in a region are potentially belonging to this category. From these stands approximately 1 to 5% may be selected and categorized as "selected". Another 5 to 10% of stands of the category "selected" may be approved as "tested". From these figures we may roughly calculate what gains can be expected using reproductive material from the different categories, if the variation is known.

After it has been shown that the category does not necessarily reflect the genetic quality, it should not be forgotten that this was intended by both the OECD-Scheme and the EEC-Directive. In the OECD-Scheme it says: "..category tested, reproductive material which is genetically improved" and "...the genetic superiority of the basic material shall be proved by tests" and "...the difference in both absolute and relative terms is to be expressed as far as possible as genetic gain relative to the standard".
We can read in the EEC-Directive (75/445): "...the category tested may include only such material as is shown by comparative tests to be genetically superior" and "the difference in both absolute and relative terms shall be expressed as far as possible as genetic gain relative to the standard". It is obvious that both the OECD-Scheme and the EEC-Directive have adopted the same idea, which is the improvement of the genetic quality by introducing the category "tested". But this cannot be warranted by rules for the tests set up in Appendix II resp. Annex II on the requirements for the approval of basic material intended for production of tested reproductive material. The rules prescribe obligatorily the comparative test, because progeny tests must not necessarily satisfy all the require-

ments. Thus genetic gain cannot be calculated in all cases and genetic improvement may not be the appropriate term for the superiority of a reproductive material being tested. This has been considered in the EEC-Directive, in which the term "improved value for use" is used instead (Art. 5b). We may conclude that the intention of introducing genetical terms was not fortunate at that time. The terms "superiority" and "improved value for use" should be preferred, when evaluating results of comparative tests.

4. Relationship between Basic Material and Category

Before discussing a new category it seems to be necessary to reflect on the relationship between the basic material and the category. Basic material is the unit of approval. In both the OECD-Scheme and the EEC-Directive basic material can be a seed stand, a seed orchard or a clone (and clone mixtures and cultivars if applicable). According to the principle of approval the basic material gets approval and reproduces reproductive material (seeds, part of plants and plants), which moves in the market. The principle is based on the physical existence of the basic material and the mode of reproduction (Muhs, 1988). This means, seed stands and seed orchards have to be reproduced sexually and clones have to be reproduced asexually (vegetatively). It is not permitted to market vegetatively propagated reproductive material like rooted cuttings from a seed stand or a seed orchard, or seed harvested from ramets of a clone. As long as there are only a few kinds of basic material (seed stand, seed orchard, cultivar and clone) and two modes of reproduction (sexual and asexual), it is easy to relate them to the categories.

The relationship between basic material and category is shown in the figure. The basic material, which is a result of a selection/breeding activity, is reproduced. The reproductive material may undergo some testing procedures, before the basic material can be approved according to the appropriate category (see the legend of the figure for detailed description of the symbols). The first impression may reflect the complexity of the relationship. Each basic material corresponds to one or more categories, depending on the mode of reproduction and the level of testing. While the mode of reproduction is part of the approval of the basic material, the level of testing is linked to categories. One has to follow the solid lines in the figure to comprehend the realized connections in both the OECD-Scheme and the EEC-Directive, and the broken lines for the connections of interest in future. Both groups of connections are explicitly listed in the table.

If the entire relationship between the basic material and the category shall be explained, it seems to be desirable to include the selection/breeding phase, because the forest management and the forest tree breeders are able to provide selected forest areas or differently produced breeding material. Thus the kind of basic material, whether it is a seed stand, seed orchard, cultivar, clone, clone mixture or cultured tissue, depends on the kind of selection or breeding activities (see figure). For instance phenotypical selection may result in a seed stand (Appendix IA of the OECD-Scheme, Annex IA of the EEC-Directive) or in a seed orchard (Appendix IB resp. Annex IB) or in a clone (Appendix IC resp. Annex IC) or in a clone mixture (clonal mixture, clonal variety). Clone mixtures are not explicitly regulated, therefore their use is not common practice, although not forbidden. For this reason the term "clone mixture" is written in small letters in the figure, but connected with a solid line with term "PHENOTYPICAL SELECTION". Different from the OECD-Scheme, in which phenotypically selected clones are accepted, the EEC-Directive does not allow this. The EEC-Directive Nr. 66/404 was amended in 1975 by the Directive Nr. 75/445, which makes the testing of clones from Populus sp. compulsory. Thus the items in Annex IC are obsolete.

The term "seed orchard" has different meanings. While the OECD does not give any details for the selection of the components of the seed orchard, the EEC-Directive makes selection mandatory. That is the reason, why seed orchards under the OECD-Scheme are approved as category "untested seed orchard", while under the EEC-Directive as category "selected".

The term "cultivar" is only used in the OECD-Scheme, therefore it is put in brackets in the figure. A cultivar can be produced by hybridisation (or as a result of advanced breeding). The peculiarity of the cultivar is that it can be reproduced either sexually or asexually. The term is not common in forest tree breeding, but may be introduced for special breeding products like hybrids which are produced by artificial pollination of one or more females to avoid self-pollination. According to the definition of seed orchard, this type of basic material is not covered by these definitions. If cultivars are reproduced asexually, they can be put on the same level as clones or clone mixtures. Thus the connection from "cultivar" to "asexual reproduction" may become obsolete in future.

Advanced breeding and genetic engineering are breeding activities, which may produce a lot of different kinds of basic material in future. It should be made clear that the term basic material is commonly used in two ways. Breeders start their breeding activities using basic material (breeding term) and end up in a breeding product, which may serve as basic material (legal term) for the approval (Muhs, 1988). In this context basic material (legal term) is meant, if not specified. Beside clone mixtures a new kind of basic material may be introduced, here denoted as "cultured tissue". Cultured tissue may be the result of genetic engineering, which has to be kept in that stage in order to maintain its juvenility for easy multiplication and regeneration to plantlets free of topophysis effects (or aging effects).

Principally there are two different modes of reproduction, sexual and asexual (which is vegetative propagation in almost all cases). A third mode is a combination of both, sexual and asexual, of which the sexual reproduction phase is followed by vegetative multiplication in order to get as many plants as needed from a limited amount of seed. This mode is commonly called bulk propagation (see Muhs, 1988), and can only be applied for basic material particularly destined for sexual reproduction. It does not open a principally new possibility, which will lead to a new category inevitably. But this mode will be preferred in all cases in which seed availability is limited and the vegetative propagation phase is restricted to the first few years of age. In combination with the progeny testing of the parent generation, it may fit well into the new category proposed (see below).

Up to now only comparative testing is accepted in both the OECD-Scheme and the EEC-Directive. Progeny testing, commonly done in advanced breeding may become a second test procedure for the basic material to be approved. The test procedures give different kinds of information. Therefore they cannot be replaced by each other. The comparative test
- may include non related (e.g. different provenances) and/or related (e.g. full sib progenies) reproductive material to be tested,
- can be applied for clones (clonal test),
- has pre-chosen standards, which should be known and used in as many comparative tests as possible (Appendix II, 2a; Annex II 1.1) to give an objective comparison,
- contains reproductive material, which should be representative of the basic material being studied (Appendix II, 2b; Annex II 1.2),

while the progeny test
- includes only related reproductive material
- cannot be applied for clones
- has no pre-chosen standards in the sense of the regulations, but uses instead the family mean for testing the superiority,
- does not contain reproductive material in all cases which is representative of the basic material being studied.

Especially the last item is the most important one, which can be explained by an example as follows: If the components of a seed orchard are selected and progeny tested, the pollen donors are unknown, because open pollinated seed is commonly used. In many cases the pollen donors are not components of the seed orchard to be established according to the test results. Thus the reproductive material being tested is not representative of the basic material. For the comparative test seed is collected from the seed orchard.

The pollen donors are components of the seed orchard and thus the reproductive material being tested is representative of the basic material.

The progeny test provides very useful information for breeders, while the comparative test provides information useful for users. That is the reason, why progeny tests have not been adopted by both the OECD-Scheme and the EEC-Directive. But breeders know that progeny test can also be a source of information useful for the user. Therefore progeny testing may be accepted in future, but it should be distinguished from the comparative test by declaration on the label or by setting up a new category for the progeny tested reproductive material, which could also be called "predictably genetically improved." Progeny tests help to actually improve the basic material genetically, the improvement can be predicted or calculated from the test results.

If the new category proposed should be considered to be necessary or advantageous, the requirements have to be outlined. Examples already exist of progeny tested breeding stock waiting to be approved according to the new category, which could not acquire approval as "tested" because of the missing comparative test. In future there will be an increasing number of new breds coming from advanced breeding preferable as seed orchards or cultivars already progeny tested (see table, cases 4 2 2 2 4 or 4 3 2 2 4). It seems not desirable to market those new breds as "untested seed orchards".

After having adopted the new category it may be discussed, whether the category "untested seed orchards" can be deleted. This category is more like an remnant from the pioneer phase of forest tree breeding. Advanced breeding does not need it any more. Before deletion of the category "untested seed orchard" the requirements for seed orchard in the OECD-Scheme should be changed, so that the seed orchards fit either in category "selected" or in the "new category". By this the total number of categories can be limited to four in the OECD-Scheme, while the number will increase to three in the EEC-Directive or even to four, if the "inofficial category" of reproductive material "with less stringent requirements" is considered to be a category in this sense. Harmonization of both the OECD-Scheme and the EEC--Directive would become much easier.

5. Proposal for a new category

Before proposing a new category its necessity should be proven. If basic material resulting from advanced breeding activities can be tested comparatively, then this seems not to be necessary, because it can be approved as "tested" reproductive material. If basic material cannot be tested comparatively, because it takes too much time from the establishment of the basic material to completion of the testing, it may be necessary to approve the basic material according to the new category. This situation can be illustrated by the following example: Selected parent trees from an advanced breeding programme are progeny tested and used to establish a seed orchard. The first seed can be harvested in that seed orchard after some years. From these seeds plants can be grown to set up a comparative test, which after some 10 - 20 years at the earliest (depending on species) give results for the evaluation procedure according to the requirements for the category "tested". Meanwhile the seed orchard is producing seed over 10 - 20 years, which is not allowed to be harvested, because the seed orchard is not approved. If results of progeny test are acceptable in future, the seed orchard could be approved as "predictably genetically improved" without waiting 10 - 20 years for test results, because these were already available before the establishment of the seed orchard.

There are a lot more examples (see the possibilities listed in the table), which should be carefully analysed, whether they can be categorized in "tested" instead of the "new category". It may also be an alternative to give the basic material the status of a "conditional approval", which can be done after some few years after establishment of the comparative test. In this case test results must be re-examined after some years in intervals to get "full" approval.

At this stage it is too early to reflect on the requirements for the approval of basic material intended for production of reproductive material of the new category. First the cases have to be analysed (see above), then the requirements can be outlined. It is proposed to include only that basic material, which is progeny tested and for which genetic gains for at least one of the characters of growth vigor, adaptation, and resistance can be calculated and hence predicted.

6. Concerns

The public is very much concerned about every new bred to be released to natural ecosystems like the forests, especially if produced by genetic engineering. Some of these concerns may not be justified, but many concerns should be considered carefully. Problems will also be created by the use of clonal reproductive material in clonal forestry, which is assumed to be very important in future forestry. When introducing reproductive material derived from basic material of advanced breeding, hybridisation, and genetic engineering it should undergo an examination considering the following:

- the impact on genetic diversity
- the risk of genetic contamination
- the impact on the entire ecosystem.

We know from many examples that the introduction of a new member in an ecosystem may cause a lot of changes.

In order to avoid an intermixing of largely naturally managed forest ecosystems with new breds, reducing, replacing and contaminating naturally adapted populations, it is proposed to regulate the deployment and use of such new breds by dividing the total forest area into three differently managed types characterized by

- wood plantation, where intensive management for the production of wood has first priority over the social functions of the forested area;
- traditional forest areas, where both functions, the wood production and the social and protection functions have equal weight and have to be integrated in the management;
- natural reserves for different purposes e.g. biotope protection, landscape protection, conservation of genetic resources and other, where wood proproduction has no priority and management should be adapted to meet the social and protection functions, which have highest priority.

In this context it may be proposed to restrict the use of new breds, to the wood plantations only and not to permit any reproductive material of new breds growing in the natural reserve areas (with the potential risk of interfering in the ecosystem). Traditional forestry has to decide to what extent new breds should be planted and where. If social and protection functions predominate in some areas decision should be made even more carefully. Forest Services and private forest owners should cooperate to come to an agreement about the areas for natural reserves, and politicians should help by supporting natural reserves and setting up rules for compensation, taxation, etc. In doing so, foresters and the public could be convinced that protection of natural reserves and use of new breds in forestry do not exclude each other.

7. References

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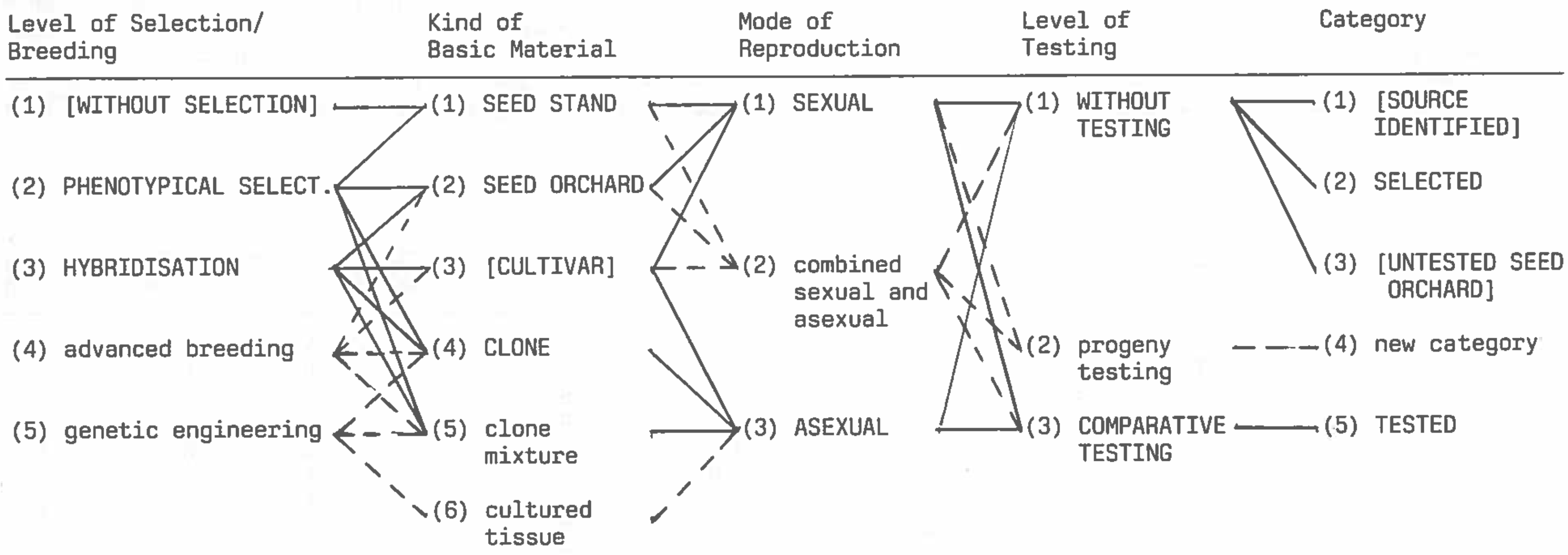
Figure: Relationship between Basic Material and Category



Legend: The figure should be read from left to right in the following way: Activities in selection and breeding produces some kind of basic material, which is reproduced by one of the modes of reproduction, then the reproductive material may undergo some testing, before the basic material can be approved according to one of the categories. Terms in capital letters indicate the existing situation as adopted by the OECD-Scheme and by the EEC-Directive (except those in brackets). Terms in small letters are not considered till now, but should be after amendment. There is an exception with "advanced breeding", which is written in small letters, although basic material produced by advanced breeding has been approved in some cases already. Solid lines indicate usual connections adopted by both the OECD-Scheme and the EEC-Directive, broken lines indicate connections not adopted so far. Missing connections are indicating unusual, not desirable or not accepted cases.

*Combined sexual and asexual reproduction is often called bulk propagation (see Muhs, 1988).

Table: Realized Case corresponding to the numbers in the figure (left)
Cases, which may be realized after having adopted the proposals for amendment (right)

Level Select.	Basic Nat.	Mode Repro.	Level Test.	Categ.	Realized in
1	1	1	1	1	0
2	1	1	1	2	0 E
2	1	1	3	5	0 E
2	2	1	1	3	0
2	2	1	3	5	0 E
2	4	3	1	2	0
2	4	3	3	5	0 E
2	5	3	1	2	0
2	5	3	3	5	0 E
3	2	1	1*	3	0
3	2	1	3	5	0 E
3	3	1	3	5	0
3	3	3	3	5	0
3	4	3	3	5	0 E
3	5	3	3	5	0 E

0 = realized in the OECD-Scheme
E = realized in the EEC-Directive
*) = after early testing

Level Select.	Basic Mat.	Mode Repro.	Level Test.	Categ.
2	1	2	1	2
2	1	2	3	5
2	2	2	1	2
2	2	2	2	4
2	2	2	3	5
3	2	2	2	4
3	2	2	3	5
3	3	2	2	4
3	3	2	3	5
4	2	1	2	4
4	2	1	3	5
4	2	2	2	4
4	2	2	3	5
4	3	1	2	4
4	3	1	3	5
4	3	2	2	4
4	3	2	3	5
4	4	3	3	5
4	5	3	3	5
5	4	3	3	5
5	5	3	3	5
5	6	3	3	5

Legend: The left table contains realized cases as indicated by solid lines in the figure. The numbers should be read as follows: for example 1 1 1 1 1 0 means: (1) Without selection, a (1) seed stand is chosen, producing seed by (1) sexual reproduction, which is (1) without testing approved as (1) source identified reproductive material. This case is only realized by (0) the OECD-Scheme. Another example 3 4 3 3 5 OE means: From a (3) hybridisation program a (4) clone is selected, which reproduces (3) asexually (vegetatively) reproductive material undergoing a (3) comparative test and is approved as (5) tested reproductive material. This case is realized in both the OECD-Scheme and the EEC-Directive.
The right table consists of totally 22 cases, which are marked at least by one broken line each.

PROBLEMS OF COORDINATION CONCERNING EXTERNAL QUALITY STANDARDS OF EEC AND ISTA REGULATIONS

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ABSTRACT

The application of ISTA rules to the EEC Directive 71/161/EEC of 30 March 1971 on external quality standards for forest reproductive material clarifies the method of applying the EEC regulations.

The EEC regulations contain definitions which are unknown in the ISTA regulations, for instance

- specific purity
- viable seeds per kilogramme of product marketed as seed.

The application of ISTA rules shows possibilities of a reasonable interpretation of these definitions.

Under the EEC regulations conditions were introduced which seed must satisfy if it should be marketed. These conditions are sometimes too stringent with regard to the natural preconditions, for example for domestic oaks.

Methods of determination are normally not yet available for species of the same genus. The methods of determination for domestic oaks are not precise enough to control, whether the EC requirements are met. Research is needed.

ZUSAMMENFASSUNG

Die Anwendung der ISTA-Regeln auf die EG-Richtlinie 71/161/EWG vom 30. März 1971 über Normen für die Beschaffenheit von forstlichem Vermehrungsgut klärt die Art und Weise der Anwendung der EG-Regelungen.

Die EG-Regelungen enthalten Definitionen, die in den ISTA-Regelungen unbekannt sind, z. B.

- spezifische Reinheit
- lebende Keime pro Kilogramm des als Saatgut in den Verkehr gebrachten Erzeugnisses.

Die Anwendung der ISTA-Regelungen zeigt Möglichkeiten einer vernünftigen Interpretation dieser Begriffe auf.

Die EG-Regelungen haben Anforderungen eingeführt, denen Saatgut entsprechen muß, wenn es in den Verkehr gebracht werden soll. Diese Anforderungen sind manchmal

zu streng im Hinblick auf die natürlichen Vorausetzungen, z. B. bei den einheimischen Eichen.

Unterscheidungsmethoden für Arten der gleichen Gattung stehen in der Regel noch nicht zur Verfügung. Die Unterscheidungsmethoden für die einheimischen Eichen sind noch nicht präzise genug, um zu kontrollieren, ob die EG-Anforderungen erreicht werden; Forschung ist erforderlich.

1. Legal Regulations and ISTA Regulations

1.1 EEC Regulations

The application of Council Directive 71/161/EEC of 30 March 1971 on external quality standards for forest reproductive material marketed within the Community raises a lot of problems. The Directive has been in force for nearly 20 years. Step by step we gather experience with its application and step by step we see the problems involved more clearly.

Let us have a look at this regulation.

1.1.1 Article 5, Paragraph 1 reads:

The member states shall provide that seed may not be placed on the market unless it satisfies the conditions laid down in Annex 1.

Annex 1 has the following wording:

ANNEX 1

CONDITIONS WHICH SEEDS MUST SATISFY

1.1 Fruits and seeds must satisfy the following conditions as regards their specific purity:

	Maximum content of fruits and seeds of other forest tree species (% of weight)
Abies alba Mill	*0.1*
Fagus sylvatica L.	*0.1*
Larix decidua Mill.	*0.5*[1]
Larix leptolepis (Sieb. and Zucc.) Gord.	*0.5*[1]
Picea abies Karst.	*0.5*
Picea sitchensis Trautv. et Mey	*0.5*
Pinus nigra Arn.	*0.5*
Pinus sylvestris L.	*0.5*
Pinus strobus L.	*0.5*
Pseudotsuga taxifolia (Poir.) Britt.	*0.5*
Quercus borealis Michx.	*0.1*
Quercus pedunculata Ehrh.	*0.1*[2]
Quercus sessiliflora Sal.	*0.1*[2]

1 *If not more than 1 % of other Larix seeds is present this is not considered to be an impurity.*
2 *If not more than 1 % of other Quercus seeds is present this is not considered to be an imputiry*

1.2 Harmful organisms which reduce the usefulness of the seeds shall be at the lowest possible level.

1.1.2 Article 10 has the following wording:

The Member States shall provide that, when seed is placed on the market, the following additional information be given in the document required under Article 9 of the Council Directive of 14 June 1966;

(a) the words "EEC Standard"
(b) the number of viable seeds per kilogramme of product marketed as seed
(c) the purity
(d) the germination of the pure seed
(e) the weight per 1000 seeds of the lot
(f) where appropriate, a statement that the seed has been kept in old storage.

1.1.3 Article 12 reads:

The Member States shall take all measures necessary to ensure compliance with the provisions of this Directive which concern seed, by official control in the form of check sampling at least. Official controls shall be carried out in accordance with current international methods, in so far as such methods exist.

1.2 ISTA Regulations

The International Seed Testing Association (ISTA) has developed a lot of regulations for testing the external quality of seeds. The current regulations are published in "Seed Science and Technology" Volume 13, 1985, pp.1 - 241.

2 Conditions which seeds must satisfy

2.1 Explanation of the conditions of Annex 1

Annex 1 of the EEC Directive lays down the conditions which seeds must satisfy. The conditions concern the specific purity of fruits and seeds of all species which are subject to this Directive. Only poplar is not included. The conditions for specific purity require that the percentage of weight of other forest tree species may not be higher than the maximum percentage given in Annex 1.

We have to distinguish the following 4 groups:

1st group:
Abies alba (silver fir)
Fagus sylvatica (common beech)
Quercus borealis (red oak)
The maximum percentage of fruits and seeds of other forest tree species may be 0.1 %.

2nd group includes:
Picea abies (Norway spruce)
Picea sitchensis (Sitka spruce)
Pinus nigra (black pine)
Pinus sylvestris (Scots pine)
Pinus strobus (Weymouth pine)
The maximum percentage permitted is 0.5 %.

3rd group includes:
Larix decidua (European larch)
Larix leptolepis (Japanese larch)

The maximum percentage is 0.5 %. There are other conditions: The presence of other Larix species of not more than 1 % is not considered to be an impurity.

4th group: Quercus robur (pendulate oak)
Quercus petraea (European oak)
The highest percentage of other forest tree species is 0.1 %, but if not more than 1 % of other Quercus seeds is present, this is not considered to be an impurity.

2.2 Problems of application of Annex 1

This regulation raises the problems outlined below. ISTA rules are not very helpful because specific purity does not exist in ISTA rules.

2.2.1 *First problem: determination of species of the same genus*

The determination of species is a big problem, if only seed and not a whole tree is available. Normally, it is not possible to distinguish different species of the same genus.

For instance:

The specialists of the seed testing station are not able to distinguish seed of
Picea abies and Picea omorica
Fagus sylvatica and Fagus orientalis
Pinus sylvestris and Pinus nigra or Pinus mugo
Larix decidua and Larix kaempferi .

But the specialits are able to distinguish seeds of Quercus petraea and Quercus robur and vice versa, but not to the extent required by the EEC Directive.

It is possible to reach the required standard of the EEC Directive, if the seeds are collected in approved pure stands without trees of a species of the same genus. But we are not able to control, whether the conditions for specific purity concerning species of the same genus are met or not.

My idea is that at the present stage the testing authority should work on the information given by the seed dealer or forest owner. If the seed dealer or forest owner state that the species of the seed sample is Picea abies, this information should determine the species in spite of the fact that other species of the same genus may be included. But the testing authority should give all information about other species which it is able to provide. On the document may be mentioned that there are no means for a differentiation of species from the same genus.

I would like to express my wish for more research in this field which is geared to precisely determine pure species.

2.2.2 *Second problem: definition of other forest tree species*

It is quite clear that the non-forest species and normal plants are not included. But the question is which forest tree species are included

- only the species mentioned in the Directive
- forest tree species from the EC region
- forest tree species from oll over the world.

The proposal is that all species should be included which may be present in a marketed seed lot in our region, that means we should include as other forest tree species all forest tree species of the northern temperate climate zone. Seed testing stations should agree on a list of these species.

Looking at larch and oak we should handle the problem of other Larix or Quercus species in the same way.

2.2.3 *Third problem: reference quantity*

What is the reference quantity for the maximum percentage of other forest tree species? There exist several possibilities. Should we take as reference quantity
- the whole seed lot
- the pure seeds and other seeds or other tree seeds
- the pure seeds.

Specific purity is not subject to the ISTA rules. ISTA only provides for rules on purity. ISTA distinguishes 3 goups in a seed lot:
- pure seed
- other seed
- inert matter, for example small stones, foliage and so on.

ISTA gives in the context of seed purity in its testing documents (orange certificate) the weight percentage of these 3 groups in reference to the whole sample.

If this is the objective of coordinations between ISTA and EEC regulations the whole seed sample should be taken as a basis for the percentage of other forest tree species.

By changing the percentage of inert matter or other non-forest species by adding this material to the seed lot, one can reach a more favourable percentage of other forest tree species. But one can recognize these operations in the accompanying document and therefore it will not be done.

2.2.4 *Fourth problem: the domestic oak problem*

The biggest problem in this context lies in the field of the external quality of our two domestic oaks, Quercus petraea and Quercus robur.

This problem is due to the following facts:
- the mixture of the two oaks in approved stands
- the lack of sufficient differentiation possibilities for the fruits to the extent required by the EEC Directive.

In a seed lot of Quercus robur you find most part of the fruits with intensive stripes, but about 10 % of the fruits show less intensive stripes.

In a seed lot of Quercus petraea one can see that nearly all fruits show no stripes, some fruits have also less intensive stripes.

Fruits with less intensive stripes can be Quercus petraea or Quercus robur.

In my opinion there exist the following solutions:

- to delete the two oaks from the list in Annex 1, until we have gathered more knowledge of how to distinguish seeds of these two oaks

- to introduce for these tow oaks two different categories for the external quality of oak

  Category A corresponds to the conditions in Annex 1

  Category B a percentage of 10 to 15 % of other oaks is not considered to be an impurity.

3. Information on the accompanying document

3.1 <u>First information: EEC standard</u>

In the document the words "EEC standard" show that the conditions of Annex 1 are met. If the conditions of Annex 1 are not fulfilled, the seed lot is not allowed to be marketed.

3.2 <u>Second information: number of viable seeds per kilogramme of product marketed as seed</u>

This information can be obtained by calculation, if the following information about

- purity
- germination
- weight of thousand seeds of the seed lot

is available. We'll come back later to this point.

3.3 <u>Third information: purity</u>

As I mentioned earlier ISTA divides a seed lot into the following groups:

- pure seeds
- other seeds
- inert matter (small stones and so on)

By this information purity is characterized. ISTA gives for these three groups of a seed lot the weight percentage of each group in reference to the total weight of the seed sample.

Another problem is - as mentioned earlier - to distinguish pure seeds of a certain species from other seeds of the same genus.

On the other hand, the EEC Directive concerning purity can be practiced following completely the ISTA rules.

One could imagine that the information is given in the following way:

<u>1. Example</u>

pure seeds	92.0 %	Abies alba
other seeds	1.0 %	(Crataegus 0.9 %, Picea 0.1 %)

inert matter	7.0 %	(small stones)
total	100 %	

2. Example

pure seeds	90.0 %	Quercus robur (5 % fruits with less intensive stripes)
other seeds	2.0 %	(Crataegus 1.5 %, Quercus petraea 0.5 %)
inert matter	8.0 %	
Total	100 %	

3.4 Fourth information: germination of the pure seed

The germination test is a very important goal of the ISTA rules. But the problem is that germination tests normally take several weeks. The longest test period is needed for Fagus sylvatica 28 - 182 days, the shortest test period for Pinus nigra and Pinus sylvestris 14 days, for other species 21 - 49 days.

The test period may change, if tests are carried out in practice. The ISTA station normally provides the following analysis results:

- normal seedlings
- fresh seeds
- abnormal seedlings
- dead seeds
- empty seeds.

The results are given as a percentage of the number of seed which is subject to the analysis.

The main problem of this kind of investigation is that the test takes too much time. Very often there is a need or wish to sell material, when germination tests are not yet finished. The tetrasolium test offers the possibility to get results in 3 days. The test is officially conducted by ISTA for the following species which are covered by the EEC Directive:

- Abies alba

  Fagus sylvatica
- Pinus strobus
- Pseudotsuga menziesii.

The test can also be carried out for the other species mentioned in the EEC Directive. ISTA stations provide the following information:

- percentage of viable seed (red seeds)
- percentage of dead seeds
- percentage of empty seeds.

The reference basis is the number of seeds which are subject to the analysis.

I understand the wording of the EEC Directive in the sense that the tetrasolium test is also admitted. It should be mentioned on the accompanying document, if the tetrasolium test or the germination test was applied. Furthermore, the accompanying document should contain the analysis results for all groups of seedlings or seed.

3.5 Fifth information: the weight of 1,000 seeds of the lot

According to the ISTA rules the weight of 1,000 seeds of the lot is given in grammes. Reference is made to pure seeds, not to the whole seed lot, as one can gather from the wording of the Directive.

The moisture content has a very great influence on the weight of 1,000 seeds.

3.6 Sixth information: the number of viable seeds per kilogramme of the product marketed as seed

With this point now we come back to our point 3.2 which we had dropped.

By the germination test or the tetrasolium test we know the percentage of viable seeds depending on the number of seeds.

In the case of germination tests we should include as viable seeds

- normal seedlings and
- fresh seeds.

In the case of the tetrasolium tests the red seeds, i. e. the seeds with viability, should be included as viable seeds.

The calculation for the position is the following:

number of viable seeds per kilogramme of product marketed as seed

=

$$\dots \frac{\text{\% purity x } \dots\dots \text{ \% germination . 100}}{\text{weight of 1,000 seeds (g)}}$$

The question may be raised, if it is necessary to provide calculated data instead of original data in a document on the marketing of seeds.

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CHARACTERIZATION OF THE POLISH NORM FOR TREE PLANTS PRODUCED IN PLASTIC TUNNELS FOR FOREST PLANTATIONS AND TREE-PLANTINGS

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ABSTRACT

Before 1960, one applied in Poland norms for individual tree species. In 1967 and then in 1976, new improved versions of the norms were established. The last one is still operative, it involves 123 species (15 coniferous and 108 deciduous ones).
The development of plant production in controlled environment (plastic tunnels, glasshouses, frames) necessitated the elaboration in 1982 of a new norm for reproductive material - tree plants from controlled conditions for forest plantations and tree-plantings.
The norm involves only 26 tree species from generative reproduction, therefrom 11 coniferous and 15 deciduous species.

CHARAKTERISTIK DER POLNISCHEN NORM FÜR BAUMPFLANZEN AUS FOLIENZELTEN FÜR FORSTKULTUREN UND PLANTAGEN

Vor 1960 gab es in Polen Normen nur für die einzelnen Baumarten. Im Jahre 1967 erschien eine Norm, welche die Anforderüngen für 110 Nadel- und Laubbaumarten umfaßte (BN-67/9212-02). Im Jahre 1976 hat man eine neue, verbesserte Version aufgestellt, die bis jetzt gilt. In die neue Norm hat man ein wesentliches Meßelement eingeführt, nämlich die Stärke der Pflanzen im Wurzelhals. Dies ist polnische Norm für Pflanzmaterial von Bäumen und Sträuchern für Forstkulturen, Plantagen und Flurholz (BN-76/ 9212-02), erarbeitet durch das Forstliche Forschungsinstitut. Die Norm ist verbindlich für die Produktion und den Umsatz seit Anfang 1977.

Gegenstand der Norm sind Pflanzen der Arten, Varietäten und Kultivare von Bäumen und Sträuchern produziert in Forst- und Flurholz-Baumschulen. Sie bestimmt auch die Etikettierung, Aufbewahrung, Verpackung, den Transport und die Untersuchung dieser Pflanzen. In der Norm sind 123 Arten, davon 15 Nadel- und 108 Laubarten, berücksichtigt. Die Norm findet Anwendung sowohl im inneren wie im Handels-Pflanzenumsatz.

Die Entwicklung der Pflanzenproduktion in kontrollierter Umwelt, insbesondere in Folienzelten, versetzte uns in die Notwendigkeit, eine Norm für derartige Pflanzen aufzustellen. Gegenstand dieses Referates ist die Fachnorm BN-82/9212-03 für Pflanzmaterial - Pflanzen aus kontrollierten Bedingungen für Forstkulturen und Plantagen. Die Norm gilt seit 1. Januar 1983. Sie wurde durch das Forstliche Forschungsinstitut erarbeitet. Es ist eine neue Bearbeitung und stellt eine Erweiterung und Ergänzung der Norm BN-76/9212-02 für Pflanzen, produziert unter kontrollierten Bedingungen (Folienzelte, Glashäuser, Frühbeete) dar.

Die Anzucht der Pflanzen unter kontrollierten Bedingungen sichert ihnen bessere Wärme- und Feuchtigkeitsverhältnisse als es auf offener Fläche der Baumschule gibt. Die Möglichkeit der Erreichung optimalen Mikroklimas im Rauminnern läßt eine intensivere und ausgiebigere Produktion der Pflanzen zu. Sie erreichen in kurzer Zeit beträchtliche Ausmaße. Man erreicht dabei größere Saatausgiebigkeit und in diesem Zusammenhang bedeutende Sameneinsparung als auf offener Fläche.

Die Norm umfaßt 26 Baumarten aus generativer Vermehrung, davon 11 Nadel- und 15 Laubarten. Sie ist verbindlich im inneren und im Handelsumsatz von Pflanzen für Forstkulturen und Plantagen. Die Norm ist auf Messungen biometrischer Merkmale gestützt, solcher wie Trieb- und Wurzellänge, Stärke am Wurzelhals, Gewicht der Triebe und der Wurzeln. Diese Angaben ermöglichen bei der Begutachtung der Pflanzen die Methode von Schmidt-Vogt - der kleinsten zulässigen Stärke und des Nutzwertes der Pflanzen durch die Bestimmung des Verhältnisses des Gewichtes der Triebe zum Gewicht der Wurzeln - anzuwenden.

In die Norm wurden folgende Bezeichnungen eingeführt: Substrat - organisches und anorganisches Material mit bestimmter Azidität und eventuell angereichert mit Zusatz von Mineraldüngern, ausgenutzt anstelle von Boden zur Pflanzenproduktion; hinsichtlich der Zusammensetzung unterschied man einheitliches Substrat (z.B. Torfsubstrat) oder gemischtes Substrat (z.B. Sand und Torf), als auch Saatbett - ausgelegte Schicht des Substrats oder des anstehenden Bodens, vorbereitet zur Pflanzenproduktion.

In der Norm gibt es auch solche Bezeichnungen wie: Pflanzenstamm, verschulte Pflanze, Skelettwurzeln, Warzelballen, Beschädigungen, Partie Pflanzmaterial, Pflanzenprobe usw.
Die Pflanzen sind in zwei Gruppen eingeteilt: A-Pflanzen der Nadelbäume, B-Pflanzen der Laubbäume. Pflanzen für Forstkulturen und Plantagen sind in Abhängigkeit vom Alter in Typen, bezeichnet mit Symbolen, eingeteilt. Pflanzen der Bäume für Forstkulturen und Plantagen, produziert unter kontrollierten Bedingungen, zählt man zum Untertyp "Pflanzen aus kontrollierten Bedingungen" und bezeichnet sie bei der Angabe des Produktionssymbols mit Buchstaben k.

Jeden der Untertypen von Pflanzen für Forstkulturen und Plantagen teilt man in Abhängigkeit von Güte in zwei Klassen ein: I und II. Ein Beispiel der Bezeichnung zweijähriger unverschulter Pflanzen aus kontrollierten Bedingungen II. Güteklasse: Edeltanne 2/0 k II BN-82/9212-03.

Die Pflanzen der Bäume für Forstkulturen und Plantagen müssen folgenden Anforderungen entsprechen:

- die Endknospe am Pflanzenstamm soll gesund und gut ausgebildet sein,
- die Höhe der Pflanzen für Forstkulturen und Plantagen, bei welchen nur das Minimalausmaß angegeben ist, darf nicht den doppelten Wert dieses Ausmaßes überschreiten,
- unzulässig sind Beschädigungen, Nekrosen, Verwelken, Runzelung der Pflanzenrinde,
- unzulässig sind Zwieseln und Vielstämmigkeit,
- Kronentriebe der Nadelbaumpflanzen dürfen nicht beschnitten werden, bei Laubbaumpflanzen kann die Hälfte der Kronentriebe beschnitten werden,
- das Wurzelsystem soll zusammengedrängt sein,
- wenn bei einer Pflanze sogar eines der mit der Norm bestimmten Elemente den Anforderungen der I. Klasse nicht entspricht, dann zählt man sie zur II. Güteklasse.

Genaue Anforderungen hinsichtlich der Pflanzen von Nadel- und Laubbaumarten für Forstkulturen und Plantagen sind in entsprechenden Tabellen dargestellt. Die Tabellen enthalten: Produktionssymbol, Güteklasse, Höhe des oberirdischen Teiles in cm, Durchmesser im Wurzelhals in mm, Wurzellänge in cm und Bemerkungen. Für die einzelnen Arten sind polnische und lateinische Namen angegeben. In der Norm wurden folgende Nadelbaumarten berücksichtigt: Pseudotsuga menziesii (Mirb.) Franco, Abies alba Mill. (Abies pectinata DC), Abies grandis Lindley, Larix decidua Mill. (Larix europaea DC), Pinus nigra Arnold, Pinus mughus Scop., Pinus strobus L., Pinus sylvestris L., Picea excelsa Link. (Picea abies/L.Karst), Picea pungens Engelm., Thuja occidentalis L.; Laubbaumarten: Betula verrucosa (Betula pendula Roth.), Fagus silvatica L., Quercus robur L. (Quercus pedunculata Ehrh.), Quercus rubra L., Carpinus betulus L., Fraxinus excelsior L., Aesculus hippocastanum L., Acer platanoides L., Acer pseudoplatanus L., Acer negundo L., Tilia cordata Mill. (Tilia parvifolia Ehrh.), Alnus glutinosa Gaertn., Alnus incana Mnch., Robinia pseudoacacia L., Populus tremula L.

In Bemerkungen bei der Douglasie und der Großen Kalifornischen Tanne hat man Vorbehalt gemacht, daß die Pflanzen dieser Arten für Verschulung in Containern oder auf offener Fläche bestimmt sind. Pflanzen der Europäischen Lärche und der Gemeinen Fichte, bestimmt für Plantagen, bedürfen der Verschulung auf offener Fläche nach dem zweiten Jahr. Birken- und teilweise Erlenpflanzen bedürfen der Verschulung nach dem ersten Produktionsjahr. Bei zweijährigem Produktionszyklus der Pflanzen von Weymouthskiefer und Gemeiner Kiefer hat man empfohlen, die Folie bis zur ersten Julidekade abzunehmen, um der Entstehung eines zweiten Zuwachses vorzubeugen.

Auf Wunsch des Abnehmers stellt der Produzent einen Herkunftsschein für jede Partie Pflanzmaterial aus, in welchem folgende Angaben enthalten sind:
- Name und Anschrift des Produzenten,
- Nummer (des Herkunftsscheines),
- Gattung, Art und botanische Varietät in polnischer und lateinischer Sprache,
- Produktionssymbol (für Pflanzen für Forstkulturen und Plantagen),
- Symbol des Waldwuchsgebietes und -bezirkes, sowie Ort des anerkannten Samenbestandes (oder Samenplantage), in welchem die Samen zur Pflanzenproduktion gewonnen wurden,
- Güteklasse der Pflanzen,
- allgemeiner Gesundheitszustand (nach Augenschätzung),
- Datum der Ausstellung des Scheines,
- Unterschrift und Stellung der Person, welche den Schein ausgestellt hat.

Man unterscheidet drei Perioden der Pflanzenaufbewahrung: vom Herbst über Winter, Frühjahrsaufbewahrung und kurzfristige Aufbewahrung (Einschlagen für eine Zeit bis 6 Tage). Pflanzen der Laubbaumarten aus kontrollierten Bedingungen können für alle drei Perioden aufbewahrt werden, während die Pflanzen der Nadelbaumarten nur im Frühjahr und kurzfristig gelagert werden.

Die Verpackung erfolgt in Kästen und Ballots. Jede Pflanzenpartie soll vor der Einpackung bei dem Produzenten geprüft werden. Die Größe der Probe zur Prüfung und die Zahl fehlerhafter Pflanzen hängen von der Größe der Partie Pflanzen in der Probe ab. Jede Pflanze von einer Probe wird genau beschaut und ihre in den allgemeinen und eingehenden Güte-Anforderungen bestimmten Parameter werden gemessen. Eine Pflanze wird bereits als fehlerhaft angesehen, sogar wenn sie nur hinsichtlich eines Parameters den Anforderungen nicht entspricht. Eine Partie Pflanzen, welche der Norm nicht entspricht, kann nochmals sortiert und geprüft werden. Die Ergebnisse der wiederholten Prüfung sind sodann endgültig.

IMPORT OF FOREST REPRODUCTIVE MATERIAL. POLICY AND RULES.

Peter Krutzsch, National Board of Forestry, Sweden

The transfer of forest reproductive material goes as far back as the cultivation of forests - or still further as probably to the seeding of oak, beech and cherry for primarily non-forest use. transfer has been a story of trial and error for a very long time. Only recently, one could say, scientific knowledge has been obtained.

The importance of these transfers is tremendous. The possible outcome varies from total disaster to outstanding good results. The general motive for seed transfer is, that a certain material (species and/or provenance) is more suitable on certain sites than the original material.

This new material may be safer in cultivation, or less complicated with regard to pests and deseaes. It may produce more volume, or a higher yield and/or a special yield, a higher value. It may also be of special environmental interest.

One amazing fact: Generally, at least in Sweden, the use of the non-local material is more profitable.

The choice of the best source and a proper ranking of different options require profound knowledge - normally built on long (how long ?) experience.

One obstacle, badly interfering with our intentions to use the best material, is the difficulty to obtain it. It may be that this material is scarce in general (high altitude seed) or scarce just because of long intervalls between seed years. Then the choice of some substitute becomes necessary and the question is: how far from optimum is this substitute still acceptable, still good ?

Another obstacle, not necessarily following natural laws, is the price of our reproductive material. Certainly, a scarce and very special material will have a higher price than a common one, but price per se does not reflect suitability or fitness for the planting site. How often does the price influence the choice of planting stock ? How often is a cheap, perhaps surplus plantstock of doubtful or inferior value chosen for the sake of its price tag ?

The problem we are facing is to choose a good or, if possible, the best suited reforestation stock. The problem exists already with regard to the use and transfer of domestic material. The importation of forest reproductive material, which is our concern here, is just a little more long distance transfer. The length of transport is not necessarily correlated to the genetic distance between local source and new source. Neither has the distance of transport anything to do with the new source's superiority.

In most countries the forest law compels the forest owner to reforestate forest land or to plant forest on land not used for other purposess. This basic claim may be accompanied by regulations prescribing the use of certain species and/or provenances - alternatively forbidding the use of certain material. The regulations may exist for domestic material only or for both domestic and foreign material - or even just for foreign sources.

We should look closer at the motives for these regulations, at the thresholds applied, at the responisiblity following those regulations and finally of course ask ourselves if regulations are called for. One point of consideration is also the international character which these regulations assume automatically, when transfer = importation is compulsory or forbidden.

The Swedish situation is shown in table 1. (The figures are approximations and show an average of the last few years).

The amounts imported are given in percentage (2) of the total demand (1), in order to show the degree of dependance on foreign material. The motives for these importations are different and in this respect the last column (4) perhaps is conclusive: The better knowledge, the stricter the legislation.

Scots pine is the species most used and the one we know most about (knowledge 5). For very strong reasons the legislator decided very early to put a major ban on importations and draw up rules for the domestic use and transfer. Some quantities are imported from Finland. Since domestic sources for the high altitudes in the North are not readily available, we have to rely on North Finnish sources. These sources are of the same hardiness and also in other respects comparable. Small importations from Norway, mostly of close-to- the-border sources, satisfy temporary shortage. Approximately 90 % of our Swedish seed is harvested in seed orchards (some 20 active) and even for these, the use is regulated in the Forest Act.

Norway spruce is our second-most important forest species. And of course, even Norway spruce is well studied. The importation is strictly regulated - some 80 million of seedlings are of foreign origin. Importations are restricted to eastern sources - and there to regions earlier inspected and phenotypically approved of by the National Board of Forestry. The motive for importation is quite clear: A considerable superior material for southern Sweden, phenologically safe with a higher yield. The seed in general is less expensive than our own - however this does not seem to motivate importations.

Lodge pole pine, our third and quite new species, now on half-a-million hectares. All seed is imported from Northern BC.

and the Yukon Territory. Good knowledge of provenance behavior enabled the legislator to draw up a strict regulation of imports and provenance transfer. The motive for importation is clearly a higher yield for lodge pole pine. Properly used, it outgrows our local sources by 20 to 30 %. The use of lodgepole pine is restricted even beyond the transfer regulations: There is an altitudinal border in the north - and also a southern latitudinal limit. The annual area of planting is restricted and some other conditions to protect environmental interests are in force.

After these three main species in Swedish Forestry - where good knowledge and clear motivations of silvicultural nature exist, follows a list of species which are imported on less stringent reasons.

Black spruce only quite recently came into focus. All of it is imported from the northern parts of its natural habitat. Importation is regulated, but not the use within the country. The motive is silvicultural: It seems to be a species for the frost-stricken sites, where none of our own species will grow into any useful forest.

Sitka spruce is regarded as a potential species in Swedish forestry. In spite of limited knowledge of transfer and proper use, importation is restricted. The species is frequently used in Central Europe - normally with sources not hardy enough for northern conditions. The restrictions are aiming to prevent the importation of these "Central European" sources and to further the importation of more northern sources from Canada.

Douglas fir, right now, is of little interest only. Our provenance knowledge is limited. There are no restrictions on importation, however strong recommendations are issued: Do not use Central European sources or sources from the US. Canadian sources are hardier and seem to be the only suitable ones.

Planting or cultivating broad leave species is a rather new phenomenon in Swedish forestry. 10 years ago, no forester ever planted any tree of that kind, and birch he regarded as a weed. Only in landscaping and gardening broad leave species were used. The earlier restriction on the importation of most deciduous tree species were removed in the Forest Act of 1979. Now only the importation of birch, oak, alder and beech is under the control of the Forest Act.

Allthough only comparatively small quantities are planted, mostly in afforestations of overflow farm land, almost every plant comes from foreign sources. This supply situation is not satisfactory. The motive for importation is the lack of domestic material. There are sufficient approved seed stands of good quality in our country - however seed years come only with long intervals. At the same time it seems that domestic material, if procured, would have a considerably higher price than importations from central Europe. So certainly the lower price of foreign material is of significance for importations.

Since our knowledge of provenances and seed transfer in deciduous species is poor or non-existant, very little substance for legislation is given. The risk that not sufficiently hardy material of too far southern origine is introduced, causes general legal restrictions on the importation of oak, beech and alder. Our strong recommendations for the use of local sources are in vain - the scarcity of domestic seed together with financial interest are strong incitaments for imports.

It seems reasonable that the most frequently used species and those which are well studied are under legal control. The legislator assumes in this way much of the responsiblity for faults or sucess as far as species and provenance is concerned.

For these species the rules for importation are quite stern:

1. Only sources <u>superior</u> to available domestic material are allowed.

2. If domestic material is <u>scarce</u> or difficult to procure, sources of foreign origin similar or equal in silvicultural value (with special consideration on hardiness) are admitted.

(The question how much superior the foreign material should be never has been under discussion. In general the superiority is of multi-trait character and difficult to assess.)

For species less frequent in reforestation and those where knowledge and experience are limited, legal interference is moderate. Importations are controlled only as far as assumed climatic fitness and phenotypic appearance are concerned. Recommendations for transfer and local use are given as upp-to-date as possible instead of regulations and rules.

IMPORTATION OF FOREST REPRODUCTIVE MATERIAL INTO SWEDEN.

1 million of seedlings planted (appr)
2 % of these wich currently are imported (appr)
3 countries from wich these plants should come from
4 state of provenance (transfer) knowledge: 5 to 0=nil

		1	2	3	4
PINUS SYLVESTRIS	§§	225[1]	5	FINLAND (NORWAY)	5
PICEA ABIES	§§	200	40	USSR, POLAND, LATVIA FINLAND	5
PINUS CONTORTA	§§	50	100	CANADA	5
PICEA MARIANA	§	1	100	USA, CANADA	4
PICEA SITCHENSIS	§	*	100	DENMARK, CANADA	3
PSEUDOTSUGA		*	100	DENMARK, CANADA	2
BETULA SP	§	5	10-90	FINLAND	3
QUERCUS SP	§	3	80	DENMARK, NORWAY, BRD N POLAND, (HOLLAND ?)	2
ALNUS SP	§	1	50	(BRD N, POLAND N) ?	1
POPULUS SP		*	50-90		1
ACER SP		*	100		0
TILIA SP		*	100		0
PRUNUS AVIUM		*	90		0

[1] of which 200 million (c 90%) come from Seed Orchards
* 100.000 to 500.000 seedlings
§§ Both import and transfer are regulated
§ Only the import is regulated

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1 Jährlicher Bedarf, Millionen Pflanzen
2 % davon werden importiert
3 Geeignete Herkunftsländer
4 Stand der forstgenetischen Kenntnisse

[1] davon etwa 200 Millionen aus Samenplantagen
* zwischen 100.000 und 500.000 Pflanzen
§§ Import und Anbau gesetzlich geregelt
§ Nur der Import unterliegt gesetzlicher Kontrolle

HARMONIZATION OF THE OECD-SCHEME AND THE EEC-DIRECTIVES RULING THE TRADE WITH FOREST REPRODUCTIVE MATERIAL, NEEDS AND PROBLEMS

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1. Abstract

Although the roots of both the OECD-Scheme for the control of forest reproductive material moving in international trade and the EEC-Directives on the marketing of forest reproductive material are the same, they have a different outfit and rule over different markets. It may happen that a country, which is simultaneously member of the OECD and EEC, is governed by three different rules, the OECD-Scheme, the EEC-Directives and the national act for forest reproductive material. All rules are based on the principle of approval, the principle of identification and the principle of control. While the OECD-Scheme comprises 4 or 5 categories, the EEC-Directives have 3 or 4 categories, if the proposed new category and the "category" of less stringent requirements are included. Both have 2 resp. 3 in common: selected, tested and predictably genetically improved reproductive material, if the proposed new category is included. Advantages of the existing rules are outlined, and disadvantages have to be avoided. This can best be done by using the same terminology, setting the same standards as far as possible. The reasons for harmonization are the joining of the EEC by an OECD-member-country and vice versa, and the same control system and certification procedure by the authorities. Most relevant problems are the differently advanced stages of both rules and the strategies followed by the organisations.

2. Introduction

International trade with forest reproductive material is expanding. The three main international markets are within Europe, between North America and Europe, and in tropical and subtropical countries. Thus the range of different species is rather broad. Two international schemes for the trade with forest reproductive material exist, namely the "OECD-Scheme for the Control of Forest Reproductive Material Moving in International Trade" (Organisation for Economic Cooperation and Development, Paris, 1974) and the "Council-Directive on the Marketing of Forest Reproductive Material EEC 66/404" (European Economic Community, 1966) and its amendmends EEC 69/64 and EEC 75/445, in the following called EEC-Directive(s). There are more directives like that on external quality standards for forest reproductive material marketed within the community (EEC 71/161), but these are not considered in the following.

It is common understanding that the trade between two countries follow that scheme, which both countries have in common. If both countries are EEC member countries, they have to apply the EEC-Directives, even if both countries are OECD-member countries and have adopted the OECD-Scheme simultaneously. Member countries of the OECD follow the OECD-Scheme on a voluntary basis. Trade with a non member country either of the EEC or the OECD has no common basis; in this case the trade is not regulated.

In the following it shall be looked into the question, whether a harmonization of both international schemes is necessary and what problems are connected with a harmonization.

3. Three principles

First, the fundamental conception of both international schemes shall be outlined. Both international schemes govern the marketing of forest reproductive material and do not rule the deployment of forest reproductive material in practice. For this reason, three principles are followed by both schemes:

- The principle of approval is the most important one. The basic material is the object of an official act, called approval. The act of approval gives permission to an owner of the basic material to collect reproductive material from the basic material and sell it in the market (Muhs, 1988). Reproductive material from any other basic material, which is not approved, is excluded from the market.
- The principle of identification is based on a reference number or letter, which shall be given to the approved basic material. By this the basic material gets an identity, which enables the Designated Authorities, responsible for the implementation of the scheme to follow directives to certify reproductive material derived from that approved basic material. Each approval of basic material has to be listed in a national list (Muhs, 1992).
- The principle of control consists of two parts: a label accompanying the lots of reproductive material from the place of collection/production via all steps of processing, storing, transporting, raising and marketing to the place of final use and a controlling agency, which is independent and/or public, in most cases under the responsibility of the Designated Authority (Muhs, 1992).

All three principles are logical parts of the fundamental conception of the schemes. Approval without identification is incomplete and only approved and identified basic material can be controlled. It is a prerequisite for a harmonization that both international schemes have these principles in common.

Differences appear when going into the details. Here the most striking difference is the number and definition of the categories, which have been delt with in another contribution of these proceedings (Muhs: Is there a need for the introduction of a new category in both the OECD-Scheme and the EEC-Directive governing the trade with forest reproductive material?). The OECD-Scheme has four categories and after introduction of a new category up to five, whereas the EEC-Directive contains two respectively three categories (or even three resp. four, if the category of "less stringent requirements is included). It is not the number of categories, which causes problems when harmonizing the schemes, it is their definition. They should be identical not only in denomination but also in content. Examples for differences are the non tested seed orchards, which have a category of their own, called "untested seed orchards" in the OECD-Scheme and in special cases the seed orchards can also be categorized as "selected", whereas in the EEC-Directive seed orchards fall into the category "selected". Due to this difference a seed orchard in category "selected" has a different meaning depending on the scheme, after which it has been approved. Generally a "selected" seed orchard according to the OECD-Scheme fits into the same category "selected" of the EEC-Directive, but not necessarily vice versa in all cases.

If adopting a new category (as discussed in another contribution in these proceedings) by only one of the schemes, either by the OECD-Scheme or the EEC-Directive, it would create even more striking differences between both schemes. For example, progeny tested reproductive material may be categorized in the new category in OECD-Scheme but it could not be marketed according to the EEC-Directive, if it does not meet the requirements of either category "tested" or "selected", as is presently the case. Such a development should be avoided.

4. Do we need two international schemes?

One is inclined to deny the question at the first moment. Indeed the development of the European integration will lead to an internal European market and then the question is no question any longer, because the EEC-Directive acts like an outline legislation for all member countries. Thus the EEC-Directive will concentrate on the internal European market with its specific problems, as it has been doing since the beginning. The EEC-Directive cannot replace the OECD-Scheme in international trade with non EEC member countries. The OECD-Scheme has to be flexible and easily adapted to world-wide trade with reproductive material of various species of different climatic regions. This also is a reason, why the OECD-Scheme cannot replace the EEC-Directive, because it has the role of a guide for the participating countries more than an imperative regulation. Thus the question can be answered by "yes" because of the special situation of the EEC.

5. Needs for harmonization

If both international schemes will continue to exist and have an overlapping part of their markets, it is most desirable to have them harmonized, in order to
- facilitate the trade between the countries participating in the OECD-Scheme and the EEC-member countries
- make the adoption of the OECD-Scheme by EEC-member countries easy
- standardize control systems
- support forestry
- concentrate research efforts connected with the regulations, which are of common interest.

Focusing on these goals, the following problems may impede the harmonization:
- different situations of the forests and the domestic markets in the countries
- different stages of development of forestry and of the implementation of regulations
- different policies.

If harmonizing both schemes these problems should be considered.

6. Strategy for the harmonization

The process of harmonization should include two parts, bringing technical parts into line with each other and bringing policies in agreement and completion. Especially the following items are of interest:

(a) harmonization of technical parts
- meaning of categories (the number of the categories may differ)
- certifications
- control systems
- definition of technical terms

(b) harmonizing of policies
- both schemes should continue in their efforts to facilitate trade and protect the interest of the user
- the OECD-Scheme should help the developing countries to join the scheme
- the EEC-Directive should concentrate on the realization of the internal European market after 1992 and member countries to adopt the OECD-Scheme for trade with non member countries

- both schemes should contain some rules, which give basic guidance for the conservation of forest genetic resources
- both schemes should be open for new developments in breeding and propagation techniques.

It is hoped that the opportunity for a harmonization will be taken, which seems favourable at the moment, because of the necessary amendments in both schemes. A harmonization would strengthen the position of the schemes and arouse a higher degree of acceptance by both the tradesmen and the users.

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BREEDER'S RIGHTS AFFECTING THE TRADE OF FOREST REPRODUCTIVE MATERIAL

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1. Abstract

Principally, there are two different ways for a breeder to acquire protection for new plant varieties. The UPOV--Convention for the protection of new plant varieties was enforced in 1961 and gained worldwide acceptance. Some patent acts like the US Plant Patent Act allow the patenting of plant varieties, others like the European Patent Act do not. But it may be made possible in future that biological processes and products be subjected to a patent. The different breeder's rights are explained and advantages and disadvantages are discussed. Especially the influence of breeder's rights on the marketing of the new forest plant varieties are of interest. It seems that both the UPOV-Convention and the patent acts will have detrimental effect on the diversification of the cultivars and clones by limiting their number available on the market. Future development will lead to three different regulations, which affect the trade of forest reproductive material:

- Marketing of forest reproductive material (OECD-Scheme, EEC-Directives)
- Protection of new plant varieties (UPOV-Convention)
- patenting of biological processes or products used for the production of forest plants.

If clonal forestry should ever have a break-through, it can be promoted by regulations favouring both breeding and marketing of clonal material.

2. Introduction

It is obvious that breeders efforts must be rewarded by financial returns. This gains in importance as expenses of breeding work increase. Especially with increasing use of biotechnology and genetic engineering, the breeder will try to protect his new varieties (breeds, clones, clonal mixtures). This can be done by applying for protection of new varieties of plants according to the UPOV-Convention (1991) and national laws, which are based on the UPOV-Convention, or by applying for a patent, which is possible in a few countries so far. The effect of the protection of new plant varieties and of patenting is different from the effect of regulations for marketing as reported elsewhere (Muhs, 1992). Protection and Patenting are aiming at stimulating breeding work and consequently increasing the number of breeds, clones and clonal mixtures. But this must not necessarily be true in all cases, which shall also be shown below.

3. Protection of new varieties of plants.

The act of the International Convention for the Protection of New Varieties of Plants was enacted in December 1961 and has been supplemented in 1972 and revised in 1978 and 1991. This act has been adopted by a number of countries (17 in total). Another international rule for the protection of new plant varieties is being prepared and planned to be enforced on April 1, 1991 (EEC-Directive, Commission Doc. 347/90, Council Doc. 8487/90), which in general is based on the UPOV-Convention. Here the article 6 (1) of the UPOV-Convention (reproduced below) is the most interesting one. It says: "The breeder shall benefit from the protection provided for in this Convention when the following conditions are satisfied: (a) Whatever may be the origin, artificial or natural, of the initial variation from which it has resulted, the variety must be clearly distinguishable by one or more important characteristics from any other variety whose existence is a matter of common knowledge at the time when protection is applied for. Common knowledge may be established by reference to various factors such as: cultivation or marketing already in progress, entry in an official register of varieties already made or in the course of being made, inclusion in a reference collection, or precise description in a publication. The characteristics which permit a variety to be defined and distinguished must be capable of precise recognition and description.

(b) At the date on which the application for protection in a member State of the Union is filed, the variety (i) must not - or, where the law of the State so provides must not for longer than one year - have been offered for sale or marketed, with the agreement of the breeder, in the territory of the State, and (ii) must not have been offered for sale or marketed, with the agreement of the breeder, in the territory of any other State for longer than six years in the case of vines, forest trees, fruit trees and ornamental trees, including, in each case, their rootstocks, or for longer than four years in the case of all other plants. Trials of the variety not involving offering for sale or marketing shall not affect the right to protection. The fact that the variety has become a matter of common knowledge in ways other than through offering for sale or marketing shall also not affect the right of the breeder to protection.

(c) The variety must be sufficiently homogeneous, having regard to the particular features of its sexual reproduction or vegetative propagation.

(d) The variety must be stable in its essential characteristics, that is to say, it must remain true to its description after repeated reproduction or propagation or, where the breeder has defined a particular cycle of reproduction or multiplication, at the end of each cycle.

(e) The variety shall be given a denomination as provided in Article 13".

The UPOV-Convention and the planned EEC-Directive can be applied to all botanical genera and species including hybrids. A variety can be a cultivar, clone, line, stock or hybrid being capable of cultivation. It must not comprise a whole botanical taxon. Cells or part of cells or cell-lines are not considered to be varieties. The EEC plan to allow the protection of new varieties as the only kind of breeder's right that is to say that patenting of plant varieties is not permitted, while cells or cell-lines may be subject of a patent, if they fulfill the requirements. The protection is given by a national agency or in case of the EEC by an authorized office for all member countries. The period of protection for forest tree species shall be not less than 18 years according to the UPOV-Convention and 50 years according to the planned EEC-Directive.

4. Advantages and disadvantages of the protection of new plant varieties.

The advantages of protecting new plant varieties are obvious. The breeder gets financial returns by marketing his new plant variety. The protection will give him the exclusive right for marketing for at least 18 years, while the approval according to the regulations for the marketing of forest reproductive material permits him to market his new plant variety.

Another effect of the protection act is that only a few varieties, clones or clonal mixtures of a forest tree species will be protected and be able to be introduced into the market, while many others do not get the protection because they cannot fulfill the requirements laid down in article 6 of the UPOV-Convention. Especially the requirement that a new variety must be clearly distinguishable by one or more important characteristics from any other variety gives rise to serious concern whether the protection act is supporting clonal forestry. It is, for instance, practically impossible to distinguish between one hundred clones of a clonal mixture in order to identify each one in the case of most coniferous species. A solution to this problem may be proposed as follows: only one clone per clonal mixture should be subjected to protection. This clone then acts as leader or indicator clone (Muhs, 1986). In this case it should be made sure that the composition of the clonal mixture is subjected to the approval. If the composition is not fixed by approval, clones can easily be replaced by other ones or removed for illegal use because they are not protected except the leader clone. It may be expected that roughly about 20 to 40 clones of a species can be characterised by unique morphological traits or combination of traits, which may not be possible in the hundreds or thousands of clones being member clones of the clonal mixtures. That means that the potential number of unique clones is restricting the number of clonal mixtures, which can get protection (if the unique clones can be dispensed in that way that each clonal mixture gets just one unique clone). From what is said above the conclusion may be drawn that the protection act may put up obstacles instead of stimulating breeders to breed new varieties.

The act of approval is independent from the act of protection. A clone or a clonal mixture can get approval without protection and vice versa. While the approval is free of charge for the breeder, the protection is expensive. The best strategy for a breeder is to register the clone first and after receiving the approval for marketing, to apply for the protection. If the requirements for distinction and novelty cannot be fulfilled, the clone will not get protection and the breeder will loose his interest in marketing the clone, because he cannot be sure that somebody else will participate in his returns by propagating and marketing the unprotected clone. There is already an example of a good new poplar hybrid clone that did not get protection because it could not be distinguished from an older approved clone by present methods. Although the new clone has higher growth potential, it cannot replace the old one, because the holder of the protection right of the old clone is not the breeder of the new clone. This unwanted effect of the protection act should be eliminated, otherwise it will result in a low number of clones or clonal mixtures moving in trade. The best clones seem to be worthless, if there are low chances or hindrances for marketing. On the other hand it can be expected that the possibility to protect plant varieties will stimulate breeding activities.

5. Patent acts applied to plants and parts of plants.

The patent act gives another possibility to the breeder for safeguarding his interests, but on a quite different level. Object of a patent can be the invention of an innovative technical process or a new type of organism, which may or may not occur in nature. The latter is not uniformly regulated in all patent laws. There are differences between the laws from USA and Europe. While the US Plant Patent Act (1930, amended 1954) allows the patenting of plant varieties, the European Patent Convention does not. The planned EEC-Directive about the protection of new plant varieties prescribes that plant varieties can only be protected by the EEC-Directive and not by the European Patent Act or any national Patent Act of an EEC-member country. The question, whether biological processes and products are patentable, is difficult to answer. (For review, see Beier et al, 1985).

Biological processes and products in this context are: (Williams, 1983):

- new varieties based on transgenic plants
- parts of plants
- special breeding methods
  - -- tissue culture
  - -- transfer of DNA, protoplast fusion
  - -- regeneration of plantlets
- products used in gentechnology
  - -- vectors
  - -- genes isolated from plants
  - -- adaptors
  - -- promotors
  - -- micro organisms
  - -- cell-lines
- test- and evalution methods.

According to the General Patent Act of the USA the above listed biological processes and products seem to be patentable, if the requirement of the usefulness, novelty, and unobviousness and some other formal prerequisites are fulfilled. In Europe the discussion about the patentability of these biological processes and products is still going on.

What can we learn from what has been presented so far? A clone itself can be an object for a patent. And a clone can be produced using patented processes or products, thus the clone is a patent dependent product. In both cases the breeder's interest is to get returns for his breeding efforts. But the marketing of patented clones and patent dependent clones may have the same or similar effect on the diversification of the cultivars and clones by limiting the number available on the market as the marketing of protected cultivars after the UPOV-Convention. At the moment there are only few experiences available. It cannot be jugded to what extent and in which way patenting and protecting of clones is affecting clonal forestry. Will both kinds of breeder's rights lead to a high number of clones and a high degree of diversity in clonal mixtures or not?

6. Historical development of the breeder's rights.

The historical roots of the protection of plant varieties go back to the last decades of the 19th century. Both the Deutsche Landwirtschafts-Gesellschaft (DLG, German Farmers Association) and the Bund der Landwirte (BDL, the Agrarian League) informed the farmers by demonstration trials that new breeds are superior to conventionally produced seed of most important agricultural crops in 1888. In 1895 a system for the approval of seed was set up and 1905 a pedigree seed register for "DLG-Hochzuchtsorten" (high grade varieties) was introduced.

Since 1925 the testing of varieties was introduced first on a private and later on a public basis and in 1930 a draft of a Seed and Plant Stock Law was discussed, which "even included a provision that recognized special protective rights favouring those who developed new species of cultivated plants obtained by breeding. But the proposal became bogged down in the Reichstag (parliament) and when the National Socialists came to power after 1933, the political focus narrowed to the goal of keeping inefficient seed out of cultivation." (Bent et al., 1987).

At that time provenance research of forest tree species had already started. The legislation concerning the forest reproductive material was initiated in 1925 by a steering committee, but it failed and as late as 1934 a law was enforced (Artgesetz), which aimed at the application of seed and plants of forest trees rather than at the approval and protection of the breeders interest. This short historical review shows the dilemma of regulating this difficult subject. The development in other countries like France was to some extent similar, but did not end up in a law directing the application of seed and plants. While contrary to the development in Germany, in France the patenting of plant varieties was made possible and was first applied in 1951 (Neumeier, 1990).

In the United States of America the development was fundamentally different from that in Europe. Since 1906 efforts had been made to draft the Plant Patent Act, which was enforced in 1930 (Neumeier, 1990). In 1980 the Supreme Court decided that microorganisms are patentable also under the General Patent Law (Chakrabarty Decision). Before this decision it was generally assumed that protection for asexually reproduced plants was limited to the Plant Patent Act only (Bent et al., 1987). In 1970 the Plant Variety Protection Act was enacted, which is influenced by the European plant variety protection acts. Thus three different legal regulations for the protection of breeder's rights are available in the United States.

Coming back to the dilemma, which entails conflicting interests between politicians, breeders, and consumers. It has been shown that regulations for the deployment of forest reproductive material is not applicable, except for isolated countries (Muhs, 1992). These regulations have been (or are still) the opinion of the politicians because of their ease of handling, but they cannot meet all the demands. Thus future developments will lead to an approach solving the dilemma, splitting up into three different regulations:

- marketing of forest reproductive material (OECD-Scheme, EEC-Directives)
- protection of new plant varieties (UPOV-Convention)
- patenting of biological processes or products used for the production of forest plants (Plant Patent Act of the USA, European Patent Convention after revision).

This development has been initiated in the fifties and sixties of this century and continues to amend the existing international rules, especially the OECD-Scheme, the EEC-Directives and the European Patent Convention in order to consider recent developments in biotechnology, including genetic engineering. If clonal forestry should ever have a break-through, it can only be promoted by regulations favouring both breeding and marketing of clonal material.

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DELINEATION OF PINE PROVENANCE REGIONS AND SELECT STANDS SELECTION IN SPAIN.

Delineation of Pine Provenance Regions and Select Stands selection in Spain.

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Abstract

Provenance regions for Pinus sylvestris L and Pinus nigra Arn. have been deduced from environmental data, mainly climatic and edaphic studies of each species.

Also, factors influencing selection of Select Stands, on these regions in Spain, are considered.

Resumen

Pinus sylvestris L. y Pinus nigra Arn. son dos especies que se muestran con una gran variación ecológica y geográfica en España.

La delimitación y caracterización de las regiones de procedencia de estas dos especies se ha realizado dividiendo las masas basándose en criterios geográficos (distancia entre las masas), criterios climáticos (tipo de fitoclima existente) y edáficos (tipo de suelo y propiedades). La información se ha obtenido de los estudios ecológicos de cada una de las especies y por superposición de las masas con mapas fitoclimáticos y de suelo. Se han diferenciado 17 regiones para Pinus sylvestris L. y 8 para Pinus nigra Arn.

Se analizan, someramente, algunos factores que condicionan la elección de material base selecto dentro de las regiones diferenciadas.

Introduction

In Spain, the Pinus genus covers a total area of over 4,900,000 ha, about half of which is the product of reforestation. The largest part of timber production goes to conversion ((57.2% of the total) and crushing (35%). Only 1.9% is used for high-quality veneer.

Scotch pine (Pinus sylvestris L.) and Austrian pine (Pinus nigra Arn) have been widely used for reforestation, if rather less than Pinus pinaster and Pinus halepensis. From 1977 to 1987, average areas of 8,500 ha were repopulated with Scotch pine and 5,800 with Austrian pine. P. nigra of non-Spanish orgin was also used. Seed consumption is very high in these species because of the area repopulated, and also varies widely over time. The average for the period 1986-1989 was 1700 kg of seed per annum of Pinus sylvestris and 760 kg per annum of Pinus nigra ssp. salzmanni. In addition, 30% of the total Austrian pine seed used was imported Pinus nigra ssp. nigra.

In order to adapt Spanish to Community legislation on forest reproductive material, the regions of origin of Pinus sylvestris L. and Pinus nigra Arn must be demarcated; within these regions, the base material is in turn demarcated.

This paper analyses the criteria adopted for differentiating regions of origin of P. sylvestris L. and P. nigra Arn in Spain. Also examined are the predominant factors considered in choosing select stands on the basis of the characteristics of both species in Spain.

Demarcation of provenance regions of Pinus sylvestris L. and Pinus nigra Arn.

The Community certification model is based on the region of origin as the certification unit for base reproductive material (select stands and seed orchards in our case), comparable to the seed zone as conceived by SNYDER (1972) and reported by the AOSTA (BARNER & KOSTER, 1976; BARNER & WILLAN, 1983).

There are two main approaches to demarcation of regions of origin: agglomeration and division (CTGREF, 1976). The latter is the more widely used.

In Spain, the division method has been used to identify the seed zones in Galicia (TOVAL & VEGA, 1982) and the Basque Country (MICHEL, 1986). However, a large number of areas have been determined as common to all species.

The division for Pinus sylvestris and Pinus nigra is based on data concerning the conditions in which their natural stands grow in Spain. The demarcation was performed using available information on variation of these conditions and on characteristics of climate, soil and geographical isolation. In this way, variation in both species can be mapped more precisely.

Adjacent zones with different ecological characteristics and mosaic variation of ecological factors are grouped in the same region of origin as long as they belong geographically to the same region. As HATTEMER (1987) has observed, there will be more similarity between two nearby forests (even if their ecological characteristics are different) than between two forests with similar ecological characteristics but geographically separated.

However, if the geographical distance between forests is sufficient, they may be supposed to diverge, and therefore different stands with the same ecological conditions but not belonging to the same geographical region are placed in separate provenance regions.

a) Geographical distribution.

The natural distribution of the species is taken from the Forestry Map of Spain (CEBALLOS et al, 1968). Artificial stands are not considered because the provenance of the seed is generally unknown, and also because their age is rarely greater than one felling cycle, so that adaptation is not sufficently established.

Both species have a characteristic pattern of fragmented areas around large nuclei in mountainous zones. Scotch pine occurs in four main areas (Pyrenees, Iberian System, Central System and Penibetic System) and Austrian pine in three (Pyrenees, Iberian System and the Segura and Cazorla ranges). These are surrounded by a variety of marginal clusters. There is therefore a possibility of discontinuous variation in the ecological characteristics of the different stands (GAUSSEN etc al. 1964; NICOLAS & GANDULLO, 1969; RUIZ DE LA TORRE, 1979; ELENA et al, 1991).

b) Climatic characteristics.

Our survey of the species' climatic characteristics is based on ecological studies of each of the species (NICOLAS & GANDULLO, 1969; ELENA et al, 1985), which show the wide variation from zone to zone.

Although occurring preferably in subnemoral oroborealoid phytoclimates, Scotch pine is also found in nemoral and even in Mediterranean situations. Austrian pine occurs preferably in genuine nemoro-mediterranean and cool nemoral substeppe climates, but is also found in phytoclimates clearly tending towards Mediterranean.

Mapping of these results is based on the Phytoclimatic Atlas of Spain (ALLUE, 1990), on a scale of 1:1,000,000. Further contrast was achieved by inclusion of phytoclimatic diagnosis of the meteorological stations close to stands of either species. Thus we were able to determine the predominant phytoclimates in each region and its phytoclimatic tendencies and/or alternations.

c) Soil characteristics.

Soil surveys for the two species (NICOLAS & GANDULLO, 1969;

SANCHEZ PALOMARES et al, 1990) were the main sources used to study the edaphic factors influencing variation in each one. This localised description was supplemented with data from the 1:1,000,000-scale soil map of Spain (EEC, 1985).

Scotch pine is found over the entire soil range from brown or reddish-brown calcareous soils with a calcareous crust horizon, apparently preferring moist brown (siliceous) soils or brown limestone forest soils. Austrian pine occurs in a narrower range of soils, the only differences being in limestone lithofacies and the degree of soil evolution. This trait is insufficient to differentiate groups.

Tables I and II show the climatic and soil charateristics of the Spanish provenance regions defined for Pinus sylvestris L. and Pinus nigra Arn.

Criteria for choice of select stands.

Select stands allow identification of the ecological and phenotypical characteristics of seed-producing trees within regions of origin.

The general selection criteria legally established in Spain in conformity with EEC guidelines (BOE, 1989) are imprecise and depend largely on the characteristics of the species it is wished to select. The possible description of these stands is set forth in various manuals (PUERTO & TOVAL, 1985).

Thus, after selection of sreproductive base material, the following may be said of the two species concerned:

-Consumption of seed in the last 10 years has undergone a marked decrease, related to the decrease in populated area. Actual seed consumption figures for the last 10 years can be used to calculate the annual area of select stands needed to cover these requirements. Depending on whether the seed production considered for these stands is low or high, the annual area (ha) needed for select stands ranges from 750 ha for Scotch pine to 145 ha for Austrian pine. In order to maintain a seed store for at least three years, these areas must be enlarged.

-Form is not a restrictive trait for either species. Poor-quality trunks normally go together with low growth-rates, on which basis stands are rejected.

-Population size is not a limiting factor either. The minimum unit required for silvicultural management is usually greater than 50 ha, which must coincide with the zone selected in order to facilitate location and gathering of seed.

-There is at present no means of legally enforcing, nor interest on the part of proprietors in, restriction of felling to a defined period in which seed can be gathered. Then again, 72% of stands of Scotch pine are retained, to a greater or lesser extent, for protective purposes (MONTERO & GOMEZ, 1990), which very much restricts seed gathering.

-Spanish stands of the two species normally receive little silvicultural treatment prior to felling. At high-quality locations, this leads to large numbers of trees per hectare, the individuals having small crowns and hence producing little seed. In other cases we find unmanaged forest, practically irregular in structure, where accurate assessment of quality is difficult. In any case, the phenotypical characteristics of these stands are absolutely determined by the treatment to which they have been subjected.

In conclusion, we may say that neither selection of base material under the current legislation nor gathering of reproductive material present difficulties from a theoretical standpoint. However, where funding for these purposes is scarce (owing to lack of user demand or low economic value of the species), the difficulty involved in achieving a proper selection is such that the term "select" denotes no genetic superiority over other kinds of reproductive material.

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Table 1. Climatic and soil description of the provenance regions of Pinus sylvestris L.

PROVENANCE REGION	TOTAL AREA (ha)	PHYTOCLIMATIC SUB-TYPE (ALLUE,1990)	SOIL TYPE (NICOLAS & GANDULLO, 1969)	
ALTO VALLE DE PORMA 1	413	VIII(VI)	Siliceous	Distric cambisol
ALTO EBRO 2	14999	VI(V)/VI(IV)2	Calcareous	Calcic cambisol
PIRINEO NAVARRO 3	18549	VI(VI(V)	Calcareous	Calcic cambisol
PREPIRINEO MONTANO SECO 4	43972	VI(VII)	Calcareous	Calcic cambisol
PIRINEO MONTANO HUMEDO ARAGONES 5	116381	VIII(VI)	Calcareous	Calcic cambisol
PIRINEO MONTANO HUMEDO CATALAN 6	72187	VIII(VI)	Siliceous Calcareous	Distric cambisol Calcic cambisol
PREPIRINEO CATALAN 7	1787	VI(VII)	Calcareous	Calcic cambisol
MONTANA SORIANO BURGALESA 8	95238	VIII(VI)	Siliceous	Distric cambisol
SIERRA DE AYLLON 9	13107	VI(IV)2	Siliceous Calcareous	Distric cambisol Calcic cambisol
SIERRA DE GUADARRAMA 10	43633	VIII(VI)	Siliceous	Distric cambisol
SIERRA DE GREDOS 11	4615	VIII(VI)/VI(IV)2	Siliceous	Distric cambisol
MONTES UNIVERSALES 12	121705	VIII(VI)	Siliceous Calcareous	Distric cambisol Calcic cambisol
MONTANAS LEVANTINAS 13	2123	VI(IV)2 VI(IV)1	Calcareous	Calcic cambisol
SIERRA DE GUDAR 14	21627	VI(VII)	Calcareous	Calcic cambisol
SIERRAS DE BECEITE Y TOLOSA 15	8123	IV(VI)	Calcareous	Calcic cambisol
MONTANAS DE PRADES 16	579	VI(IV)1	Siliceous	Distric cambisol
SIERRAS PENIBETICA 17	1316	IV(VII)	Siliceous Calcareous	Distric cambisol Calcic cambisol

Table II. Climatic and soil descripcion of the provenance regions of Pinus nigra Arn.

PROVENANCE REGION	TOTAL AREA (ha)	PHYTOCLIMATIC SUBTYPE (ALLUE, 1990)	SOIL TYPE (SANCHEZ PALOMARES et al. 1989)	
			CALCAREOUS	SILICEOUS
1. PREPIRINEO ARAGONES OCCIDENTAL	4.480	VI(VII)	CALCIC CAMBISOL	-
2. PREPIRINEO ARAGONES ORIENTAL	4.288	VI(VII)	CALCIC CAMBISOL CALCIC LUVISOL (-)	-
3. PREPIRINEO CATALAN	55.487	VI(VII)	CALCIC CAMBISOL CALCIC LUVISOL (-)	-
4. ALTO AMPURDAM	-	VI(IV)4	CALCIC CAMBISOL	-
5. BAJA CATALUNA	6.631	VI(IV)1/VI(IV)4 ---> VI(V)	CALCIC CAMBISOL	EUTRIC CAMBISOL (-)
6. ALTO MAESTRAZGO	25.543	VI(IV)2/VI(IV)4/VI(VII) —> VI(V)	CALCIC CAMBISOL CALCIC LUVISOL	-
7. SISTEMA IBERICO MERIDIONAL: 7A. SERRANIA DE CUENCA Y ALTA ALCARRIA	137.154	VI(IV)2/VI(VII) y VI(IV)1 —> VI(IV)2	CALCIC CAMBISOL CALCIC LUVISOL (-)	EUTRIC CAMBISOL FERRIC LUVISOL (-)
7B. SUR DE CUENCA	47.842	VI(IV)1 —> VI(IV)2	CALCIC CAMBISOL	EUTRIC CAMBISOL (-)
7C. TERUEL	26.960	VI(VII) —> VI(IV)1	CALCIC CAMBISOL CALCIC LUVISOL (-)	ORTHIC CAMBISOL (-)
8. CORDILLERAS BETICAS: 8A. CAZORLA-ALCARAZ	52.002	VI(IV)2 ---> VI(IV)1 y IV4 —> IV(VI)1	CALCIC CAMBISOL EUTRIC PODZOLUVISOL	EUTRIC CAMBISOL (-)
8B. SIERRAS ORIENTALES	17.656	IV(VI)1 —> VI(IV)1	CALCIC CAMBISOL	-
8C. SIERRA MAGINA	501	IV(VI)1	CALCIC CAMBISOL	-
8E. SIERRA DE MARIA	527	IV(VI)1 —> VI(IV)1	CALCIC CAMBISOL	-
9. SISTEMA CENTRAL	50	VI(IV)2	-	EUTRIC CAMBISOL
10. SORIA	2.055	VI(IV)1 —> VI(IV)2	CALCIC LUVISOL	-

Report of the Meeting "Actual problems of the legislation of forest reproductive material and the need for harmonization of rules at an international level" of the IUFRO Working Party S2.02.21 at Gmunden and Vienna from June 10-14, 1991

CONCLUSION FROM THE FINAL DISCUSSION AND THE TECHNICAL SESSION

A. THE PARTICIPANTS AGREED TO THE FOLLOWING CONCLUSIONS

1.
Harmonization of both international rules (OECD-Scheme and EEC-Directive 66/404 and its amendments) should be of primary importance in forthcoming amendments. Basically the technical terms should be defined identically and certifications and labels should show the same informations. The categories may differ in number but not in definition.

2.
As breeding of new varieties has been advancing in the last decades, the consumer should be given the opportunity to make use of these new varieties. In case they cannot be marketed as tested reproductive material it should be considered to introduce a new category in both international rules which has been preliminarily named as "predictably genetically improved reproductive material".

3.
The marketing of vegetative propagated material, clones as well as bulked material, needs to be regulated for all species in question. It should be aimed at giving the consumer additional information about propagation method, for instance in vitro propagated plants, cuttings and plants derived from somatic embryogenesis and others. Further informations about the basic material as for instance test results, description of test sites, pedigree in case of new breeds should be made availabel to the customer more easily.

4.
To promote the marketing of clonally propagated material, identification methods are needed urgently, this should include methods for phenological, morphological, biochemical and genetic traits. Although a number of such methods have been established, only a limited number of clones can be distinctly identified. Restrictions in the member clones that can be identified may result in a lower number of clones that can be marketed. This effect is unwanted. It is recommended to cooperate in research on the development of identification methods internationally.

5.
Developing countries have advanced their forest management and their demand for reproductive material is increasing. The OECD-Scheme may serve as a model for establishing national rules. It should be open for countries which may adopt the scheme. Therefore special situations in the forestry of those countries should be considered when amending the OECD-Scheme.

6.
The participants are concerned that biological processes and products could become subject of a patent, which is already in practice in the United States of America and may be adapted in Europe by revision of the European Patent Act. The impacts of such patenting procedures on breeding and production of forest reproductive material is not predictable. To protect breeders'rights the UPOV convention for the protection of plants (International Union of New Varieties of Plants) seems to be better adapted to forestry.

7.
The implementation of EEC-Directives in the EEC-member countries has reached different levels because forestry has developed differently and especially new members have not had the time to implement the directives fully. Therefore, before amending the EEC rules it is important to be informed about the stage of implementation in each member country. Informations should be made available.

8.
The EEC-Directive 71/161 dealing on regulations on external quality standard does not have a corresponding rule within the OECD-Scheme. The implementation of these EEC rules causes some problems, for instance to meet the requirements for seed purity, identification of seeds of related species, a.o. It was questioned wether these external quality standards should be subject of such a detailed directive, because trade customs have developed which regulate this more efficiently. It should be considered if these rules have to be revised.

9.
The participants propose to consider the need to conserve forest gene resources when amending both international rules. Although it is known that this is not subject of the rules, they should not contradict the aim to maintain a high level of genetic diversity. Furthermore silvicultural practices follow new approaches in order to meet site conditions more specifically, for which appropriate reproductive material may not always be available. This should also be considered.

10.
As breeding methods are developing rapidly, both international rules should not obstacle this development.

11.
As a consequence of the implementation of the EEC-rules, the EEC-members have an urgent demand in research in this field. The forthcoming amendment will induce even more research activities. Therefore, the EEC commission should help the member countries to do the necessary research by increasing the financial support.

B. TECHNICAL SESSION

1.
The Chairman, Hans-J. Muhs (Germany), and the Co-Chairman, Peter Krutzsch (Sweden), were re-elected for a second term.

2.
The next workshop is planned to be held in Nairobi, Kenya.

i) Preliminary topics: (1) The OECD-Scheme and the developing countries, importance and implementation of the scheme and (2) The importance of ISTA (International Seed Testing Association) for establishing seed quality standards of tropical forest tree species.

ii) Local organization: Kenya Forestry Seed Centre
Proposed date: February 1992.

THE VIRGIN FOREST OF ROTHWALD

Historical survey:

The continued existence of this reserve is due to its particular history.

The area belonged originally to the Babenbergers, margraves of Austria. In 1330, one of the Babenbergers founded the Carthusian monastery of Gaming; we passed by the monastery. The area of Rothwald was the most remote part of this estate and was almost inaccessible. Its boundary with the estate of the adjoining monastery of Admont was indefinite. Some parts of Rothwald lie in the water catchment of Salza, other parts are in the Ybbs and Erlauf catchment.

There were extensive clear-cuttings for firewood in the whole whole region during the middle of the 18th century. Forest products were transported by inclined flumes, horse-drawn, rail-roads and river floating, often in combination, as far as the city of Vienna. Fortunately, an area of about 300 ha remained more or less intact.

In 1875 an ancestor of the present owner acquired the estate of Langau. The overcutting was stopped and a reforestation programme was started, by direct seeding and by planting. Thus, the surrounding forest contains a second generation of genetic material, of local origin but not always coming from the same elevation zone. The new owner protected the relict virgin forest, treating it as a natur consrvation area for its aesthetic values and as a hunting reserve.

Site conditions:

The Rothwald area lies between 950 and 1400 m in the humid Northern Rim zone of the Alps. There is a long-lasting snow cover of anbout 200 days with a snow depth averaging 3 m with a maximum of up to 6 m. The temperatures are moderate with an annual mean of about 4°C, a January temperature of -4/-5°C and a July temperature of 12/14°C. The rainfall is high, exceeding 2300 mm per year, with a maximum in the growing period.

Geologically, the area belongs to the Northern Calcareous Alps, the bedrock ist mainly Dachstein limestone and massive dolomite. The red colour of the socalled Hierlatz limestone is

probably the origin of the name Rothwald.
Terra fusca is the predominant soil. On flat sites the soil is frequently gleyed, highly acidified and podzolized. There are also rendzina and mixed soils with a high clay content.

The forest:

The natural forest association is the beach-fir-spruce (Abieto fagetum) of the high montane zone. The stand structure is very variable depending on the site an phase (age) of development. Ancient individuals of spruce and fir can be found, with ages of 600 - 700 years, while beech last only 400 - 500 years. Fir is predominant in volume. Like spruce, the fir produces boles of enormous size. In numbers of trees, beech is the greatest component, especially in the regeneration. Beech dominates the understorey. Maple and elm are important additional species.
Spruce regenerates well on decaying fallen trunks and on raw humus. Pure spruce stands can be found as a climax type only near the timberline and on extreme sites such as a stone field. The temperature inversion allows an upper beech zone to grow on the timberline itself.
The tallest fir is 58 m high and has a timber volume of 43 cubic metres. Beech is considerably shorter. The growing stock in the virgin forest is about 630 cubic metres per hectare, with the three principal species in almost equal proportions.

Production forest:

The virgin forest cannot be a model for the production forest. However, it demonstrates interactions within a forest ecosystem and forms a gene bank of indigenous structures. Within one rotation, the managed spruce forest shows rapid podzolization, increased stagnation of surface water, higher soil bulk density and a decline in the quality of the humus. Moreover the stand structure of spruce is less resistant to wind throw than the virgin forest.
Adjacent stands are generally established from local seed, so they maintain the genetic value of the forest for the future. We find some selected stands of high quality in the vicinity. Unfortunately, the area was substantially reduced by wind throws from two storms.

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