

Essential Derivation
Information and Guidance to Breeders
June 2005

1. Preamble

2. Background

- 2.1. Why a Revision of the 1978 Act of the UPOV Convention
- 2.2. The Definition of Essentially Derived Varieties
 - 2.2.1. The Preparation of the 1991 Diplomatic Conference
 - 2.2.2. The Adopted Text

3. ISF Position on Essentially Derived Varieties

- 3.1. General Consideration
- 3.2. ISF Interpretation of Article 14.5 of the 1991 Act of the UPOV Convention
- 3.3. Assessment of Essential Derivation
- 3.4. Burden of Proof

4. The ISF Crop-by-Crop Approach

- 4.1. Maize
- 4.2. Vegetables
 - 4.2.1. Tomato
 - 4.2.2. Lettuce
- 4.3. Ryegrass
- 4.4. Oilseed Rape
- 4.5. Conclusion

5. Consequences for Breeders

1. Preamble

The ISF Secretariat has prepared this paper at the request of the Breeders Committee. Its objective is to inform breeders on essential derivation and dependency, based on the various position papers adopted by ISF on this subject and the work carried out by the section.

In 2002, the merger of the International Association of Plant Breeders (ASSINSEL) and the International Seed Trade Federation (FIS) formed ISF. Readers will find references to both ASSINSEL and ISF in the following sections of the paper.

This document is not an ISF position paper.

2. Background

2.1. Why a Revision of the 1978 Act of the UPOV Convention

The concerns regarding plagiarism are not new and as early as in 1980, during its Congress in Cannes (France), ASSINSEL had a lively discussion on sister lines, converted lines, distinctness and novelty and decided to have in-depth discussions on that topic on the occasion of its 1981 Congress in Acapulco. After the 1981 Acapulco Congress, ASSINSEL requested UPOV “to take all necessary measures to prevent converted lines from infringing and pirating breeder’s genetic material”. In 1982 ASSINSEL sent a letter to its members stating, “the ASSINSEL Council, conscious of the new developments in the area of plant breeding, particularly in respect of the applications and issues raised by Genetic Engineering believe that the time has come to again study the question of important characteristics.”

However, at that time the Administrative and Legal Committee of UPOV, during its meeting of April 28, 1983, considered “amendment to the Convention was inadvisable for the time being”.

Due to further development of genetic engineering decision was taken in 1987 to revise the Convention, in particular the introduction of two new concepts, “essential derivation” and “dependence”.

2.2. The Definition of Essentially Derived Varieties

2.2.1. The Preparation of the Diplomatic Conference

A sub-group of experts, including ASSINSEL representatives met on March 1990 in Geneva and proposed the following definition for essentially derived varieties: “A new variety is essentially derived from another variety when it is derived from a single original variety and has maintained essentially the same genome of the original variety with only a few genes having either deliberately or not deliberately been changed, resulting in small differences at the genomic, genetic or phenotypic levels. A cross between two varieties alone would in general not lead to an essentially derived variety. It would not matter either whether a variety was directly or indirectly derived from the original variety. The amount of effort or time needed to reach that change would be no criterion, only whether the resulting genome was essentially the same or not.”

Several examples were discussed during that meeting and considered as possibly leading to essentially derived varieties: reselection within a variety, backcrossing, modification by genetic engineering, somaclonal variants, natural or induced mutations, change in chromosomes number, cell fusion.

A definition was proposed in the basic text for the Diplomatic Conference: “... a variety shall be deemed to be essentially derived from another variety when

- i) it is predominantly derived from the initial variety, particularly through methods which have the effect of conserving the essential characteristics that are the expression of the genotype [...] such as ...
- ii) it is clearly distinguishable from the initial variety and
- iii) it conforms to the genotype [...] of the initial variety, apart from the differences which result from the method of derivation”.

Prior to the Diplomatic Conference, ASSINSEL wrote a letter to UPOV:

“ASSINSEL is strongly in favour of introducing the concept of dependence for essentially derived varieties and accepts the cases mentioned in the draft revised text as examples, underlining, however, that these are not exhaustive. Under no circumstances does ASSINSEL consider that it is a weakening of the breeder’s exemption because it applies to varieties derived essentially from pre-existing protected varieties.

ASSINSEL insists on the necessity of clearly defining the starting point of dependence in function of the genetic distance established on the basis of technical expertise. The implementation of this principle of dependence should be carefully studied. In particular, there must be a provision for the reversal of the burden of proof in the case where the breeder of a pre-existing protected variety has been able to show that a new variety is essentially derived from this pre-existing variety. In no case should it happen that the decision on derivation (for essentially derived varieties) falls to official administrative services”.

2.2.2. The Adopted Text

During the Diplomatic Conference the following definition was finally adopted: “A variety shall be deemed to be essentially derived from another variety (the initial variety) when

- i) it is predominantly derived from the initial variety, or from a variety that is itself predominantly derived from the initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety
- ii) it is clearly distinguishable from the initial variety, and
- iii) except for the differences which result from the act of derivation, it conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety.

Essentially derived varieties may be obtained for example by selection of natural or induced mutants or of a somaclonal variant, the selection of a variant individual from plants of the initial variety, backcrossing or transformation by genetic engineering”.

The reference to conformity to genotype, making the difference between assessing distinctness based on phenotype and essential derivation, was missed during the conference.

Also during the Diplomatic Conference it was agreed, at the request of Japan, that UPOV should develop guidelines on essentially derived varieties. However, it was also clearly said that those guidelines should not change the wording of the Convention and that assessment of essential derivation would in no case be the task of the officials. (It must be noted that after two or three years of discussions UPOV has decided not to work on those guidelines for the moment).

3. ISF Position on Essentially Derived Varieties

3.1. General Consideration

ISF strongly supports this concept of essentially derived varieties (e.d.v.), which allows some new technological developments such as genetic engineering to be taken into account. It has also the potential to drastically decrease the risk of plagiarism in plant breeding. ISF also considers that this principle, whilst appropriately strengthening Breeder’s Right, does not restrict the breeder’s exception, a key feature of the UPOV Convention.

ISF notes that even if there are not yet internationally agreed-upon professional rules and usages for assessing essential derivation and for solving disputes, the concept has already greatly contributed to avoiding infringement as breeders are being more careful in their breeding programs.

As will be shown in the following sections, this principle mainly involves questions of scope of protection and enforcement of the rights of the breeder. It is, therefore, left to the initiative of the breeder to enforce these rights. ISF stresses that the determination of essential derivation is not part of the procedure of the granting of the Breeder’s Right. However, registration data of the varieties based on UPOV guidelines should be available after granting of rights.

3.2. ISF Interpretation of Article 14.5 of the 1991 Act of the UPOV Convention

i) The technical aspect

For a variety to be considered as essentially derived, it must fulfill three requirements in relation to the initial variety while retaining the expression of the essential characteristics of the initial variety:

- clear distinctness in the sense of the UPOV Convention
- conformity to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety
- predominant derivation from an initial variety.

If one of these requirements is not fulfilled, there is no essential derivation.

ii) The legal aspect

The principle of dependence only exists in favor of a non-essentially derived protected variety. This means that:

- the initial variety must be a protected one¹
- dependence can only exist from one protected variety alone
- the initial variety must not be itself an essentially derived variety².

Essential derivation is a matter of fact whereas dependency resulting there from is a possible legal consequence. Therefore, if an e.d.v. has been claimed and proved as such with legal validity, it remains an e.d.v. forever. Even if the protection period of the i.v. has been exhausted, a variety derived from the first variety in a chain of essentially derived varieties remains an e.d.v. and the remaining varieties in the chain will still be essentially derived from the i.v., but not dependent of that no longer protected variety. The reason for this lies in the spirit of the concept of dependency. This principle has mainly been introduced to protect more efficiently the initial breeder and not those who make derivations from his work.

3.3. Assessment of Essential Derivation

The assessment of essential derivation takes place after establishing that a variety is clearly distinguishable from all varieties, which are a matter of common knowledge and should consider the following requirements:

- conformity to the initial variety in the expression of the essential characteristics that result from the genotype or the combination of genotypes of the initial variety
- predominant derivation from the initial variety.

The first requirement could be based on reliable phenotypic characteristics: either close relationship in general which could lead to a "conformity threshold" parallel to the minimum distance threshold used for distinctness or only small differences in some simply inherited characteristics. If this requirement is considered as fulfilled, then, we have to assess the second one, which is "predominant derivation from the initial variety".

Predominant derivation from the initial variety implies that the initial variety or products essentially derived therefrom have been used in the breeding process.

In order to prove that use, various criteria or a combination thereof may be used:

- combining ability
- phenotypic characteristics
- molecular characteristics
- breeding records

3.4. Burden of Proof/Reversal of Burden of Proof

According to the general rule of burden of proof, it is to the owner of the initial variety to prove essential derivation and then claim dependency. However, if the owner of the i.v. can give reasonable evidence of essential derivation (*prima facie* proof), ISF is in favor of the reversal of the burden of proof. For *prima facie* proof, the following elements should be sufficient:

- strong phenotypic similarity
- only small differences in some simply inherited characteristics
- strong genetic similarity.

If the owner of the i.v. has fulfilled one of the above requirements, then the second breeder would have to prove that there is no predominant derivation, or that he had not used the i.v., or a variety essentially derived from that i.v.

¹ If the act of derivation is made during the grace period as provided for in the UPOV Convention or between the date of application for protection and the date of granting the protection of the initial variety, dependency from the initial variety will start at the time of granting. However, the breeder of the initial variety will, at least, be entitled to an equitable remuneration in line with Article 13 on Provisional Protection of the 1991 Act of the UPOV Convention if the essential derivation is commercialised during the grace period or during the period between the date of application and the date of granting.

² An essentially derived variety can be directly derived from the initial variety or from a variety that is itself predominantly derived from the initial variety. It is possible to have a "cascade" of derivation. However, each essentially derived variety shall only be dependent on one, the protected initial variety. A cascade of dependence shall not exist, the principle having been introduced to better protect the breeder of the initial variety and not those having made derivations from his work.

The use of distance coefficients to define a threshold, which would be a trigger point for the reversal of the burden of proof is another interesting approach. Up to now, ISF has mainly worked on thresholds based on distances measured by molecular markers. Geneticists and statisticians consider that technically it is equally possible to measure distance coefficients using morphological markers but that these distances are not always reflective of genetic distances or of pedigree relationships. Additionally, use of morphological characteristics would probably be more difficult due to environmental factors, and much more expensive.

In the early 1990s the approach adopted by ISF was to work with two thresholds as follows:

- a first threshold below which a variety should be considered as non essentially derived from an initial variety and a second threshold above which the new variety should be considered as essentially derived, except if the breeder can prove, by clear evidence, that he/she has started from independent germplasm.
- between the two thresholds the derivation could be disputable and the breeder of the putative essentially derived variety should have to give, in case of amicable negotiation or arbitration, information on the origin of the new variety and possibly to open the breeding records.

More recently the general opinion of ISF members moved to the definition of only one threshold that would divide the scale of conformity into two parts: below the threshold there would be no presumption of essential derivation, above the threshold there would be presumption of essential derivation and the burden of proof of non predominant derivation would fall on the breeder of the putative essentially derived variety.

The threshold will certainly vary from species to species, depending on the existing genetic variability within the species and the established breeding procedures.

3.5. Dispute Settlement

ISF recommends to its members, in any case of dispute, to first enter into a conciliation or arbitration procedure according to ISF Conciliation and Arbitration Procedure Rules before resorting to legal action. Indeed one of the good reasons to use arbitration in international trade and intellectual property disputes is that the normal courts have difficulties to take decisions on very technical matters. They have to ask the opinion of experts. So it is more efficient to address those experts directly in the frame of a well-established procedure.

4. The ISF Crop-by-Crop Approach

This chapter describes the work done by the crop specific Sections. It describes the situation at the time of publication of this document. It must be noted that the situation is constantly evolving.

4.1. Maize

Whilst the Maize Section did not embark directly on a study, the question of essential derivation has been heavily discussed at several meetings and in particular the Section was instrumental in the adoption of guidelines on assessment.

It also discussed in detail the work done by the maize seed industry in France, the US and Germany. The most advanced project is the French one.

The work was initially done using RFLP and the adopted thresholds were, using the Rogers distance:

- Red zone: above 90% of similarity
- Orange zone: between 90 and 85%
- Green zone: below 85%

A new analysis using microsatellites was completed and new thresholds were agreed upon to take into account the greater variability expressed:

- Red zone: above 90% of similarity
- Orange zone: between 90 and 82%
- Green zone: below 82%

A code of conduct with those thresholds has been adopted by the French maize seed industry members as follows: "Above the threshold of 90% the variety should be considered as an edv without further discussion; between 82 and 90% there is possible essential derivation and the parties have to negotiate; below 82% there is no essential derivation.

In the case of hybrid crops, the value of the red zone is to allow taking into account the development of "essentially derived" lines from the genetic structure of a hybrid (reverse engineering). Further consideration will be given to this specific case.

A meeting will take place in Chicago in Dec 2005 to analyse the three national studies and possibly develop a common ISF position.

4.2. Vegetables

4.2.1. Tomato

This was the first edv study organized by ISF, further to a decision taken by the vegetable section in Nairobi in 1993. Tomato was chosen because a good genetic map existed for that crop and because, at that time, many breeders considered molecular markers to be an inadequate tool for assessing relationships in tomato.

Three molecular techniques, RAPD, AFLP and microsatellites, as well as morphological characteristics were used on a California open-pollinated cluster.

The results suggested that:

- the discriminatory power of phenotypic data and molecular technologies are comparable
- the various molecular techniques give the same ranking.

Internally the chairman of the working group proposed the following preliminary thresholds based on distances calculated from RAPD results using the complement to the simple matching coefficient:

- Red zone: above 85%
- Orange zone: between 80 and 85%
- Green zone: below 80%.

However, it was decided not to circulate that proposal to the section for adoption before additional statistical work be done, which is still pending.

4.2.2. Lettuce

In 2000, the vegetable working group decided to switch to lettuce and worked on three cultigroups, butterhead greenhouses and summer field crop and Salinas iceberg. The molecular markers used were AFLP and the statistical distance was the Jaccard one. Based on some information of genetic relatedness for some known varieties and on the statistical upper-tail principle using the five closest varieties, the working group proposed to the section a threshold of 0.96 Jaccard distance. The section adopted the attached guidelines in Berlin in 2004 (Annex I).

4.3. Ryegrass

At the end of 1996, the forage and turf section decided to launch an experimental study on ryegrass and aimed at

- generating morphological, biochemical and DNA-marker data for a core set of selected ryegrass accessions with known genetic relationships
- examining the relationship between genetic similarity estimated from molecular data and the phenotypic similarity estimated from morphological data using the same representative plants for each accession, and
- providing an expert and statistical based interpretation of these data from which ASSINSEL may begin to develop the design of a future protocol to follow in cases of putative essential derivation.

Twelve diploid perennial ryegrass accessions, comprising five closely related groups were supplied by ASSINSEL members and were subject to morphological and molecular analyses.

The results of the study were presented to the members of the Section in a meeting in Melle on January 27, 1999 and in Melbourne also in 1999. They show that the known relationships between the twelve accessions are correctly expressed by the AFLP methodology and consistent with the results of morphological characterization. The analysis of the AFLP data indicates that the estimates of similarity among the tested accessions are robust and that analysing fewer than 60 plants could reduce costs without compromising accuracy.

It should be possible to assess genetic distance by using either morphological or molecular data.

On the grounds of those results, the Section during its meeting in Melle proposed a threshold of 7 for the squared Euclidean distance between pairs of varieties, using the 5 AFLP primer combinations and the protocol as tested by DvP. In case of Euclidean distance below that proposed threshold the new variety could be considered as a putative essentially derived variety and various actions could be taken.

A draft code of conduct based on that threshold was adopted in Chicago in 2002 (Annex II).

4.4. Oilseed Rape

A study on essential derivation started in 2001. The first phase analyzed the intra-varietal variability and the second one the possibility to pool plants of the same variety to have a good representation of its genetic make-up. The results having been positive, phases 3 and 4 are now going on to analyse the inter-annual variability and the variability of winter and spring varieties presently on the market. The objective is to implement the upper-tail principle to choose one threshold.

For that study, molecular markers are microsatellites and the genetic distance is the Jaccard one.

The final results should be presented to the section during the ISF congress in Santiago in May 2005.

4.5. Conclusion

An important scientific work has been done by ISF members on the assessment of essential derivation with an evolution from two thresholds to one threshold (but the two-threshold approach has merit in particular in the case of hybrid parental lines) and from a genealogical approach to a more statistical one supported by former genealogical data.

Two codes of conduct/guidelines have already been adopted. The concept is already used in amicable discussions and some cases are pending in courts. Obviously essential derivation will become increasingly important in the future.

5. Consequences for the Breeders

The concepts of derivation and dependence will prevent “cosmetic” breeding changes or plagiarism, which could sometimes allow the creation of distinct varieties in the sense of the UPOV Convention. The consequences for the breeders, the farmers and biological diversity more broadly should be positive and will certainly impact the breeder’s work.

a) Breeding methods

Any conventional breeding method could, in theory, provide an essentially derived variety. Certain methods appear to give a higher risk of developing essentially derived varieties. Among these methods we include:

- natural or induced mutations
- repeated backcrosses; (discussions still continue on the number of backcrosses which could lead to an essentially derived variety. As shown in the French text of the 1991 Convention, which is of evidence, the authors of the Convention had in mind at least two backcrosses, the word being written in plural. However, it must be noted that the selection pressure exerted after the backcross(es) can have an important effect on the final result)
- selection in an existing variety, for example the choice of clones in a synthetic variety;
- transformation by genetic engineering.

Breeders would have to pay more attention to the results of their breeding work when working with protected varieties in the framework of the “breeder’s exemption”. If the result of the breeding work is an essentially derived variety, authorisation of the breeder of the initial variety is required for commercialisation of the e.d.v. Commercialisation may be refused or allowed under specified conditions.

b) Development of technical information

Conformity thresholds for essential derivation, such as presented above, can be defined in the frame of professional agreement (which would be the solution) or, in a case-by-case basis, in decisions by courts of law. In either case, thresholds will be come to exist in the years ahead. To know their freedom to operate in relation to such thresholds, breeders will need:

- a good knowledge of the range of phenotypic, molecular and physiological variability of varieties present in the market, and
- to know the phenotypic, molecular and physiological profiles of their genetic material and experimental varieties, as well as their breeding histories and documentation of legal access.

Breeders will need to employ the tools necessary for assessing such profiles in their research programs. Such tools will not only be used for the protection of intellectual property, but should also promote improvement of breeding efficiency.

c) Maintaining breeding records

Conformity thresholds only, at least in the zone of uncertainty (orange zone), will not allow a decision on derivation and dependence. In case of litigation, information on parental material and breeding

methods will be needed. Thus, breeders will need to maintain clear and accurate breeding records. Breeders are encouraged to seek competent professional legal advice on the best ways to develop and maintain these important records.

Annex I

GUIDELINES FOR THE HANDLING OF A DISPUTE ON EDV IN LETTUCE

(Adopted by the ISF Vegetable and Ornamental Section, May 2004)

1. The 1991 Act of the UPOV Convention introduced the concepts of essential derivation and dependency from an initial variety (i.v.).
2. The ISF Vegetable and Ornamental section has conducted, in 2001 – 2002, a study to evaluate the inter-variety genetic diversity based on the use of AFLP. Three groups of varieties were used: 35 Butter Head Greenhouse heated (short-day butterhead varieties for heated glasshouse production), 21 Butter Head Field Summer (long day butterhead varieties for outdoor production) and 27 Iceberg varieties of the Salinas-type.
3. The results of the study are available in the ISF internal report posted on the ISF website and in the following publication (Statistical Aspects of Essential Derivation, with illustrations based on Lettuce and Barley, F.A. van Eeuwijk and J.R. Law, Euphytica, 2004), to which it is recommended to look at for further details.
4. Based on the results of the study the ISF working group has decided to propose a threshold of 0.96 Jaccard similarity for the three cultigroups, taking into account the present diversity available on the market but also having in mind the need to protect effectively future breeding work¹.
The technical protocol is annexed to the present guidelines. It has to be followed precisely for assessing the genetic distance.
5. The above-mentioned threshold is a trigger point to initiate a discussion between the breeders of the putative initial and essentially derived varieties. If the Jaccard coefficient is higher than 0.96, the breeders will try to reach an amicable settlement. If this settlement cannot be reached, the breeder of the i.v. may ask for the arbitration, according to the ISF rules for disputes settlement and the mediators/conciliators or arbitrators may ask for the reversal of the burden of proof. The breeders of the putative EDV will have to provide the information that is relevant to determining the status of his variety. They may be asked to open their breeding records to an independent neutral expert. (See the ISF arbitration rules for further details)
6. The guidelines shall apply on all varieties subject to national laws.
7. After a period of 5 years the protocol and the threshold shall be reviewed in the light of the experience gained and the technical and scientific evolution.

TECHNICAL PROTOCOL FOR IMPLEMENTATION OF THE ISF GUIDELINES FOR THE HANDLING OF A DISPUTE ON EDV IN LETTUCE

(Adopted by ISF Vegetable and Ornamental Section, May 2004)

Plant material

Three types of lettuce were included in the study, in order to establish this PROTOCOL:

- Butter head for long day outdoor production (acronym FS; 21 varieties)
- Butter head for short day greenhouse production (acronym GH; 35 varieties)
- Crisp head lettuce, USA Salinas type (acronym IC; 27 varieties)

Seed lots

When a seed sample has been sent in an official office for protection purpose, that sample, or a sample of the same seed lot, has to be the reference for marker studies in arbitration process.

DNA samples

A leaf disc will be taken of 10 different plants of each variety and the discs will be pooled. The DNA preparation protocol that is used is described in CJ Steward Jr and LE Via, 1993, Biotechniques 14: 748-750.

¹ Thresholds for other lettuce cultigroups (and possibly other species) could probably be determined using the same molecular and statistical approach as for the three lettuce cultigroups of the study.

Primer combinations

The following 10 AFLP primer combinations will be used: E33/M59, E35/M48, E35/M49, E35/M59, E35/M60, E38/M54, E44/M48, E44/M49, E45/M48, E45/M49.

Genetic similarity

Markers will be scored as present or absent, where presence is represented by a score of 1, while absence is scored as 0. All bands, whether monomorphic or polymorphic, will be used to calculate genetic conformity. Conformity between varieties will be calculated by the Jaccard coefficient. This means that for a pair of varieties the similarity will be given by the ratio of the number of markers with bands in both varieties (1,1) on the number of markers for which at least one band appears in either of both varieties (1,1; 1,0; 0,1).

Precision of estimates for genetic similarity

Standard error for similarity estimates will be obtained by the following procedure. Calculate Jaccard similarity estimates between varieties for each of the 10 sets of markers corresponding to the different primer combinations. In this way, for each pair of varieties, 10 similarity estimates will be obtained. Next, calculate standard deviations across the 10 similarity estimates per variety pair. Finally, calculate standard errors by dividing the standard deviations by $\sqrt{10}$.

The use of 10 primer combinations leads to standard errors of about 0.007 and confidence intervals of ± 0.014 for the similarities in the upper tail of the distribution of similarity estimates. This is accepted by the study group as representing a sufficiently high level of precision.

Threshold

A threshold for potential essential derivation cases is set at a value of 0.96 Jaccard similarity by means of the tail principle. (1)

New marker systems

Whenever a new marker system is going to be introduced for essential derivation purposes in butter head or crisp head lettuce, the new system should be calibrated on the AFLP system described in this annex. This means that the rank order of the similarity coefficients between current and new system should be high for the collection (or a representative subset thereof) of FS and GH varieties used in the present lettuce study. In addition, standard errors for individual similarities should be within the same order of magnitude as found in the present study, i.e., be around 1% of the similarity estimate.

(1) Specific remarks :

(This principle works as follows. First define the reference set of varieties for the particular problem. As for the lettuce study, there existed a clear separation between the three types (FS, GH, IC) on the basis of cluster-analyses and multidimensional scaling on Jaccard similarities, it was decided to treat initially each lettuce type separately. Next, within a reference set of varieties, order the similarities from low to high. Finally, choose a cut-off point, or threshold, in the ordered series of similarities above which variety pairs will classify as being suspect. Such a threshold will typically be placed somewhere in the highest 5% of similarities. A threshold is well chosen when for variety pairs above the threshold arguments can be given why these varieties are so similar. Simultaneously, no variety pairs known to be closely related should end up clearly below the threshold.)

The lettuce study group has placed the threshold at 0.96 similarity for all three lettuce types included in the study. This threshold was chosen on the basis of the position of 95 percentiles in butter head groups, FS and GH. The 95 percentile is the similarity value for which it holds that only 5% of the variety pairs has higher similarity. For a number of the variety pairs in the upper 5% tail of the distribution of Jaccard similarities for FS and GH convincing reasons could be given for their inclusion in the upper tail.

The crisp head group, IC, had less genetic variation than the butter head groups and its 95 percentile corresponded to a similarity value of 0.98. Still, the lettuce study group argued that the amount of genetic variation found in the butter head groups should serve as a standard to be complied with and for that reason also for crisp head lettuce, a threshold similarity value of 0.96 was installed. Further support for this threshold in the crisp head group was given by the breeding history of many variety pairs with similarities larger than 0.96. Many of such variety pairs might be considered to present examples of derivation.)

**Principles of a Code of Conduct in
Essentially Derived Varieties of Perennial Ryegrass**

(Adopted in Chicago, May 2002)

1. The 1991 Act of the UPOV Convention entered into force in 1998 and introduced the concepts of essential derivation and dependency from an initial variety (i.v.).
2. The Forage Plants Section of ASSINSEL conducted in 1997 and 1998 a model study to evaluate tools and to determine possible thresholds for assessing putative essential derivation.
3. Based on the results of the study, the Section proposed during its meeting in Melle in January 1999 to adopt a provisional threshold, 7 for the squared Euclidean distance between pairs, using 60 plants per variety and a 5 primer combination. (The testing protocol, as annexed to this present code of conduct, should be followed precisely for assessing the distance). That proposal was confirmed by the section during its meeting in Melle in March 2002 and the following principles for a Code of Conduct were agreed upon.
4. In case of doubt a new variety is essentially derived from an i.v., doubt based on the fact that the new variety presents the essential characteristics of that i.v., the breeder of the i.v. will have, very likely, the squared Euclidean distance between the two varieties measured.

If the distance is 7 or lower, the breeder of the i.v. may ask for ISF arbitration and the arbitrator may ask for the reversal of the burden of proof. The breeder of the putative essential derived variety (e.d.v.) will have to show that he has not practiced essential derivation from the i.v.. The arbitrators also have the right to ensure that the putative i.v. is not itself an e.d.v. from a preexisting variety.
5. The Code of Conduct would only apply to varieties commercialized or registered for the first time after its entry into force.
6. In order to encourage companies to adopt the code of conduct so that it could be possible to refine the threshold based on new molecular data, a transitional period of 5 years will be established after the entry into force of the code of conduct. During the transitional period the companies adhering to the code shall commit themselves:
 - Not to claim any dependency rights for essentially derived varieties commercialized or registered for the first time during the first two years after adoption of the code of conduct.
 - To agree on compulsory licensing of the e.d.v. by the owner of the i.v. at a level of 50% of royalties obtained in normal commercial practices for essentially derived varieties commercialized or registered for the first time during the following 3 years.
7. After the period of 5 years the threshold will be reviewed and, if necessary revised. Then the code will continue to apply and the owner of the i.v. will have the freedom to exercise his full rights as provided for in the applicable laws.