UPOV

TWC/I/4
ORIGINAL: English
DATE: May 15, 1984

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS

First Session
Cambridge, United Kingdom, May 17 to 19, 1983

REPORT

adopted by the Technical Working Party on Automation and Computer Programs

Opening of the Session

1. The first session of the Technical Working Party on Automation and Computer Programs (hereinafter referred to as "the Working Party") was held at Cambridge, United Kingdom, from May 17 to 19, 1983. The list of participants appears in Annex I to this report.

2. Mr. A.F. Kelly, Deputy Director of the National Institute of Agricultural Botany (NIAB), welcomed the participants, on behalf of Dr. G.M. Milbourn, to the NIAB at Cambridge. The session was opened by Mr. C. Hutin, Chairman of the Working Party.

Tasks of the Working Party

3. The Chairman referred to document TWC/I/2 which reports on the creation of the Working Party and the tasks given to it during the last session of the Technical Committee.

Adoption of the Agenda

4. The Working Party unanimously adopted the agenda for its first session as reproduced in document TWC/I/1.

Inventory of Existing Hardware

5. The Working Party noted the information on the existing hardware as indicated in document TWC/I/3, Annex I, No. 1, and made a few corrections to that document. In addition, the experts from each of the member States represented furnished additional information, partly in writing, partly orally. With respect to the information given in document TWC/I/3, the Associate Officer from the Office of UPOV, being a national of Japan, was in a position to give to the Working Party further explanations and answer questions concerning the situation in Japan. Such additional information was given not only on this subject but on most of the subjects mentioned in document TWC/I/3.

6. The additional information supplied by the United Kingdom in writing is reproduced in Annex II to this report.

7. As a result of all the additional detailed information given and in order to improve the comparison of all that information, it was finally decided to establish a comparative table of the existing hardware. This table, which was partly prepared during that session and partly completed by correspondence after the session, forms Annex III to this report.

Inventory of Data Processing Functions at Present Applied in the Plant Variety Protection Offices

(i) Handling of General Administrative Activities

The individual experts in the Working Party supplemented the information on the handling of general administrative activities, as indicated in document TWC/I/3, Annex I, No. 2(i), by the following information. In the Federal Republic of Germany, the computer was used to help in the invoicing of fees for national listing and for the application of plant variety protection, it was used for the establishing of the yearly statistics of the varieties and for the list of varieties for VCU tests. It was also planned to use it in future for the hitherto separated list of varieties for DUS tests. In Spain, the computer was used to handle the applications. It was also planned to prepare the lists of varieties under test and the statistics on the varieties tested with the help of the computer. In France, the same data base was used for administrative matters and the VCU tests, but not for the DUS tests. Invoicing by computer was done as part of general invoicing, including that for seed testing. In the Netherlands, the use of the computer for administrative handling was still in preparation. In the United Kingdom the computer was used to keep a Name and Address File, a Test and Trials File, a National List and Grants of Rights File and a Seed Quantities and Fees File with programs for the maintenance of the Name and Address File, for the application and fees, for the entry on the National List and for the renewal of notifications and the renewal of invoices.

(ii) Handling of Checking of Variety Denominations

The individual experts in the Working Party supplemented the information on the handling of the checking of variety denominations as indicated in document TWC/I/3, Annex I, No. 2(ii). The summary of this additional information let to the establishing of a further table which is reproduced in Annex IV to this report. The Working Party first established a table indicating for its member States only the information items forming part of the tables used by the member States for checking variety denominations. On the basis of this table the Working Party then, however, went a step further and included also information on the coding used by those member States for the different entries. This information has in the same way as for Annex III been checked and completed after the session by correspondence. Annex IX contains further information on the procedure for the testing of variety denominations in the Netherlands received after the session.

(iii) Handling of Testing for Distinctness, Homogeneity and Stability

The individual experts in the Working Party supplemented the information given in document TWC/I/3, Annex I, No. 2(iii), as follows, restricting themselves on that agenda item to the testing of self-fertilized crops. In the Federal Republic of Germany, a working list was prepared first and the data were thereafter corrected. For distinctness, each variety was compared with each other variety in respect of a predefined distance. Homogeneity of self-fertilized crops was not checked with the help of the computer. In Spain, only cross-fertilized crops were tested with the help of the computer. In France, different programs existed for cross-fertilized and self-fertilized crops. While for cross-fertilized crops a description was established for each plant, for self-fertilized crops a description was established only for each variety. In the Netherlands, the descriptions of varieties of potatoes and self-fertilized crops were compared with the help of a decision table established for each characteristic in advance. Homogeneity and stability test results were not normally processed by computer programs. In the United

Kingdom, the testing of DUS for cereals, for example, was done by separating the varieties in a number of small groups (8 - 10) with the help of major morphological characteristics which did not change over the years. These small groups were then checked against the remaining characteristics whereby a class width was established in the 1-9 scale based on experience. All pairs of varieties which it was not possible to separate by a given class width were then listed by the computer.

Data Processing Functions Required by Plant Variety Protection Offices

8. The individual experts in the Working Party supplemented the information given in document TWC/I/3, Annex I, No. 3, as follows. In the Federal Republic of Germany, first priority was given to the standardization of methods, thereafter to the checking of variety denominations. In Spain, first priority was given to the standardization of general administrative activities, thereafter to the testing of distinctness, thereafter to the checking of variety denominations. In the Netherlands, first priority was given to the standardization of the procedures for testing and the translation of observations into variety descriptions, thereafter to the checking of variety denominations, thereafter to the automation of administrative procedures. In France, the computerization of administrative procedures was quite advanced and therefore France was more interested in a more intensive use of the technical testing and checking of variety denominations by computer. In the United Kingdom, in the field of administration, need was seen for the entering into the computer of the computer records of present variety denominations and the entering of historical information on varieties prior to 1979. With respect to integration, it was felt necessary to establish systems for the direct translation of numerical codes, the establishing of a computerized seed certificates scheme, and the integration of technical information into one single system containing the administrative files data bases as well as the technical files. All other experts present felt that one single data base comprising administrative and technical files would also be desirable for their countries.

Standardization of Entries

9. Discussions on the standardization of entries had already started under the item on handling of checking of variety denominations which had led to the preparation of the table reproduced in Annex IV to this report.

10. In order to obtain practical information on the possibilities or difficulties of preparing with the help of the computer one list of variety denominations of all the member States by using the computerized information on the different lists so far existing in the UPOV member States it was agreed to make a start with one species. The Working Party finally chose barley and agreed that Mr. Royer (France), Dr. Laidig (Federal Republic of Germany), Mr. Duyvendak (Netherlands) and Mr. Graham (United Kingdom) would participate in the first attempt to prepare a standardized list of variety denominations. Mr. Royer would receive from the other experts mentioned above by September 15, 1983, at the latest, an example of one page of the list of barley variety denominations together with precise formation on the format, the length of all fields and any other restrictions to that list. He would then by the end of October prepare a proposal for a standardized list and send it back for counter proposals by the other experts. At the same time he would also send a copy to the Office of UPOV which would circulate these proposals to the other UPOV member States asking them for further proposals. The result of this inquiry would then be presented to the Working Party during its second session.

11. Parallel to this study Mr. Duyvendak (Netherlands) would prepare an analysis of the different lists of varieties under test at present circulated between the UPOV member States and prepare proposals on how these lists could be standardized.

12. Furthermore, Mr. Mossop (United Kingdom) would analyze the lists of varieties in the UPOV Gazettes and would prepare proposals for a further standardization of these lists.

Methods Used for Cross-Fertilized Plants

13. Dr. Weatherup (United Kingdom) explained in detail the program available for the testing of distinctness, homogeneity and stability at the computer center in Belfast. Details on this program are reproduced in Annex V to this report. Following the detailed explanations, discussions arose on the different possibilities for the analysis of test results on distinctness, namely

(i) the application of the UPOV criteria of differences which occur with 1% probability of error, for example, on the basis of the method of the least significant differences in two or two out of three growing seasons;

(ii) the application of the t score;

(iii) the application of a combined over-year analysis, and

(iv) the application of the multi-variate analysis.

14. In this connection, Dr. Laidig (Federal Republic of Germany) explained the results of his simulation study comparing the application of the UPOV criteria, of the t score and of the combined over-year analysis. This study revealed that, with the application of the t score distinctness was more frequently established than with the UPOV criteria but that, with the increasing of the variety x year interaction, the application of the UPOV criteria would lead to an increase in wrong decisions. A combined over-year analysis would give a chance of more stable and repeatable decisions.

15. After further discussions, the Working Party came finally to the conclusion that the combined over-year analysis seemed to be the most satisfactory, would lead to a better discrimination and would diminish the risk of establishing differences which did not exist. It therefore agreed to recommend that the Technical Committee consider the adoption of a combined over-years analysis in place of present UPOV distinctness criteria.

16. The multi-variate analysis was also considered to be a useful tool but might reveal too precise differences and might require certain safeguards if introduced for distinctness purposes. A shortcoming of the multi-variate analysis would be that often it would allow two varieties to be distinguished without enabling the examiner to say which characteristic caused the differences.

17. The Working Party also discussed at length the UPOV criteria for establishing homogeneity requiring, for measured characteristics, a variance exceeding 1.6 times the average of the variance of the varieties used for comparison. It finally agreed to study at home the criterion mentioned by Dr. Weatherup in his report, namely the mean standard deviation of the controls + $t_{2\%}$ x the standard deviation of control standard deviations, and to study the consequences that would arise if UPOV changed its criteria to the above-mentioned ones.

Future Program, Date and Place of Next Session

18. The Working Party agreed to hold its second session at La Minière, France, from May 15 to 17, 1984. On May 17, 1984, the meeting would close at noon. During that session, the Working Party would continue discussions or start new discussions on the following items:

(i) Standardization of Entries
(Mr. Duyvendak (Netherlands) to prepare a proposal for the standardization of the lists of varieties under test, Mr. Mossop (United Kingdom) to prepare a proposal for the standardization of the lists of varieties of the Gazettes),

(ii) Checking of Variety Denominations
(Mr. Royer (France) to prepare a proposal for a standardized list of variety denominations),

(iii) Methods Used for Cross-fertilized Plants (with emphasis on the testing of homogeneity),

(iv) Description of Varieties
(Mr. Law (United Kingdom) to prepare a working paper on the basis of examples of wheat descriptions as well as wishes for the standardization of variety descriptions to be sent to Mr. Law by Dr. Laidig (Federal Republic of Germany), Mr. Royer (France), Mr. Duyvendak (Netherlands), Mr. Del Fresno (Spain).
This working paper would then be circulated to the above-mentioned persons and through the Office of UPOV to the other member States not present during the first session. Answers to this circulated working paper and proposals for additions would form the basis of discussions during the coming session.),

(v) Report on the Progress Made With Respect to the Intregration of Files,

(vi) Inventory of Data Base and Their Structure
(The expert from the United Kingdom to prepare a description of one data base and send it to the Office of UPOV by the end of July for circulation to the other member States which would be asked to describe their data bases in the same way as the example and send the description to the Office of UPOV by the end of December. This description should not be limited to the DUS testing but should also include the testing of agronomic value as well as the administrative handling.),

(vii) Intercommunication Network
(Mr. Talbot (United Kingdom) to prepare a paper outlining the network available as of present (already attached as Annex VIII) as well as a second working paper with proposals for future networks.),

(viii) Weighted Evaluation
(Mr. Royer (France) to prepare a working paper on the present situation in France regarding the application of weighted evaluation in the testing of agronomic value.)

(ix) Exchange of Software
(Mr. Talbot to prepare a working paper on the improvements to be introduced to facilitate the exchange of software.)

19. In addition to the above-mentioned items for the coming session of the Working Party, the following further questions were raised without, however, taking a decision on their discussion during the coming session:

How does the bar code work? Where intermediate forms are necessary and how can they be eliminated? How can observations best be transformed into descriptions? Which parameters need special attention because they may have a skew distribution? The uniformity parameters? What is needed to obtain direct communication between UPOV authority computers? Does international standardization (for example ISO) exist for countries, cities, botanical taxa, publications? Ought we, before listing and using lists of variety names define sources, define limits, estimate place and status of variety names, define responsibilities for the entry and deletion of names, define procedures of treatment for: translation of names, synonyms, trademarks, selections within umbrella varieties? How to harmonize application forms which would enable data to be used directly by the computer? Should we collect information on the access to files?

Visits

20. In the morning of the second day, the Working Party visited the computer facilities available at the Plant Variety Protection Office. Here a demonstration was given on the Name and Address File, on the Test and Trials File, on the National List and Grant of Rights File, on the Seed Quantities and Fees File, on the creation of a Test and Trials File Record, on the using of REPORTER to select unnamed varieties, on the Variety Names File and on variety name checking. Examples and some further information on these files is reproduced in Annex VI to this report.

21. During the same morning the Working Party also visited the computer facilities at the NIAB. Here it saw the follow-on system to the administrative files and detailed explanations were given on the use of Microfin, a

portable technical field recorder enabling the examiner to feed data in the field directly into the computer. It was furthermore demonstrated how the administratives files used by the PVRO could also be used for technical purposes.

22. Both visits were enlarged during the last day by further demonstrations, for example in the NIAB, explaining the use of the bar code.

Any Other Business

23. Annex VII to this report reproduces an article prepared by H.D. Patterson and Dr. S.T.C. Weatherup on statistical criteria for distinctness between varieties of herbage crops.

24. This report was adopted by the Technical Working Party on Automation and Computer Programs at its second session on May 15, 1984.

[Annexes follow]

LIST OF PARTICIPANTS
IN THE TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS
CAMBRIDGE, UNITED KINGDOM, MAY 17 TO 19, 1983

I. MEMBER STATES

FRANCE

Mr. C. HUTIN, Directeur de recherches, INRA/GEVES, GLSM, La Minière, 78280 Guyancourt (tel: 0033 3 043 8113)

Miss M. C. BIGE, Unité de Calcul, INRA/GEVES, GLSM, La Minière, 78280 Guyancourt (tel: 0033 3 043 8113)

Mr. F. ROYER, Unité de calcul, INRA/GEVES, GLSM, La Minière, 78280 Guyancourt (tel: 0033 3 043 8113)

GERMANY, FEDERAL REPUBLIC OF

Dr. F. LAIDIG, Bundessortenamt, Osterfelddamm 80, 3000 Hanover 61 (tel: 0511-57041)

NETHERLANDS

Mr. R. DUYVENDAK, Botanical Research, Agricultural Crops, RIVRO, P.B. 32, 6700 AA Wageningen (tel: 08370-19056)

Mr. A.M. VAN DER BURGT, RIVRO, P.B. 32, 6700 AA Wageningen (tel: 08370-19056)

SPAIN

Mr. J.M. ELENA ROSSELLO, Jefe del Registro de Variedades, INSPV, 56, José Abascal, Madrid 3 (tel: 01-4418199)

Mr. M. DEL FRESNO, Registro de Variedades, INSPV, 56, José Abascal, Madrid 3 (tel: 01-4418199)

Mr. M. VILLENA, Instituto Relaciones Agrarias, 56, José Abascal, Madrid 3 (tel: 01-4428211)

UNITED KINGDOM

Mr. A.F. KELLY, Deputy Director, National Institute of Agricultural Botany, Huntingdon Road, Cambridge CB3 0LE (tel: 0223 276381)

Mr. S. GRAHAM, Computer Manager, Ministry of Agriculture, Fisheries and Food (MAFF), White House Lane, Cambridge CB3 0LF

Mr. A. G. HAMPSON, National Institute of Agricultural Botany, Huntingdon Road, Cambridge CB3 0LE (tel: 0223 276381)

Mr. J. R. LAW, National Institute of Agricultural Botany, Huntingdon Road, Cambridge CB3 0LE (tel: 0223 276381)

Mr. D.J. MOSSOP, Higher Executive Officer, The Plant Variety Rights Office, White House Lane, Huntingdon Road, Cambridge CB3 0LF

Mrs. V. SILVEY, National Institute of Agricultural Botany, Huntingdon Road, Cambridge CB3 0LE (tel: 0223 276381)

Mr. M. TALBOT, Agricultural Research Council (ARCUS), Unit of Statistics, University of Edinburgh, James Clerk Maxwell Building, Mayfield Road, Edinburgh EH9 3JZ (tel: 031 667 1081)

Dr. S.T.C. WEATHERUP, Biometrics Division, Department of Agriculture for Northern Ireland (DANI), Newforge Lane, Belfast BT9 5PX (tel: 0232 661166)

Mr. P. WINFIELD, Department of Agriculture for Scotland (DAFS), Agricultural Scientific Services, Edinburgh

II. OFFICER

Mr. C. HUTIN, Chairman

III. OFFICE OF UPOV

Dr. M.-H. THIELE-WITTIG, Senior Counsellor, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland (tel: 022 999152)

Mr. K. SHIOYA, Associate Officer, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland (tel: 022 999297)

[Annex II follows]

ANNEX II

UPOV TECHNICAL WORKING PARTY ON AUTOMATION AND COMPUTER PROGRAMS

HARDWARE AND SOFTWARE AT UNITED KINGDOM COMPUTING CENTRES

1. Organisation

Data processing for Plant Variety Rights purposes is undertaken in Cambridge, Belfast and Edinburgh:-

England and Wales	- NIAB, Cambridge - Plant Variety and Seeds (PVS) Division of Ministry of Agriculture, Fisheries and Food (MAFF), Cambridge
Northern Ireland	- Biometrics Division, Department of Agriculture for Northern Ireland (DANI), Belfast
Scotland	- Agricultural Research Council Unit of Statistics (ARCUS), Edinburgh - Department of Agriculture for Scotland (DAFS), Edinburgh

The UK administrative work is, predominantly, undertaken by PVS Division of MAFF at Cambridge where a CTL 8066 computer is located.

Statisticians from NIAB, ARCUS and DANI form the Inter-departmental Statisticians Group (IDSG) which is responsible for developing and implementing the use of suitable statistical methods and corresponding computer systems for UK plant variety testing. The IDSG is concerned with technical, rather than administrative, work and has, in particular, devised and implemented statistical software packages for use at all three UK computing centres.

2. Hardware

A MAFF owned and operated Computer Technology Limited (CTL) 8066 computer is installed in PVS Division Cambridge and is used for both technical and administrative purposes.

The Cambridge installation consists of

<u>Main computer</u>

CTL 8066 with 512K bytes
2 AD Disc Drives (48m bytes exchangeable)
2 CD Disc Drives (4.8m bytes exchangeable)
1 Line Printer (200 lpm)
1 Card Reader
1 800 NRZ Magnetic Tape Drive

<u>Secondary computers</u>

Links from 8066 to ACT Sirius micro-computers are planned for 1983. Stand-alone COMMODORE PET micro-computers are available at NIAB. Back-up systems on remote IBM mainframes.

<u>Input/output terminals</u>

6 slave Visual Display Units (CIFER); 7 more to be installed in 1983 and more to follow.
Card data entry is steadily being replaced by key to disc systems using 'slave' and 'intelligent' terminals.

Main computers at Belfast and Edinburgh are, respectively a VAX 11/750 with 2m byte core and 2 fixed discs each of 121 m byte (DANI); a PRIME 550 with 1.75 m byte core and 3 x 80 m byte discs (ARCUS). Both systems have magnetic tape decks, several key to disc terminals for input and output purposes and back-up services provided on remote main frame computers. Secondary computing is provided by a range of micro computers - APPLE, COMMODORE PET, ACT SIRIUS etc.

3. Software

3.1 A list of programs, brief descriptions of their functions and examples of computer output are attached.

3.2 General administrative software in the Seeds and Fees (COBOL) package deals with receipt of new variety applications, monitors and automatically updates disc files showing the progress of varieties through the testing system, provides checks on fee payment and issues letters to applicants (breeders).

3.3 Variety name checking is done by means of phonetic checking in the SOUNDX program.

3.4 Statistical analysis of technical data recorded for the assessment of distinctness, uniformity (homogeneity) and stability is done by use of the DUST suite of FORTRAN programs commissioned by the IDSG and written by Dr STC Weatherup. The DUST package is available at all UK computing centres.

Tests for distinctness - based on univariate t-tests on paired variety comparisons, initially using the 2 out of 3 significant at P=0.01 rule. Dr Weatherup's t-score also applied. (Programs TVAL, TEST. Standard errors based on within-trial reps x varieties mean square).

Test for stability - uses univariate t-tests to compare stocks of the same variety. (Program STAB).

Test for uniformity - compares standard deviations, for candidate variates with standard deviations for control group. (Program UNIF).

NIAB
May 1983

[Annex III follows]

ANNEX III

Information on the Existing Hardware and on Computer Languages Used

COMPUTER HARDWARE	DE	ES	FR	JP	NL	GB ENG.	GB SCOT. ARC	GB SCOT. DAFS	GB N. IREL.
Main Computer									
Company	SIEMENS	IBM	SOLAR	HITAC	DEC	CTL	PRIME	IBM	DEC
Model	7.521	360-50	16-85	M-240H	PDP 11/44	8066	550	3032	VAX 11/750
Internal memory (Kb)	1500	256	1024	6000	512	512	1750	8000	2000
External memory (Mb)	600		110	4210	56	240	240	5000+ 100,000	242
Tape									
Bits per inch	800, 1600	800	1600	1600, 6250	-	800	800, 1600	1600	
Inch per second			25		-				
Protocol (direct communication between computers)			BSC multi-leaving teletype 300-1200 bauds (via transpac)		-	IBM 2780			
Languages	COBOL	COBOL	COBOL	COBOL	-	COBOL	-	COBOL	-
	FORTRAN 77	FORTRAN 66	FORTRAN 66	-	FORTRAN 77	FORTRAN 66+77	FORTRAN 66+77	FORTRAN 66	FORTRAN 77
	Assembler, RPG		Assembler, PLI	PLI	Assembler	CTL Reporter			
Language used for									
- Administration	Assembler		COBOL, FORTRAN		FORTRAN 77				
- Checking of variety denominations	Assembler		PLI		FORTRAN 77				
- DUS testing	RPG FORTRAN		FORTRAN 66		FORTRAN 77				
Character Code ASCII	+	-	+	-	+	+ (via	+	+	+
Character Code EBCDIC	+	+	+	+	-	+ CCL)	+	+	+

[Annex IV follows]

ANNEX IV

Information on Items Forming Part of the
Tables Used by the Member States for Checking Variety Denominations
and on the Coding of those Items

Variety Name Data Base	DE	ES	FR	JP	NL	GB
Species	1-3 letters	3 figures	4 figures	5 figures	3 letters	3 figures
Maximum space reserved for variety name	20	25	19 letters	40	24	28
Country of breeder	+	+	+	+	+	+
Name of breeder	4 letters	6 figures + name (25 letters)	4 figures + name (22 letters)	20 letters	3 figures or name (20 letters)	4 figures + 1 letter
Reference number of the variety used by the authority	3 letters + 4 figures	6 figures	6 figures	2 letters + 6 figures	3 letters + 1-4 figures	7 figures (3 for species, 4 for variety)
Source (Y = Year, M = Month, D = Day)	Publication YMD		Publication DMY	Publication YM	Publication YM	Publication MY
Sources used						
OECD catalogue	+		+	-	+	+
EEC Common Catalogue	(+)		+	-	+	+
Own National Gazettes	+	+	+	+	+	+
National Gazettes of other UPOV member States	+	+	+	-	+	+
Other sources (specify)					Breeders Catalogues	
Variety name test:						
Literal test	-	+	+	+	+	-
Phonetic test	German	Spanish	French	Japanese	Dutch	English
	BSA 3-5 letters		1-4 letters	under examination	Houwing Matrix	Soundex (consonants)

[Annex V follows]

PLANT VARIETY PROTECTION COMPUTER SOFTWARE: UNITED KINGDOM

The DUST suite of FORTRAN statistical programs, written by Dr S T C Weatherup (DANI, Belfast), is available for use at the three UK computing centres in Belfast, Cambridge and Edinburgh. (Reference: Weatherup, STC. (1980). Statistical procedures for distinctness, uniformity and stability variety trials. Journal of the Agricultural Society, 94, 31-46).

The following list indicates the programs used on a routine basis by NIAB. All except the first are part of the DUST suite. The initial data entry program, SUN, has been specially written to handle data input from the MICROFIN data recording devices used at Cambridge.

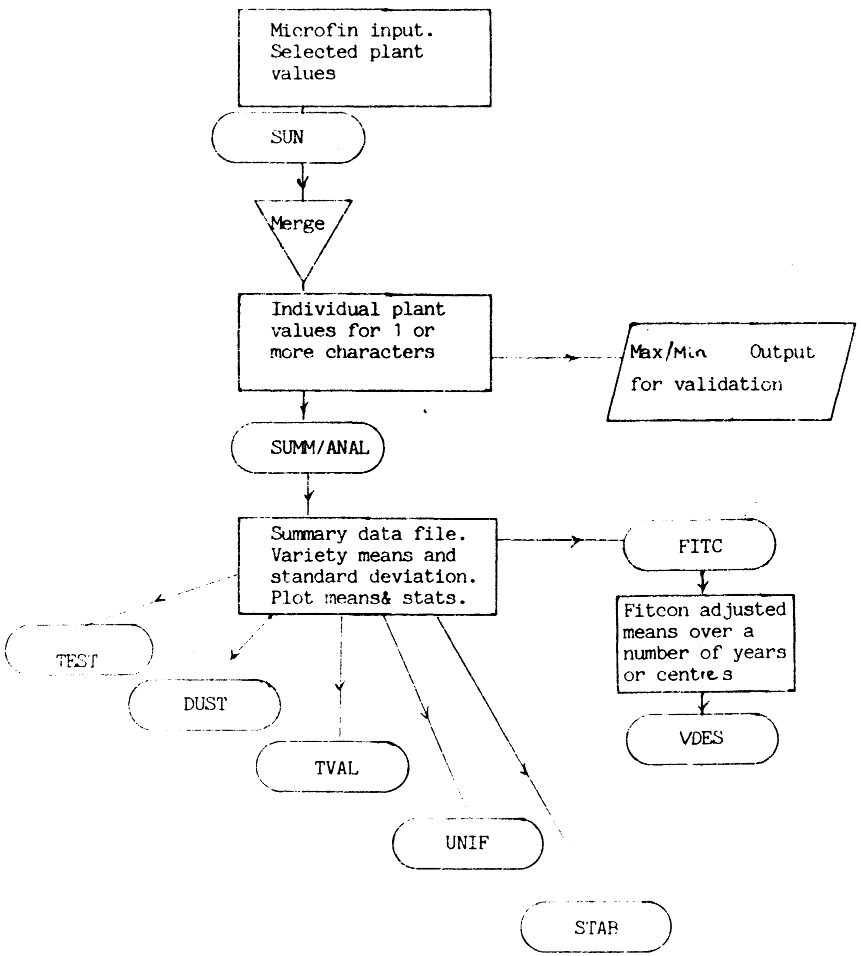
Program name	Function
SUN	Updates the current master file with new additional data records. This could be for whole plots previously unrecorded or further plant values from a number of plots. When the data file is complete a listing of the maximum and minimum value of each plot (for each characteristic) is output as a check on the data recorded.
SUMM/ANAL	Summarizes individual plant measurements by producing standard deviations for each plot on all characteristics. Combines results from plots of the same variety and performs analyses of variance on plot means for each characteristic. Options exist to generate new characteristics from existing ones as well as to perform basic transformations on the individual plant data.
TEST	Compares all variety pairs using critical differences on each characteristic.
DUST	Calculates the number of separations per character and determines essential characteristics and minimum character sets. The coefficient of racial likeness between all variety pairs is calculated.
UNIF	Uses the standard deviations of nominated control varieties to calculate critical values at various probability levels, against which the standard deviations of individual applicant varieties can be tested.
STAB	Determines the stability of varieties from comparisons between its stocks, normally in two years. As well as calculating probability levels for comparisons between stocks in each year on all characters it determines probability levels over all years.
TVAL	Determines the probability levels of differences between defined pairs of varieties, on specified characteristics in each of a number of years and produces a combined probability over all years based on the variety x year variance. T-score values over years are calculated.

FITC — Produces adjusted variety means over years (or centres) using a fitted constants analysis for a number of characteristics.

VDES — To provide a variety description in a coded form (Class Numbers 1-5) for each variety and each of a selected set of characteristics. Class numbers can be assigned either in relation to specified 'boundary varieties' or by dividing the range of expression for a particular characteristic into a number of equal parts. Over year adjusted means from FITC are used.

NIAB
May 1983

US DATA PROCESSING FLOW CHART - AS IMPLEMENTED AT CAMBRIDGE



0321

Output from TEST - Tall Fescue DUS Special Plants Cambridge 19[illegible]

TEST

COMPARISON WITH 16 BARUNDI1

		CHARACTERS															
		1	91	4	5	8	10	11	14	15	17	18	98	20	5%	2%	1%
1	S170	-	-	-	-1	+1	+	+1	+1	-	-	0	0	-	4	4	4
2	S170 NEW	-	-	-	-1	+1	+	+1	+5	-	+	-1	-2	-	6	5	4
4	ALTA	-	-	+	-1	+1	+	+1	+1	-	-	-	-	-	4	4	4
5	BACKAFAL	-	-	+	-	+1	+2	+	+1	+	+	-1	-1	-	5	5	4
6	CONWAY	-	-	-	-1	+1	+	+	+1	-	+	-	-	-	3	3	3
7	CONWAY N	-	-	-5	-1	+1	+	-	+1	-	-	-5	-5	-	6	3	3
8	DOVEY	-1	-1	-1	-1	+1	+	+2	+1	+	+	-1	-1	-5	10	9	8
9	FESTAL	-	-	-	-1	+1	-	-2	+1	-5	-1	-	-	+	6	5	4
10	RABA	-5	-5	-	-1	+1	+	+	+1	+5	+5	-5	-5	-	9	3	3
12	JEBEL	0	0	+	-1	-	-1	-	+	-	-1	-1	-1	-1	6	6	6
13	KASBA	0	0	-	-1	-5	-2	+	+	-	-2	-5	-	-	5	3	1
17	BARUNDI2	0	0	+	+	-	+	+	+	-	+	-	-	+	0	0	0
18	BARUNDI3	0	0	+	+	-	-	-	+5	+	+	-	-	-	1	0	0
19	BARCEL 1	0	0	+	-	-	-	-1	+	-	-	-	-	+	1	1	1
20	BARCEL 2	0	0	+	+	+	-	-1	+	-	-	-	-	+	1	1	1
21	BARRIETI	-	-	+	-	-	-1	-5	+2	+	-	-	-	-	3	2	1
22	CONWAY78	-5	-5	-	-1	+1	+5	+	+1	-	-	-1	-1	-	8	5	5
23	DOVEY 77	-	-	-1	-1	+1	+	+	+2	-	+	-1	-1	-1	7	7	6

COMPARISON WITH 17 BARUNDI2

		CHARACTERS															
		1	91	4	5	8	10	11	14	15	17	18	98	20	5%	2%	1%
1	S170	-	-	-1	-1	+1	+	+1	+5	-	-	+	+	-	6	4	4
2	S170 NEW	-	-	-	-1	+1	+	+1	+	-	+	-	-	-	3	3	3
4	ALTA	-	-	-	-1	+1	+	+1	+5	-	-	-	-	-5	6	3	3
5	BACKAFAL	-	-	-	-	+1	+5	+	+1	+	+	-2	-2	-	6	4	2
6	CONWAY	-	-	-1	-1	+1	+	+	+1	-	+	+	+	-	4	4	4
7	CONWAY N	-	-	-1	-1	+1	+	-	+1	-	-	-	-	-	4	4	4
8	DOVEY	-1	-1	-1	-1	+1	+	+2	+1	+	+	-1	-1	-5	10	9	8
9	FESTAL	-	-	-5	-1	+1	-	-2	+	-5	-1	-	-	-	6	4	3
10	RABA	-5	-5	-1	-1	+1	+	+	+1	+5	+5	-	-	-	8	4	4
12	JEBEL	0	0	-	-1	-	-1	-	+	-	-1	-1	-1	-1	6	6	6
13	KASBA	0	0	-2	-1	-5	-1	+	-	-	-1	-	-	-	6	4	3
16	BARUNDI1	0	0	-	-	+	-	-	-	+	-	+	+	-	0	0	0
18	BARUNDI3	0	0	-	+	-	-	-	+	+	+	+	+	-	0	0	0
19	BARCEL 1	0	0	-	-	-	-5	-1	-	-	-5	-	-	+	3	1	1
20	BARCEL 2	0	0	-	+	+	-	-1	+	-	-5	-	-	+	2	1	1
21	BARRIETI	-	-	-	-	-	-1	-5	+	+	-	+	+	-	2	1	1
22	CONWAY78	-5	-5	-2	-1	+1	+	+	+1	-	-	-5	-5	-	8	4	3
23	DOVEY 77	-	-	-1	-1	+1	+	+	+	-	+	-1	-1	-1	6	6	6

No significant differences between other 2 stocks of same variety.

For example. To compare BARUNDI2 with S170 for character 8 (Date of Ear Emergence)

Mean for BARUNDI2 - 79.02 }
Mean for S170 - 63.77 } Difference of 15.25 exceeds the Sig Diff (p=0.01) of 3.342 days

Comparison between BARUNDI2 and S170 is coded +1 to indicate that BARUNDI2 is significantly greater than S170 at the 1% probability level.

Output from DUST – Tall Fescue DUS Spaced Plants Cambridge 1980

DUST

ESSENTIAL CHARACTERS

CHARACTER 10 HGT EE IS ESSENTIAL TO THE FOLLOWING PAIR

(21, 18) ←

VARIETIES 18 (BARONDI3) and 22 (BARRISTI) CAN ONLY BE SEPARATED ON CHARACTER 10 AT 1% SIGNIFICANCE LEVEL

CHARACTER 11 WDTH EE IS ESSENTIAL TO THE FOLLOWING PAIR

(19, 16) (20, 16)

CHARACTER 14 FLAGLGTH IS ESSENTIAL TO THE FOLLOWING PAIR

(18, 16) (21, 19)

THE FOLLOWING PAIRS OF VARIETIES CANNOT BE SEPARATED

(17, 16) (18, 17) (20, 19) (21, 20)

TEST USED IN COMPARISONS AT 5 % LEVEL

INDIVIDUAL CHARACTER SEPARATIONS

	CHARACTER	NUMBER OF PAIRS SEPARATED
1	HEAD YOS	29
91	HEAD YOS	28
4	ANGLEYOS	62
5	SPR HGT	127
8	DATE EE	138
10	HGT EE	75
11	WDTH EE	92
14	FLAGLGTH	88
15	FLAGWDTH	43
17	STEMLGTH	72
18	HEAD AFT	55
98	HEAD AFT	55
20	HGT AFT	34

SUMMARY

	CHARACTER	NUMBER OF PAIRS SEPARATED	CUMULATIVE
8	DATE EE	138	138
11	WDTH EE	18	156
5	SPR HGT	6	162
14	FLAGLGTH	3	165
10	HGT EE	1	166
18	HEAD AFT	1	167

THE FOLLOWING CHARACTERS ARE REDUNDANT

1 4 15 17 20 91 98

0323

UNIF

(1)

1318203 CAMBRIDGE P.R.G (TETRAPLOIDS) (03) 1982

UNIFORMITY ASSESSMENT
****

CHARACTER NAMES

WITHIN PLOT STANDARD DEVIATIONS

CONTROL ******* VARIETY *******	4 ANGLEYOS	5 SPRINGHT	8 DATEOFEE	10 HGT ATEE	11 WDTHATEE	14 FLAGLGTH	15 FLAGWDTH	17 SLTEEE3U	19 HEAD/PLT	20 HGT AFT
10 BARVESTR	3.23	3.42	2.03	7.10	7.25	2.96	1.31	8.56	0.95	9.86
12 BASTION	2.58	3.38	3.88	5.80	5.71	3.70	1.37	7.56	0.92	7.51
13 BONITA	1.94	2.83	2.83	6.07	5.60	4.09	1.37	6.41	0.94	10.98
17 GRIMALDA	3.54	3.73	4.99	6.47	7.98	3.32	1.27	8.83	0.73	3.00
22 REVEILLE	1.94	2.38	2.60	6.18	6.14	3.37	1.00	7.78	0.75	7.85
28 TONGA	1.94	3.31	2.70	6.89	5.25	3.20	1.13	7.68	1.28	12.87
40 PENANT 1	1.94	3.62	3.25	6.44	6.06	2.84	1.27	8.38	0.85	10.04
CHI SQ 6(DF)	48.68	14.45	57.52	3.23	13.15	10.43	7.88	7.00	23.71	98.83

UK CRITERION = MEAN STANDARD DEVIATION OF CONTROLS + $t_{2\%}$ × STANDARD DEV OF CONTROL STD DEV.'S

	4 ANGLEYOS	5 SPRINGHT	8 DATEOFEE	10 HGT ATEE	11 WDTHATEE	14 FLAGLGTH	15 FLAGWDTH	17 SLTEEE3U	19 HEAD/PLT	20 HGT AFT
SD CON	0.69	0.47	0.98	0.46	0.98	0.43	0.14	0.81	0.18	3.17
UK(0.1%LEVEL)	6.03	5.70	8.29	8.79	11.39	5.60	1.95	12.12	1.86	25.36
UK(1%LEVEL)	4.61	4.73	6.26	7.85	9.37	4.71	1.67	10.44	1.49	18.82
UK(2%LEVEL)	4.24	4.48	5.74	7.61	8.84	4.48	1.60	10.01	1.39	17.14
UK (5%LEVEL)	3.78	4.16	5.09	7.31	8.19	4.19	1.51	9.46	1.27	15.02
UPOV CRITERION	3.19	4.13	4.19	8.14	8.03	4.27	1.58	10.02	1.18	11.82

UPOV CRITERION = $\sqrt{1\cdot6 \times \text{MEAN VARIANCE OF CONTROLS}}$

ENTRANT ******* VARIETY *******	4 ANGLEYOS	5 SPRINGHT	8 DATEOFEE	10 HGT ATEE	11 WDTHATEE	14 FLAGLGTH	15 FLAGWDTH	17 SLTEEE3U	19 HEAD/PLT	20 HGT AFT
1 AGRESSO	4.33	3.37	3.96	7.14	7.02	3.09	1.10	8.97	0.94	8.80
2 AGRES N	0.00	2.86	4.27	7.68	7.87	3.46	1.29	6.20	0.81	6.17
4 ARTAL	3.76	2.62	3.06	6.91	8.63	4.04	1.26	7.32	0.30	3.41
5 ARTAL N	2.74	2.87	3.82	6.73	7.87	4.14	1.27	7.05	0.32	2.51
7 BARLATRA	0.00	3.64	4.01	6.81	7.12	4.17	1.28	7.18	0.99	8.19
9 BARPASTR	1.94	3.55	3.96	8.22	8.65	4.23	1.04	9.02	0.13	3.78
11 BARVST N	1.94	2.94	2.62	7.75	5.62	2.62	1.13	6.79	1.11	9.02
14 FORTIS	1.94	2.68	3.72	7.81	7.91	3.57	1.25	7.59	0.26	2.67
15 FORTIS N	2.74	2.71	4.23	7.72	8.06	3.35	1.00	7.57	0.22	3.00
19 MELTRA	1.94	2.80	4.81	7.80	7.08	3.13	1.13	6.16	0.17	3.40
20 PETRA.	0.00	1.96	2.93	6.50	7.88	3.46	1.05	6.83	0.18	2.49
23 SC HAY	4.13	2.53	3.74	7.34	7.62	3.99	0.99	6.86	1.12	7.29
24 SC HAY N	0.00	2.52	4.12	6.40	6.71	3.77	1.22	6.48	0.95	6.94
26 TAPTOE	1.94	2.62	3.15	7.37	6.65	3.96	1.17	7.03	1.02	10.44
27 TERHOY	3.54	2.61	4.61	7.71	7.95	2.80	1.29	8.13	0.92	8.06
29 TOVE	2.74	3.04	4.12	7.53	5.91	4.16	1.21	7.42	1.13	13.01
30 TOVE N	0.00	3.22	2.85	6.72	6.65	4.09	1.31	8.27	1.25	12.68
31 CITADEL	0.00	2.49	3.20	5.59	6.79	3.15	1.14	6.49	1.02	11.30
33 PRANA 1	1.94	3.25	2.86	7.59	8.49	3.51	1.38	9.09	0.94	8.10

(2)

UNIFORMITY TEST
****
NB: (BASED ON UK CRITERION)
****

NB:- (.) REPRESENTS A NON SIGNIFICANT RESULT

CHARACTERS

ENTRANT ******* VARIETY *******	4	5	8	10	11	14	15	17	19	20	24	25
1 AGRESSO	2%	.	.	.	.	.	.	.	.	.	.	.
2 AGRES N	.	.	.	2%	.	.	.	.	.	.	.	.
4 ARTAL	.	.	.	.	5%	.	.	.	.	.	.	.
5 ARTAL N	.	.	.	.	.	.	.	.	.	.	.	.
7 BARLATRA	.	.	.	.	.	.	.	.	.	.	.	.
9 BARPASTR	.	.	.	1%	5%	5%	.	.	.	.	.	.
11 BARVST N	.	.	.	2%	.	.	.	.	.	.	.	.
14 FORTIS	.	.	.	2%	.	.	.	.	.	.	.	.
15 FORTIS N	.	.	.	2%	.	.	.	.	.	.	.	.
19 MELTRA	.	.	.	2%	.	.	.	.	.	.	.	.
20 PETRA	.	.	.	.	.	.	.	.	.	.	.	.
23 SC HAY	5%	.	.	5%	.	.	.	.	.	.	.	.
24 SC HAY N	.	.	.	.	.	.	.	.	.	.	.	.
26 TAPTOE	.	.	.	5%	.	.	.	.	.	.	.	.
27 TERHOY	.	.	.	2%	.	.	.	.	.	.	.	.
29 TOVE	.	.	.	5%	.	.	.	.	.	.	.	.
30 TOVE N	.	.	.	.	.	.	.	.	.	.	5%	.
31 CITADEL	.	.	.	.	.	.	.	.	.	.	.	.
33 PRANA 1	.	.	.	5%	5%	.	.	.	.	.	5%	.
34 PRANA XF	.	.	.	.	.	.	.	.	.	.	.	.
35 FNTOOM 1	.	.	.	.	.	.	.	.	.	.	5%	.
36 FTOOM XF	.	.	.	.	5%	.	.	.	.	.	.	.
37 ALEX 1	.	.	.	0.1%	.	.	.	.	.	.	.	.
38 BURGEE 1	.	.	.	.	.	.	.	.	.	.	5%	.
39 BRASSD 1	.	.	.	.	.	.	.	.	.	.	.	.
41 BRCENT 1	.	.	.	.	1%	.	.	.	.	.	.	.
42 PLUME 1	.	.	.	.	.	.	.	.	.	.	.	.
43 BELFRT 1	.	.	.	.	5%	5%	.	.	.	.	.	.
44 BLFRT XF	.	.	.	.	2%	.	.	.	.	.	.	.
45 GAMBIT 1	.	.	.	.	.	.	.	.	.	.	.	.
47 CONDES 1	.	.	.	.	5%	.	.	.	.	.	.	.
52 GRISLE 1	.	.	.	.	.	.	.	.	.	.	.	.
53 GRISLE 2	.	.	.	1%	.	.	.	.	.	.	.	.
54 GRISLE F	.	.	.	1%	.	.	.	5%	.	.	.	.
55 MODUS 1	.	.	.	.	1%	.	.	.	.	.	.	.
56 MODUS 2	.	.	.	.	5%	.	.	.	.	.	.	.
57 MOM183 1	.	.	.	.	.	.	.	.	.	.	.	.
58 MRLIND 1	.	.	.	.	.	.	.	.	.	5%	.	.
59 LD2408 F	.	.	.	5%	.	.	.	.	.	.	.	.
60 HE64 1 F	.	.	5%	.	1%	5%	.	1%	.	.	.	.
61 MASSA XF	.	.	.	.	.	.	.	.	.	.	.	.

****

STAB OUTPUT

TETRAPLOIDS CAMBRIDGE 1981/1982 (03/03)

VARIETIES TO BE INCLUDED

		81		82
1	AGRESS A	1 AGRESSO		1 AGRESSO
2	AGRESS B	2 AGRESS N		2 AGRESNEW

CAMBRIDGE PRG(TET) 1981

	15 FLAGWDTH	17 SLTFEE30	19 HEAD/PLT	20 HGT AFT	24 EAR LGTH	25 AWNS	4 ANGLEYOS	5 SPRINGHT	8 DATEOFEE	10 HGTATEE
1 AGRESSO	8.117	92.658	2.189	43.609	30.355	0.000	2.750	32.700	91.783	53.850
2 AGRESS N	8.100	92.732	1.717	38.983	33.967	0.000	1.750	33.483	94.650	54.317
STD ERRORS	0.194	1.631	0.260	1.911	0.796	0.021	0.720	1.500	0.740	1.410
D.F.	260	260	260	260	260	260	260	260	260	260

CAMBRIDGE TETRA (03) 1982

	15 FLAGWDTH	17 SLTFEE30	19 HEAD/PLT	20 HGT AFT	24 EAR LGTH	25 AWNS	4 ANGLEYOS	5 SPRINGHT	8 DATEOFEE	10 HGTATEE
1 AGRESSO	6.594	90.394	0.872	22.100	27.548	0.000	0.750	18.200	87.259	40.137
2 AGRESNEW	6.850	92.192	0.809	20.639	28.578	0.000	0.000	18.850	87.233	38.367
STD ERRORS	0.181	1.344	0.113	1.283	0.547	0.000	0.350	0.746	0.502	1.156
D.F.	235	235	235	235	235	235	235	235	235	235

TETRAPLOIDS CAMBRIDGE 1981/1982 (03/03)

COMPARISONS BETWEEN 1 AGRESS A AND 2 AGRESS B

PERCENTAGE PROBABILITY LEVELS POSITIVE VALUES IF AGRFSS A LARGER THAN AGRESS B

	YEARS 81	YEARS 82	COMBINED PROBABILITY	
15 FLAGWDTH	95.0640	-31.8288	60.545554	NS
17 SLTEEE30	-97.4431	-34.5138	63.907103	NS
19 HEAD/PLT	20.0400	69.3771	40.624438	NS
20 HGT AFT	8.8143	42.1513	16.765590	NS
24 EAR LGTH	-0.1501	-18.4321	0.248383	**
25 AWNS	100.0000	100.0000	100.000000	NS
4 ANGLEYOS	32.6967	13.1058	19.640830	NS
5 SPRINGHT	-71.2346	-53.8417	77.271010	NS
8 DATEOFEE	-0.6578	97.0817	2.377193	*
10 HGTATEE	-81.5016	28.0060	54.164365	NS
11 WDTHATEE	-43.9847	-68.6350	68.328103	NS
14 FLAGLGTH	-10.3652	-54.0199	22.390474	NS

COMBINED PROBABILITY → CALCULATED FROM

$$\chi^2 = \sum_{\text{OVER YEARS}} \left(\frac{\text{DIFFERENCE}}{\text{SE OF DIFFERENCE}} \right)^2$$

$$= t_1^2 + t_2^2$$

TVAL

INTERMEDIATE PERENNIALS 1980,1981,1982 CAMBRIDGE (02,02,02)

VARIETIES TO BE INCLUDED

	80		81		82	
ABERS321	1	S321	1	S321	2	S321
BARLENNA	2	BARLENNA	3	BARLENNA	3	BARLENNA
BARSTELA	3	BARSTELL	5	BARSTELL	5	BARSTELA
BIANCA	25	BIANCA	25	BIANCA	6	BIANCA
CAUSEWAY	33	CAUSEWAY	27	CAUSEWAY	8	CAUSEWAY
COMBI	4	COMBI	6	COMBI	9	COMBI
ENSPORTA	5	ENSPORTA	8	ENSPORTA	12	ENSPORTA
FALCON	6	FALCON	10	FALCON	13	FALCON
HORA	8	HORA	11	HORA	15	HORA
HUBAL	9	HUBAL	12	HUBAL	17	HUBAL
KENT INL	10	KENT	14	KENT	20	KENT
MOMBASSA	12	MOMBASSA	17	MOMBASSA	23	MOMBASSA
MORENNE	20	MORENNE1	23	MORENNE	24	MORENNE
PABLO	14	PABLO	18	PABLO	26	PABLO
RVP HP	15	RVP	20	RVP	27	RVP HP
TALBOT	17	TALBOT	21	TALBOT	29	TALBOT
BRAVO	36	BRAVO 1	33	BRAVO 1	31	BRAVO
POUNDER	38	POUNDER1	34	POUNDER	32	POUNDER
BARRY 1	46	BARRY 1	37	BARRY 1	36	BARRY 1
PICKWICK	48	PICKWIK1	38	PICKWCK1	37	PICKWICK
SISU 1	57	SISU 1	46	SISU 1	42	SISU 1
RANGER 1	66	RANGER 1	53	RANGER 1	45	RANGER 1
BARLFT 1	68	BARLOFT1	56	BARLOFT1	47	BARLFT 1
STEMAC 1	86	STEMAC01	60	STEMAC01	49	STEMAC 1
GALIOT 1	50	GALLIOT1	62	GALLIOT1	50	GALIOT 1
BR79A 1	76	BAR79A 1	70	BAR79A 1	57	BR79A 1
BR79B 1	77	BAR79B 1	72	BAR79B 1	59	BR79B 1
FIESTA 1	78	FIESTA 1	74	FIESTA 1	61	FIESTA 1
ANDURL 1	60	DP7599 1	78	DP759 1	67	ANDURL 1

0327

FRG (DIP) INTERMEDIATE (02) CAMBRIDGE 1980

(1)

	4 ANGLEYOS	5 SPRINGHT	8 DATEOFEE	10 HGTATEE	11 WDTHATEE	14 FLAGLGTH	15 FLAGWDTH	17 SLTEEE30	19 HEAD/PLT	20 HGT AFT
1 S321	15.778	19.050	86.787	23.111	37.463	14.395	6,139	67.805	0.913	37,546
2 BARLENNA	16.250	14.800	89.257	18.667	39.913	15.581	6,135	67.623	0.524	31,291
3 BARSTELL	15.500	19.848	83.243	22.604	37.578	14.273	5,928	70.041	1.043	33,480
4 BIANCA	14.500	21.056	80.480	21.309	35.218	15,886	5,739	64.175	0.617	31,433
5 CAUSEWAY	14.500	18,996	83.143	20,898	38.576	15.131	5,455	61.748	1.930	40,963
6 COMBI	16.500	21.307	88.567	23,000	42.167	16,263	5,350	70.567	0.383	38,717
7 ENSPORTA	14.750	15,967	88.583	20,033	39.600	14.698	5,450	62.742	0.050	24,770
8 FALCON	17.000	18,739	82.467	23,082	38.315	16.062	6,144	63.695	0.154	32,707
9 HORA	18.000	23.117	87.783	35.500	40.867	17.533	6,217	76.780	0.333	40.367
10 HUBAL	16.750	16,928	86.887	18,702	35.411	15,211	6,143	66.359	0.871	36,946
11 KENT	14.000	17,750	85.050	22,267	39.417	15.562	6,000	75.763	1.183	36,550
12 MOMBASSA	15.500	18,739	86.503	26,685	38.730	14,363	5,536	71.500	1.990	40,032
13 MORENNE1	15.750	18,263	82.683	20,150	38.033	16,372	6,233	69.623	0.902	34,748
14 PABLO	18.000	19,317	86.783	28,267	38.600	15.167	5,350	71.517	0.567	35,650
15 RVP	15.000	24,463	79.867	27,017	37.250	14.822	5,333	71.352	1.600	39,567
16 TALBOT	16.500	20,750	87.100	26,300	43.417	16,428	6,450	70.567	0.283	30,700
17 BRAVO 1	15.250	22,269	79.665	22,389	33.156	17,696	6,515	70.526	0.793	37,819
18 POUNDER1	15.250	21,367	81.883	22,583	32.700	15,255	5,700	69.775	1.367	37,217
WITHIN SE	0.825	1,189	0.616	1,271	1.682	0.514	0,170	1.787	0.230	1,888
LSD AT 5%	2.296	3,308	1.712	3,536	4.680	1.429	0,472	4.971	0.641	5,250
LSD AT 2%	2.728	3,931	2.035	4,201	5.561	1,698	0,561	5.907	0.761	6,239
LSD AT 1%	3.023	4,356	2.255	4,656	6.163	1,882	0,621	6.546	0.844	6,914
D.F.	345	345	345	345	345	345	345	345	345	345

(2)

(...) INTERMEDIATES CAMBRIDGE (02) 1981

	4 ANGLEYOS	5 SPRINGHT	8 DATEOFEE	10 HGTATEE	11 WDTHATEE	14 FLAGLGTH	15 FLAGWDTH	17 SLTEEE30	19 HEAD/PLT	20 HGT AFT
1 S321	13.500	28.267	92.233	43.267	44.083	17.705	5.317	80.767	1.052	28.844
2 CARLENNA	8.500	21.267	97.595	33.217	44.946	18.528	5.131	77.476	0.069	21.428
3 CARSTELL	11.812	25.912	86.000	34.825	36.733	14.969	4.754	71.131	0.857	27.079
4 BIANCA	10.809	25.446	88.274	35.550	33.372	15.088	4.277	65.116	0.236	18.482
5 CAUSEWAY	8.750	22.857	90.248	33.356	38.595	15.443	4.494	70.608	0.615	18.321
6 COMBI	11.722	25.791	95.472	35.591	44.422	18.599	4.633	80.448	0.401	23.592
7 ENSPORTA	9.389	19.076	98.065	39.919	40.520	16.060	4.321	67.427	0.000	16.023
8 FALCON	11.250	26.983	86.300	36.055	39.483	18.708	5.350	73.708	0.079	24.851
9 HORA	12.750	28.250	93.233	43.017	35.267	20.762	5.300	79.125	0.572	27.507
10 HUBAL	14.695	23.817	93.610	36.312	39.695	18.737	5.400	76.675	0.435	23.837
11 KENT	9.833	22.267	93.635	37.393	39.433	16.777	4.704	76.086	0.118	19.550
12 MOMBASSA	14.590	30.462	89.983	39.615	37.128	16.528	4.321	80.166	1.059	25.607
13 MORENNE	11.750	23.950	89.106	34.843	39.117	18.835	5.479	71.875	0.021	23.094
14 PABLO	14.250	28.252	92.203	39.558	40.487	17.995	5.013	77.818	0.033	23.291
15 RVP	12.472	28.255	81.428	34.218	34.878	16.217	5.154	71.361	0.857	24.380
16 TALBOT	8.500	26.017	93.733	39.300	41.300	18.523	5.233	79.958	0.150	23.795
17 BRAVO 1	13.195	28.313	82.385	35.122	38.293	18.746	5.593	73.876	0.519	26.110
18 POUNDER	13.722	25.746	84.915	36.167	32.974	15.429	4.417	68.019	0.241	19.280
WITHIN SE	1.385	1.012	0.872	1.309	1.315	0.743	0.187	2.214	0.198	1.579
LSD AT 5%	3.851	2.815	2.424	3.639	3.655	2.065	0.519	6.155	0.551	4.391
LSD AT 2%	4.575	3.345	2.880	4.323	4.343	2.454	0.617	7.314	0.655	5.217
LSD AT 1%	5.070	3.707	3.192	4.791	4.813	2.719	0.683	8.104	0.725	5.781
D.F.	380	380	380	380	380	380	380	380	380	380

0330

(3)

CAMBRIDGE PRG (DIPLOIDS) (02) INTERMEDIATES 1982

	4 ANGLEYOS	5 SPRINGHT	8 DATEOFEE	10 HGTATEE	11 WDTHATEE	14 FLAGLGTH	15 FLAGWDTH	17 SLTEEE30	19 HEAD/PLT	20 HGT AFT
1 S321	0.750	18.700	85.800	35.783	49.883	14.255	6.217	85.200	0.422	22.730
2 BARLENNA	0.000	15.085	87.711	26.206	46.011	15.198	5.626	84.012	0.024	16.168
3 BARSTELA	0.250	18.667	83.683	32.333	44.133	13.875	5.733	76.725	0.317	18.750
4 BIANCA	0.250	16.517	82.393	28.450	42.420	14.633	5.241	73.523	0.135	16.393
5 CAUSEWAY	0.000	14.533	84.667	28.117	43.650	14.138	5.017	74.850	0.100	14.750
6 COMBI	0.750	19.533	87.150	33.833	48.733	15.755	5.700	86.073	0.117	22.417
7 ENSPORTA	0.000	15.743	88.961	29.872	46.096	12.915	5.320	75.748	0.035	13.694
8 FALCON	0.250	19.750	81.633	30.200	43.767	15.662	5.833	79.668	0.033	19.519
9 HORA	2.500	21.317	84.917	37.433	44.383	17.548	6.117	86.192	0.217	21.350
10 HUBAL	0.000	16.567	86.167	31.217	44.750	15.385	6.067	81.992	0.102	18.907
11 KENT	0.000	15.617	86.800	30.183	44.683	15.393	5.433	83.600	0.119	17.096
12 MOMBASSA	1.250	21.500	85.650	34.600	41.450	13.683	5.567	81.445	0.405	17.543
13 MORENNE	0.806	16.661	82.624	28.970	43.526	15.817	6.361	83.657	0.037	21.433
14 PABLO	0.750	19.217	84.850	36.083	45.967	16.482	5.350	87.373	0.100	22.050
15 RVP HP	0.000	20.867	79.317	33.567	43.483	15.060	6.083	74.408	0.285	19.024
16 TALBOT	0.250	18.550	85.550	33.700	45.283	15.407	6.167	82.575	0.050	21.854
17 BRAVO	0.000	21.417	79.950	33.817	46.233	18.117	6.650	81.142	0.117	20.483
18 POUNDER	0.000	18.337	80.335	33.100	40.757	14.701	5.470	73.650	0.221	16.056
WITHIN SE	0.394	0.782	0.586	1.123	1.162	0.452	0.160	1.927	0.067	1.006
LSD AT 5%	1.095	2.176	1.631	3.124	3.234	1.257	0.445	5.362	0.187	2.799
LSD AT 2%	1.302	2.586	1.939	3.712	3.844	1.494	0.529	6.373	0.222	3.327
LSD AT 1%	1.443	2.866	2.149	4.115	4.260	1.655	0.587	7.063	0.246	3.687
D.F.	315	315	315	315	315	315	315	315	315	315

(4)

131 INTERMEDIATE PERENNIALS 1980,1981,1982 CAMBRIDGE (02,02,02)

CHARACTER 8 DATEOFEE

BLOCK NUMBER / YEAR		1980	1981	1982
1	ABERS321	86.79	92.23	85.80
2	BARLENNA	89.26	97.59	87.71
3	BARSTELA	83.24	86.00	83.68
4	BIANCA	80.48	88.27	82.39
5	CAUSEWAY	83.14	90.25	84.67
6	COMBI	88.57	95.47	87.15
7	ENSPORTA	88.58	98.07	88.96
8	FALCON	82.47	86.30	81.63
9	HORA	87.78	93.23	84.92
10	HUBAL	86.89	93.61	86.17
11	KENT IND	85.05	93.63	86.80
12	MOMBASSA	86.50	89.98	85.65
13	MORENNE	82.68	89.11	82.62
14	PABLO	86.78	92.20	84.85
15	RVP HP	79.87	81.43	79.32
16	TALBOT	87.10	93.73	85.55
17	BRAVO	79.67	82.38	79.95
18	POUNDER	81.88	84.92	80.33
19	BARRY 1	89.13	98.16	87.63
20	PICKWICK	84.98	92.66	84.52
21	SISU 1	85.58	91.70	85.20
22	RANGER 1	85.05	94.50	84.47
23	BARLET 1	83.62	89.96	82.31
24	STEMAC 1	90.60	96.81	88.07
25	GALIOT 1	79.33	82.32	79.08
26	BR79A 1	78.49	81.59	78.12
27	BR79B 1	81.91	87.63	81.30
28	FIESTA 1	78.15	80.75	76.93
29	ANDURL 1	88.85	96.13	87.18

131 INTERMEDIATE PERENNIALS 1980,1981,1982 CAMBRIDGE (02,02,02)

CHARACTER 8 DATEOFEE

ANALYSIS OF VARIANCE

	DF	SUM SQUARES	MEAN SQUARES	F RATIO	% PROBABILITY
BLOCKS/YEARS	2	734.206	367.1031		
VARIETIES	28	1341.209	47.9003	23.048	0.00 ***
ERROR	56	116.382	2.0783		
TOTAL	86	2191.798			

STANDARD ERROR OF A TREATMENT MEAN 0.8323

PERCENT COEFFICIENT OF VARIATION 1.67

(5)

131 INTERMEDIATE PERENNIALS 1980,1981,1982 CAMBRIDGE (02,02,02)

CHARACTER 8 DATEOFEE

RANKED VARIETY MEANS

RANK	VARIETY		MEAN
1	7	ENSPORTA	91.870
2	24	STEMAC 1	91.826
3	19	BARRY 1	91.640
4	2	BARLENNA	91.521
5	29	ANDURL 1	90.721
6	6	COMBI	90.396
7	10	HUBAL	88.888
8	16	TALBOT	88.794
9	9	HORA	88.644
10	11	KENT IND	88.495
11	1	ABERS321	88.273
12	22	RANGER 1	88.005
13	14	PABLO	87.945
14	21	SISU 1	87.496
15	20	PICKWICK	87.383
16	12	MOMBASSA	87.379
17	5	CAUSEWAY	86.019
18	23	BARLFT 1	85.298
19	13	MORENNE	84.804
20	3	BARSTELA	84.309
21	4	BIANCA	83.716
22	27	BR79B 1	83.614
23	8	FALCON	83.467
24	18	POUNDER	82.378
25	17	BRAVO	80.667
26	25	GALIOT 1	80.244
27	15	RVP HP	80.204
28	26	BR79A 1	79.400
29	28	FIESTA 1	78.609
		STD ERROR	0.832
		L.S.D. 5%	2.358
		L.S.D. 2%	2.819
		L.S.D. 1%	3.139

INTERMEDIATE PERENNIALS 1980,1981,1982 CAMBRIDGE (02,02,02)

VARIETY MEANS OVER YEARS

(6)

	4 ANGLEYOS	5 SPRINGHT	8 DATEOFEE	10 HGTATEE	11 WDTHATEE	14 FLAGLGTH	15 FLAGWDTH	17 SLTEEE30	19 HEAD/PLT	20 HGT AFT
1 ABERS321	10.009	22.006	88.273	34.054	43.810	15.452	5.908	77.924	0.796	29.707
2 BARLENNA	8.250	17.057	91.521	26.030	43.623	16.436	5.631	76.372	0.206	22.962
3 BARSTELA	9.187	21.476	84.309	29.921	39.481	14.372	5.488	72.632	0.739	26.436
4 BIANCA	8.520	21.006	83.716	28.436	37.003	15.202	5.086	67.605	0.329	22.103
5 CAUSEWAY	7.750	18.795	86.019	27.457	40.274	14.904	4.959	69.069	0.882	24.678
6 COMBI	9.657	22.230	90.396	31.108	45.107	16.872	5.411	79.029	0.467	28.242
7 ENSPORTA	8.046	16.929	91.870	26.941	42.072	14.553	5.197	68.639	0.028	18.162
8 FALCON	9.500	21.824	83.467	29.772	40.522	16.811	5.776	74.024	0.089	25.692
9 HORA	11.083	24.228	88.644	33.650	40.172	18.614	6.145	80.699	0.541	29.741
10 HUBAL	10.482	19.104	88.888	28.744	39.952	16.444	5.870	75.009	0.469	26.563
11 KENT IND	7.944	18.551	88.495	29.948	41.178	15.911	5.379	73.483	0.473	24.399
12 MOMBASSA	10.447	23.567	87.379	33.632	39.103	14.858	5.303	77.704	1.151	27.727
13 MORENNE	9.435	19.631	84.804	27.988	40.225	17.008	6.033	75.052	0.320	26.425
14 PABLO	11.000	22.262	87.945	34.636	41.685	16.548	5.571	78.903	0.233	26.997
15 PVP HP	9.157	24.528	80.204	31.601	38.537	15.366	5.690	72.374	0.914	27.657
16 TALBOT	8.417	21.772	88.794	33.100	43.333	16.786	5.967	77.700	0.161	25.450
17 BRAVO	9.482	24.006	80.667	30.443	39.227	18.186	6.253	75.181	0.476	28.137
18 POUNDER	9.657	21.817	82.378	30.617	35.477	15.128	5.196	70.481	0.610	24.184
YEAR MS	11276.586	2573.800	2202.619	7859.096	2513.484	165.127	47.399	5661.351	31.209	13037.455
VARIETY MS	24.318	127.219	287.402	403.187	178.045	37.818	3.029	636.050	1.618	230.735
VAR.YEAR MS	10.051	11.878	12.470	20.820	29.092	5.100	0.235	40.357	0.436	35.866
F1 RATIO	2.419	10.710	23.048	19.366	6.120	7.416	12.893	15.761	3.715	6.433
VAR.REP MS	5.842	6.170	3.046	9.264	11.876	2.107	0.181	23.851	0.199	14.400
F2 RATIO	1.720	1.925	4.093	2.247	2.450	2.420	1.300	1.692	2.185	2.491
BETWEEN SE	0.747	0.812	0.832	1.075	1.271	0.532	0.114	1.497	0.156	1.412
WITHIN SE	0.570	0.585	0.411	0.717	0.812	0.342	0.100	1.151	0.105	0.894

ANALYSIS OF VARIANCE. MEAN SQUARES PER PLOT. (YEAR MS to VAR.REP MS)

BETWEEN SE $= \sqrt{\frac{VAR.YEAR\ MS}{18}}$

WITHIN SE $= \sqrt{\frac{VAR.REP\ MS}{18}}$

$$F_1 = \frac{VARIETY\ MS}{VAR.YEAR\ MS} \qquad F_2 = \frac{VAR.YEAR\ MS}{VAR.REP\ MS}$$

(7)

131 INTERMEDIATE PERENNIALS 1980,1981,1982 CAMBRIDGE (02,02,02)

BETWEEN VARIETIES CORRELATION MATRIX

		4	5	8	10	11	14	15	17	19	20	24	25
4	ANGLEYUS	1.00											
5	SPRINGHT	0.59	1.00										
8	DATEOFEE	-0.00	-0.10	1.00									
10	HGTATEE	0.67	0.85	0.28	1.00								
11	WDTHATEE	-0.04	0.34	0.58	0.47	1.00							
14	FLAGLGTH	0.35	0.64	0.14	0.66	0.63	1.00						
15	FLAGWDTH	0.39	0.64	-0.04	0.60	0.54	0.84	1.00					
17	SLTEEE30	0.40	0.65	0.46	0.83	0.72	0.76	0.67	1.00				
19	HEAD/PLT	0.13	0.15	-0.12	0.07	-0.34	-0.41	-0.22	-0.06	1.00			
20	HGT AFT	0.55	0.86	0.01	0.32	0.54	0.74	0.77	0.81	0.16	1.00		
24	EAR LGTH	0.46	0.63	0.45	0.81	0.66	0.78	0.64	0.95	-0.08	0.77	1.00	
25	AWNS	-0.09	0.03	0.05	0.07	0.26	0.03	-0.07	0.11	0.01	0.19	0.07	0.00

(8)

ABBREVIATED GENERALIZED MATRIX OF DISTANCES.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1 ABERS321	0																								
2 BARLENNA	79	0																							
3 BARSTELA	26	112	0																						
4 BIANCA	86	141	26	0																					
5 CAUSEWAY	73	71	39	21	0																				
6 COMBI	54	31	80	95	43	0																			
7 ENSPORTA	74	33	74	84	44	45	0																		
8 FALCON	38	98	15	25	33	67	86	0																	
9 HORA	58	135	94	121	114	83	160	68	0																
10 HUBAL	26	30	52	90	55	35	53	41	56	0															
11 KENT IND	44	28	57	76	35	26	46	45	66	18	0														
12 MOMBASSA	33	78	52	75	53	34	80	49	33	34	29	0													
13 MORENNE	38	58	44	73	53	60	84	19	60	14	29	48	0												
14 PABLO	29	65	54	79	54	29	80	39	20	22	20	8	33	0											
15 RVP HP	65	188	23	34	70	131	152	20	92	97	103	74	61	78	0										
16 TALBOT	12	50	33	71	53	35	53	28	45	15	22	23	22	17	65	0									
17 BRAVO	73	178	42	56	69	136	171	17	84	85	104	95	42	81	16	66	0								
18 POUNDER	72	143	31	17	34	93	113	20	66	72	61	44	50	47	21	57	39	0							
19 BARRY 1	67	58	59	80	53	63	11	89	171	62	62	82	98	94	141	60	169	114	0						
20 PICKWICK	26	65	54	95	66	36	95	42	34	27	20	18	30	12	78	16	77	63	102	0					
21 SISU 1	66	218	113	174	186	148	235	107	25	106	124	68	110	57	109	81	109	109	229	63	0				
22 RANGER 1	70	61	43	40	21	60	27	53	127	47	33	61	63	63	101	56	120	55	26	78	191	0			
23 BARLFT 1	98	110	42	28	29	103	52	59	167	83	66	92	87	99	91	87	117	52	45	116	226	9			
24 STEMAC 1	47	80	86	110	60	35	76	84	43	45	53	16	79	22	120	34	140	85	82	45	86	86	13	0	
25 GALIOT 1	60	172	30	46	76	127	158	14	71	78	89	73	40	64	8	59	7	23	156	67	89	101	97	122	0
26 BR79A 1	104	167	40	50	72	159	129	38	199	111	125	151	69	144	47	102	46	73	122	137	242	92	72	204	50
27 BR79B 1	97	112	39	22	21	90	63	38	182	90	85	110	75	110	67	85	82	59	63	118	250	42	33	143	79
28 FIESTA 1	114	198	42	34	68	176	149	42	156	114	120	119	76	122	34	111	50	31	140	136	194	77	51	178	34
29 ANDURL 1	28	49	84	142	98	32	81	80	49	27	30	24	54	20	132	20	135	110	90	16	78	93	145	28	120

	26	27	28	29
26 BR79A 1	0			
27 BR79B 1	29	0		
28 FIESTA 1	33	54	0	
29 ANDURL 1	193	159	196	0

0335

(9)

RANKED DISTANCES

1	25 GALIOT 1	17 BRAVO	6.639 ← SEE TVAL OUTPUT
2	14 PABLO	12 MOMBASSA	7.767
3	25 GALIOT 1	15 RVP HP	8.238
4	23 BARLFT 1	22 RANGER 1	9.106
5	19 BARRY 1	7 ENSPORTA	10.784
6	16 TALBOT	1 ABERS321	11.720
7	20 PICKWICK	14 PABLO	12.114
8	13 MORENNE	10 HUBAL	13.976
9	25 GALIOT 1	8 FALCON	14.278
10	8 FALCON	3 BARSTELA	14.653
11	16 TALBOT	10 HUBAL	15.105
12	24 STEMAC 1	12 MOMBASSA	15.533
13	20 PICKWICK	16 TALBOT	15.670
14	29 ANDURL 1	20 PICKWICK	15.706
15	17 BRAVO	15 RVP HP	15.940
16	18 POUNDER	4 BIANCA	16.731
17	16 TALBOT	14 PABLO	16.864
18	17 BRAVO	8 FALCON	16.873
19	11 KENT IND	10 HUBAL	18.414
20	20 PICKWICK	12 MOMBASSA	18.489
21	13 MORENNE	8 FALCON	19.419
22	29 ANDURL 1	14 PABLO	19.553
23	20 PICKWICK	11 KENT IND	19.591
24	29 ANDURL 1	16 TALBOT	19.654
25	15 RVP HP	8 FALCON	19.995
26	18 POUNDER	8 FALCON	20.110
27	14 PABLO	11 KENT IND	20.163
28	14 PABLO	9 HORA	20.396
29	5 CAUSEWAY	4 BIANCA	20.826
30	27 BR79B 1	5 CAUSEWAY	21.140
31	22 RANGER 1	5 CAUSEWAY	21.169
32	18 POUNDER	15 RVP HP	21.434
33	27 BR79B 1	4 BIANCA	21.566
34	24 STEMAC 1	14 PABLO	21.947
35	16 TALBOT	13 MORENNE	21.992
36	14 PABLO	10 HUBAL	22.193
37	16 TALBOT	11 KENT IND	22.349
38	25 GALIOT 1	18 POUNDER	22.633 SEE TVAL OUTPUT.
39	15 RVP HP	3 BARSTELA	22.866
40	16 TALBOT	12 MOMBASSA	23.446
41	29 ANDURL 1	12 MOMBASSA	24.193
42	21 SISU 1	9 HORA	24.525
43	8 FALCON	4 BIANCA	25.205
44	11 KENT IND	6 COMBI	25.756
45	20 PICKWICK	1 ABERS321	25.835
46	3 BARSTELA	1 ABERS321	26.018
47	10 HUBAL	1 ABERS321	26.248
48	4 BIANCA	3 BARSTELA	26.333
49	22 RANGER 1	19 BARRY 1	26.371
50	29 ANDURL 1	10 HUBAL	26.829
51	20 PICKWICK	10 HUBAL	26.959
52	22 RANGER 1	7 ENSPORTA	27.374
53	29 ANDURL 1	1 ABERS321	27.657
54	11 KENT IND	2 BARLENNA	27.672
55	23 BARLFT 1	4 BIANCA	28.026
56	29 ANDURL 1	24 STEMAC 1	28.055
57	16 TALBOT	8 FALCON	28.249
58	14 PABLO	6 COMBI	28.592
59	12 MOMBASSA	11 KENT IND	28.646
60	14 PABLO	1 ABERS321	28.974
61	27 BR79B 1	26 BR79A 1	29.030
62	13 MORENNE	11 KENT IND	29.258
63	23 BARLFT 1	5 CAUSEWAY	29.500

TVAL OUTPUT (10)

INTERMEDIATE PERENNIALS 1980,1981,1982 CAMBRIDGE (02,02,02)

T - SCORE IS SUM OF T- VALUES OVER YEARS
SUBJECT TO T VALUE LESS THAN 1·98 SET TO ZERO
T VALUE GREATER THAN 3·37 SET TO 3·37

COMPARISONS BETWEEN 25 GALIOT 1 AND 17 BRAVO

T VALUES POSITIVE IF GALIOT 1 LARGER THAN BRAVO

	SIGNIFICANCE LEVELS YEARS 80	81	82		COMBINED ANALYSIS T	PROB	SIG	T VALUES YEARS 80	81	82	T SCORE	F3
4 ANGLEYOS	+	+	+	ND	0.81	42.370	NS	1.29	0.28	0.90	0.00	0.09
5 SPRINGHT	-	-	-	ND	-1.04	-30.460	NS	-0.42	-0.53	-1.90	0.00	0.16
8 DATEOFEE	-	-	-	ND	-0.36	-72.109	NS	-0.38	-0.06	-1.05	0.00	0.04
10 HGTATEE	+	+	+	ND	0.76	44.795	NS	0.29	0.94	0.77	0.00	0.05
11 WDTHATEE	+	-	-	ND	-0.25	-80.157	NS	1.28	-1.11	-1.43	0.00	0.95
14 FLAGLGTH	-	-1	-5	ND	-2.47	-1.643	*	-1.01	-3.36	-2.07	-5.43	1.29
15 FLAGWDTH	-	-	-5	ND	-2.33	-2.324	*	-0.48	-1.89	-2.28	-2.28	0.66
17 SLTEEE30	-	-	-	ND	-0.76	-45.166	NS	-1.04	-0.07	-0.72	0.00	0.12
19 HEAD/PLT	-	-	+	ND	-0.38	-70.517	NS	-0.08	-1.04	0.70	0.00	0.24
20 HGT AFT	-	+	-	ND	-0.46	-65.002	NS	-0.67	0.22	-1.01	0.00	0.13
24 EAR LGTH	+	-	-	ND	-0.22	-82.611	NS	0.18	-0.44	-0.17	0.00	0.08
25 AWNS	+	+	+	ND	0.00	100.000	NS	0.00	0.00	0.00	0.00	0.00

GENERALISED DISTANCE SQUARED = 6.64 NS

DIFFERENCE OVER YEARS TESTED FOR SIGNIFICANCE USING VARS. YEARS MS AS ERROR.

$$F_3 = \frac{\text{VARS x YEARS M.S FOR GALIOT AND BRAVO}}{\text{VARS x YEARS MS FOR ALL VARIETIES}}$$

COMPARISONS BETWEEN 25 GALIOT 1 AND 18 POUNDER

T VALUES POSITIVE IF GALIOT 1 LARGER THAN POUNDER

	SIGNIFICANCE LEVELS YEARS 80	81	82		COMBINED ANALYSIS T	PROB	SIG	T VALUES YEARS 80	81	82	T SCORE	F3
4 ANGLEYOS	+	+	+	ND	0.64	52.499	NS	1.29	0.01	0.90	0.00	0.17
5 SPRINGHT	+	+	+	ND	0.87	38.808	NS	0.13	1.26	0.89	0.00	0.16
8 DATEOFEE	-1	-5	-	ND	-1.81	-7.529	NS	-2.93	-2.11	-1.51	-5.03	0.14
10 HGTATEE	+	+	+	ND	0.65	51.847	NS	0.19	0.38	1.22	0.00	0.10
11 WDTHATEE	+	+	+	ND	1.83	7.205	NS	1.47	1.75	1.90	0.00	0.00
14 FLAGLGTH	+2	-	+1	ND	1.59	11.772	NS	2.35	-0.21	3.28	5.63	0.90
15 FLAGWDTH	+1	+2	+1	D	4.21	0.009	***	2.91	2.56	2.93	8.40	0.00
17 SLTEEE30	-	+	+5	ND	1.46	14.945	NS	-0.74	1.80	2.02	2.02	1.38
19 HEAD/PLT	-	-	-	ND	-0.99	-32.821	NS	-1.84	-0.05	-0.40	0.00	0.76
20 HGT AFT	-	+1	+5	ND	1.52	13.313	NS	-0.44	3.28	2.10	5.38	1.51
24 EAR LGTH	-	+	+	ND	0.62	53.852	NS	-1.18	1.16	1.36	0.00	1.45
25 AWNS	+	+	+	ND	0.00	100.000	NS	0.00	0.00	0.00	0.00	0.00

GENERALISED DISTANCE SQUARED = 22.63 **

t- VALUES FOR EACH INDIVIDUAL YEAR.

SIGNIFICANCE LEVELS OF t- TESTS ON EACH YEAR'S DATA

D: DISTINCT - 2 x 1% DIFFERENCES IN 3 YEARS
ND: NOT DISTINCT

0337

0338

OUTPUT from FITC

FITTING CONSTANTS ANALYSIS LUCERNE CAMBRIDGE 1978-82 5 YEAR

CHARACTER NUMBER 10 CHARACTER NAMEFLOWDATE

MEAN over years, ADJUSTED FOR MISSING VALUES

VARIETY MEANS

		MEAN		78	79	80	81	82
1	DU PUITS	105,42	(5)	102,24	111,50	110,12	107,83	95,42
2	EUROPE	105,57	(5)	101,52	113,02	110,58	106,91	95,80
3	EVEREST	109,05	(5)	105,83	116,16	114,12	111,87	97,27
4	LUNA	110,32	(5)	108,31	118,10	115,64	110,87	98,67
5	M KABUL	107,53	(5)	104,64	113,52	113,31	109,46	96,73
6	M PHFONI	106,20	(5)	103,38	113,26	111,61	108,00	94,77
7	SABILT	106,26	(5)	104,34	112,70	112,15	107,06	95,06
8	SVERRE	106,15	(5)	104,26	112,55	110,11	108,12	95,70
9	VERNEUIL	107,17	(5)	103,56	114,16	112,63	108,69	96,80
10	VERTUS	107,57	(5)	104,29	115,36	111,90	109,41	96,91
11	EUVER	105,86	(5)	102,58	112,35	110,57	107,21	96,57
12	VERNON	106,37	(5)	103,32	113,21	112,21	107,99	95,13
13	VELA	104,74	(5)	101,17	112,01	112,02	104,40	94,10
14	LUTECE	104,40	(3)	-1,00	-1,00	108,96	105,32	95,00
15	ECLAT	106,69	(3)	-1,00	-1,00	112,26	107,94	95,95
16	BODROG	107,45	(2)	-1,00	-1,00	-1,00	109,32	96,40
	YEARS MEANS			103,69	113,57	111,93	108,15	96,02

RESIDUAL MEAN SQUARE = 0,6627

POOLED ERROR MEAN SQUARE = 0,7679 WITH DEGREES OF FREEDOM = 580

OUTPUT from VDES

FITTING CONSTANTS ANALYSIS LUCERNE CAMBRIDGE 1978-82 5 YEAR

		10	9	11	7	8
		FLOWDATE	ANG GROW	SLINFLOR	LEAFLGTH	LEAFWDTH
1	DU PUITS	105,42	66,05	81,82	28,10	11,26
2	EUROPE	105,57	63,76	85,10	28,50	11,97
3	EVEREST	109,05	67,15	81,55	26,10	11,91
4	LUNA	110,32	59,93	85,00	25,92	10,44
5	M KABUL	107,53	55,07	78,79	27,10	10,54
6	M PHEONI	106,20	59,92	79,71	27,22	11,30
7	SABILT	106,26	58,95	79,01	26,07	11,66
8	SVERRE	106,15	61,56	78,79	27,28	11,10
9	VERNEUIL	107,17	66,20	82,17	27,75	12,20
10	VERTUS	107,57	60,77	78,90	27,32	11,72
11	EUVER	105,86	64,01	85,84	29,13	11,93
12	VERNON	106,37	69,14	80,00	27,84	12,34
13	VELA	104,74	59,63	76,31	28,28	10,95
14	LUTECE	104,40	65,66	81,47	27,87	11,21
15	ECLAT	106,69	66,88	84,57	28,77	12,54
16	BODROG	107,45	64,35	80,40	28,16	11,84

ADJUSTED 5 YEAR MEANS

FITTING CONSTANTS ANALYSIS LUCERNE CAMBRIDGE 1978-82 5 YEAR

VARIETY RANKS

		10	9	11	7	8
1	DU PUITS	14	5	6	6	11
2	EUROPE	13	9	2	3	4
3	EVEREST	2	2	7	14	6
4	LUNA	1	12	3	16	16
5	M KABUL	4	16	15	13	15
6	M PHEONI	10	13	11	12	10
7	SABILT	9	15	12	15	9
8	SVERRE	11	10	14	11	13
9	VERNEUIL	6	4	5	9	3
10	VERTUS	3	11	13	10	8
11	EUVER	12	8	1	1	5
12	VERNON	8	1	10	8	2
13	VELA	15	14	16	4	14
14	LUTECE	16	6	8	7	12
15	ECLAT	7	3	4	2	1
16	BODROG	5	7	9	5	7

NO SEEDED CHARACTERS USED

FITTING CONSTANTS ANALYSIS

VARIETY DESC

		10	9	11	7	8
1	DU PUITS	3	1	1	1	2
2	EUROPE	3	2	1	1	1
3	EVEREST	1	1	2	3	1
4	LUNA	1	3	1	3	3
5	M KABUL	1	3	3	3	3
6	M PHEONI	2	3	2	3	2
7	SABILT	2	3	3	3	2
8	SVERRE	2	2	3	2	3
9	VERNEUIL	1	1	1	2	1
10	VERTUS	1	2	3	2	2
11	EUVER	3	2	1	1	1
12	VERNON	2	1	2	2	1
13	VELA	3	3	3	1	3
14	LUTECE	3	1	2	2	3
15	ECLAT	2	1	1	1	1
16	BODROG	1	2	2	1	2

< RANGE OF VARIETY MEANS >

SMALLEST |—— 3 ——|—— 2 ——|—— 1 ——| LARGEST

EQUAL INTERVALS.

Examples of Variety Descriptions

GRASSES

PERENNIAL RYEGRASS

(Lolium perenne L.)

ABERYSTWYTH S.23

Breeder: Welsh Plant Breeding Station, Plas Gogerddan, near Aberystwyth

Origin: Material from highly productive swards.

CLASSIFICATION

Ploidy	Diploid
Ear Emergence	Late
Habit of growth	Prostrate
Height at ear emergence	Short
Length of flag leaf	Short
Width of flag leaf	Narrow
Tendency to flower in year of planting	None
Heading in aftermath	Very little

DIFFERENCES FROM SIMILAR VARIETIES:

Over 3 days later than S 101 in ear emergence, but only 1 day later than the tetraploid variety Fortis.

Distinguished from Fortis by its shorter height at ear emergence and by its shorter and narrower flag leaf.

CEREALS

WINTER WHEAT

AVALON

Origin TJB 30/148 x TL 365a/34

Breeder Plant Breeding Institute, Trumpington, Cambridge.

Breeder's Designation TJB 409/1088

LEADING CHARACTERS

Straw thin walled, semi-dwarf. Ear white, medium dense to dense taper absent to slight. Scurs short in upper part of ear. Supernumerary spikelets common. Glume external surface rough, internal hair Group 1+-2. Grain red, oval; colour in phenol medium to dark medium.

CHARACTERS IN DETAIL

Ear	
Colour	White.
Density	Medium dense to dense
General	Medium size, taper slight in profile, absent in face, scurs short in upper part of ear, attaining about 1 cm in apical spikelet.
Apical Spikelet	Apex of upper glume truncated, medium beaks frequent
Supernumerary Spikelets	Common.
Rachis	Convex surface of apical segment with short collar hairs and slight downward extension
Lower Glume	
Size and Shape	Longer than average, rather deep, taper slight
Keel	Developed throughout length, less marked over bulge, inflection absent to slight.
Beak	Medium to short medium, straight to slightly curved
Shoulder	Width medium, more or less square.
External Surface	Rough
Internal Hair	Group 1+ 2
Internal Imprint	Medium to broad, extending to half way up glume.
Lower Lemma	
Beak	Short, straight to slightly curved, slightly swollen.
Straw	
Cross Section	Thin wall.
Length	Semi-dwarf.
Grain	
Colour	Red
Size and Shape	Medium size, oval, brush hairs medium length.
Phenol Reaction	Medium to dark medium brown.

VEGETATIVE CHARACTERS

Coleoptile pigment dark red, growth habit at tillering semi-erect to semi-prostrate, flag leaf attitude just before ear emergence semi-erect to semi-recurved, auricle pigment weak; uppermost node hairs numerous; ear weakly glaucous, culm, leaf blade and leaf sheath moderately glaucous at flowering.

N I A B
February 1979

VEGETABLES

DESCRIPTION OF A VARIETY OF BROAD BEAN (*Vicia faba L. partim*)

Based on observations made at CAMBRIDGE in 1977, 1978 and 1979

Variety name: HYLON

Reference: AFP 21/58

Date description prepared: 12 December 1979

Character	State	Note
Plant : height (at green shell stage)	3 short/5 medium/7 tall	7
Plant : number of pod bearing tillers	3 few(1 to 2)/5 medium(3)/ 7 many(4 or more)	4
Lateral leaves : nectaries	1 absent/9 present	9
Flower : melanin spot on wing petals	1 absent/ present	9
Flower : antnocyanin coloration of standard tube	1 absent/9 present	9
Flower : ~~intensity~~ extent of anthocyanin coloration on standard tube	3 weak/5 medium/7 strong	2
Flower : melanin spot on back of standard petal	1 absent/9 present	9
Flower : size of melanin spot on back of standard petal	3 small/5 medium/7 large	3
Pod : length	3 short/5 medium/7 long	7
Pod : breadth	3 narrow/5 medium/7 broad	5
Pod : attitude	1 erect/2 semi-erect/ 3 horizontal/4 drooping	4
Pod : number of seeds and ovules	actual range over three years	7.8 to 8.3
Seed : weight of 1000 seeds (g)	actual range over three years	1316 to 1766
Seed : size	3 small/5 medium/7 large	6
Seed : testa colour (at dry harvest stage)	1 grey white/2 buff/3 green/ 4 red/5 violet/6 other	2
Seed : dimple (ornamentation)	1 absent/ present	1
Seed : hilum colour	1 same as testa/2 black	2
Maturity : when lower pods ready for harvest	3 early/5 medium/7 late	8

General:

Hylon most closely resembles 'Imperial White Longpod' but has a greater number of seeds plus ovules per largest pod.

[Annex VI follows]

ANNEX VI

PLANT VARIETY PROTECTION - COMPUTER SOFTWARE
(Ministry of Agriculture, Fisheries and Food, Plant Variety and Seeds Division, Cambridge, England)

1 General Administrative Software

The Seed Quantities and Fees system is a transaction processing system with insertion, deletion, amendment and display facilities. Programs are written in COBOL and most are run in batch mode. The four major files involved are:

Name and Address File
Tests and Trials File (TAT)
National List and Grants of Rights File (NALGOR)
Seed Quantities and Fees File (SQFEE)

The programs can be grouped by function as follows:

(a) MAINTENANCE OF NAME AND ADDRESS FILE

Program Name		Function
SFEE Ø4	-	Validates creation and amendment data and updates name and address file.
SFEE Ø3	-	Deletes records from name and address file
SFEE L1	-	Lists part or all of name and address file

(b) APPLICATIONS AND FEES

SFEE Ø5	-	Online program to create records for new varieties in TAT file
SFEE Ø6	-	Deletes records from TAT file using amendment records
SFEE Ø7	-	Inserts records into TAT file for those cases not dealt with by SFEE Ø5
SFEE 11	-	Online program to amend records on TAT file
SFEE 12A	-	Extracts appropriate records from TAT and SQFEE files for material requests for test and trial
SFEE 12B	-	Sorts extracted records into order
SFEE 12C	-	Produces requests for material on pre printed stationery
SFEE 13	-	Produces labels associated with requests produced by SFEE 12C. Sent to growers/producers for attachment to material despatched as a result of the request
SFEE 14A	-	Extracts appropriate records from TAT and SQFEE files for the production of TAT fee requests
S14C	-	Produces TAT fee invoices on pre-printed stationery
SFEE 15	-	Updates records where no material request for 2nd year of trial but test fee required

SFEE 16	-	Updates TAT file with details of received fees
SFEE L2	-	Lists part or all of TAT file

(c) ENTRY ON NATIONAL LIST FILE

SFEE 9A	-	Validates insertion, amendment and deletion record for NALGOR file
SFEE 9B	-	Updates NALGOR file using valid records from SFEE 9A
SFEE 9C	-	Produces list of records amended/inserted during SFEE 9B for use in SFEE L3
SFEE L3	-	Produces part or full list of NALGOR file

(d) RENEWAL NOTIFICATIONS AND RENEWAL INVOICES

SFE 10A	-	Extraction of appropriate records from master files for production of 3 month renewal notifications. Also produces control print for records extracted
SFE 10B	-	Produces renewal notices on pre-printed stationery
SFE 10C	-	Extraction of appropriate records from master files for production of renewal invoices. Production of control print for extracted records
SFE 10D	-	Produces renewal invoices on pre-printed stationery
SFE 10F	-	Updates master records with payment receipt information

2 Variety name checking

Transaction processing system to insert, delete and amend records. Special 'soundx' code generated for names to allow the checking of new varieties for similar sounding names. Interrogation done through transaction processing system with printout produced as soon as interrogation session is completed.

May 1983

NATIONAL LIST AND PLANT BREEDERS' RIGHTS

VARIETIES UNDER TESTS AND TRIALS: NEW APPLICATIONS

Field	Entry	Field key
1. Form Type	3 1	
2. Spare		
3. AFP No.	0 1 3 0 7 0 0	00
4. Sub-group (see code list)	0 1 1	01
5. Ploidy: (1 = Not applicable; 2 = Diploid; 3 = Triploid; (4 = Tetraploid; 5 = Polyploid; 6 = Hexaploid; 7 = Other	2	02
6. Breeders' reference	LM 350	03
7. Variety name	LANCET	04
8. Name status: 1 = Proposed; 2 = Accepted; 3 = Refused	2	05
9. Variety origin (see country code list)	0 1 2 8	06
10. Application type: 1 = NL (PBR not applicable); 2 = NL; 3 = PBR (NL not applicable); 4 = PBR; 5 = Both	5	07
11. Test and trial type: 1 = DUS only; 2 = VCU and DUS	2	08
12. Date application accepted – NL	1 1 0 5 8 3	09
13. Date application accepted – PBR	1 1 0 5 8 3	10
ADDRESS CODES 14. Breeder	0 5 2 3	11
15. NL Application	0 5 2 3	12
16. PBR Application	0 5 2 3	13
17. Seed requests	0 6 5 4	14
18. Test fees	0 6 5 4	15
19. PBR Priority status: 1 = Not applied for; 2 = Applied for; 3 = Granted; 4 = Refused; 5 = Withdrawn	2	16
20. Current PD status: 1 = Not applied for; 2 = Applied for; 3 = Granted; 4 = Refused; 5 = Withdrawn	2	18
21. Previous AFP No. (if re-application)	0 1 3 0 6 5 0	21
22. Decoratives/Fruit Merit Trial: 1 = Yes; 2 = No	2	22
23. Foreign connection: (0 = None (1 = Variety DUS tested in U.K. on behalf of foreign country (2 = Variety DUS tested abroad on behalf of U.K. - fees payable (3 = Variety DUS tested abroad on behalf of U.K. - no fees payable	0	27
24. Country involved (see country code list)	0	28
25. Other countries in which tests and trials are being carried out	0 1 3 6	29
26. Total years in normal DUS test cycle	4	30
27. Total years in normal VCU trial cycle	4	44

VRO 31

NATIONAL LIST AND PLANT BREEDERS' RIGHTS

VARIETIES UNDER TESTS AND TRIALS: GENERAL UPDATE FORM

Form Type 3 2

Spare

3. AFP Number 0 1 3 0 7 0 0

Only the following fields may be updated or amended

Field	Entry	Field key
Sub-group (see code list)		01
Ploidy: 1=Not applicable; 2=Diploid; 3=Triploid; 4=Tetraploid; 5=Polyploid; 6=Hexaploid; 7=Other		02
Variety name		04
Name status: 1=Proposed; 2=Accepted; 3=Refused		05
Date application accepted – NL		09
Date application accepted – PBR		10
Address Codes: Breeder		11
NL Application		12
PBR Application		13
Seed Requests		14
Test Fees		15
PBR Priority status: 1=Not applied for; 2=Applied for; 3=Granted; 4=Refused; 5=Withdrawn	3	16
PBR Priority operative date	1 3 0 5 8 2	17
Current PD status: 1=Not applied for; 2=Applied for; 3=Granted; 4=Refused; 5=Withdrawn		18
PD Number		19
PD Operative date		20
NL Withdrawn/refused indicator: 1=Withdrawn; 2=Refused		23
NL Date withdrawn/refused		24
PBR Withdrawn/refused indicator: 1=Withdrawn; 2=Refused		25
PBR Date withdrawn/refused		26
Foreign connection: (0=None 1=Variety DUS tested in UK on behalf of foreign country (2=Variety DUS tested abroad on behalf of UK - fees payable (3=Variety DUS tested abroad on behalf of UK - no fees payable		27
Other countries in which tests and trials are being carried out		29
Year of DUS Test		31
DUS Test history (see code list)		33
VCU Trial history (see code list)		47
STOP INDICATOR: 1=Normal; 2=User stop - no action on this variety		58

VRO 32

NATIONAL LIST AND PLANT BREEDERS' RIGHTS SELECTIVE FILE LISTING : VARIETIES UNDER TEST & TRIAL PAGE 1

TAT

AFP NO 013/0700 RUN-DATE 12.05.83

01.SUB-GROUP 011
02.PLOIDY 2
03.BREEDERS' REF LH 350
04.VARIETY NAME LANCET
05.NAME STATUS ACCEPTED
06.VARIETY ORIGIN NETHERLANDS
07.APPLICATION TYPE 5:NL & PBR
08.TEST & TR'L TYPE 2: VCU & DUS
09.NL APPLIC DATE 11.05.83
10.PBR APPLIC DATE 11.05.83
ADDRESS CODES:
11.-BREEDER 0523
12.-NL APPLIC'N 0523
13.-PBR APPLIC'N 0523
14.-SEED REQUESTS 0654
15.-TEST FEES 0654
16.PBR PRIORITY STA APPLIED FOR
17.PBR PRIORITY DTE
18.PD STATUS APPLIED FOR
19.PD NO
20.PD OPERATIVE DTE
21.PREVIOUS AFP 013/0650
22.DEC/FRUIT MERIT NO

23.NL FINISH IND
24.NL FINISH DTE
25.PBR FINISH IND
26.PBR FINISH DTE
27.FOREIGN CONNXN 0
28.C'TRY INVOLVED
29.OTHER C'TRIES FR NE
DUS TESTS
30.CYCLE - YRS 4
31.TEST-YEAR 1
32.TEST STATUS 0:NEW APPLIC'N
33.HISTORY:YR 1
34. YR 2
35. YR 3
36. YR 4
37. YR 5
38. YR 6
39. YR 7
40. YR 8
41. YR 9
42.NO.YRS IN TST 0
43.EST YR COUNT 0

VCU TRIALS:
44.CYCLE - YRS 4
45.TRIAL-YEAR 1
46.TRIAL-STATUS 0:NEW APPLIC'N
47.TR. HISTORY:YR 1
48. YR 2
49. YR 3
50. YR 4
51. YR 5
52. YR 6
53. YR 7
54. YR 8
55. YR 9
56.NO.YRS IN TRIAL 0

57.1ST PL MAT REQUEST . .

58.STOP INDICATOR 1:NORMAL

END

NATIONAL LIST AND PLANT BREEDERS' RIGHTS SELECTIVE FILE LISTING : NATIONAL LIST & GRANT OF RIGHTS PAGE 1

AFP NO 013/0342 NALGOR RUN-DATE 16.05.83

1:GRANT OF RIGHTS

01.SUB-GROUP	011
02.PLOIDY	2
03.VARIETY NAME	ABERYSTWYTH S101
04.ENTRY TYPE	2:NL
05.STATUS	
06.DATE OF RIGHTS	
07.GRANT NO	
08.RENEWAL STATUS	2:RENEWAL INVCD
09.NO OF YRS EXTDED	
10.TOT YRS OF RGHTS	
11.YR OF RENEWAL	
12.ADD-CODE:RENEWAL	
13.ADD-CODE:HOLDER	
14.DATE TERMINATED	
15.STOP INDIC	

END

2:ENTRY ON NATIONAL LIST

16.STATUS	EXTENDED
17.RESTRICTIONS	
18.DAGGERED VARIETY	NO
19.DATE DAG REMOVED	
20.OPERATIVE DATE	01.07.73
21.YEARS EXTENDED	10
22.TOT YRS ON NL	20
23.YR OF RENEWAL	10
24.RENEWAL STATUS	2:RENEWAL INVCD
25.DEROGATIONS	GERMANY (F.R.)
26.NL SYNONYMS	NO
27.ENTRY ON COM CAT	IR UK
28.COM CAT ENTRY DATE	01.01.76
29.COM CAT SYNONYMS	NO
30.NO OF MAINTAINERS	02
31.NO OF UK MNT'NERS	01

ADDRESS CODES

MAINTAINERS	RENEWALS
32.0744	44.0559 A
33.0559	45.
34.	46.
35.	47.
36.	48.
37.	49.
38.	50.
39.	51.
40.	52.
41.	53.
42.	54.
43.	55.

56.DATE TERM'D	
57.VEG.LIST	N/A
58.STOP INDIC	NORMAL

0345

PAGE 1

VARIETY NAMES CHECKING SYSTEM
****

SOUNDX

DATE: 12/ 5/83

---------NAMES TO BE CHECKED---------		---------DUPLICATE NAMES FOUND---------			
CLASS	-------------NAME-------------	-------------NAME-------------	SPCS/SGP BRED ADD CODE	--------BREEDERS REF--------	TERM
01	MATHIS	MADOG	/		
		MATCH	/		
		MATTISO	/		
		MIDAS	/		

END

VARIETY NAME RECORD DISPLAY

NAME CLASS 01 VARIETY NAME MATHIS

SOUNDX CODE MV BREEDERS REF

SPCS/SBGRP 001001 AFP=NO BREEDERS ADD CODE 0846

COUNTRY CODE	STATUS	SOURCE	MNTH/YR	COUNTRY CODE	STATUS	SOURCE	MNTH/YR
GB	P	GAZ	05/1983				

YEAR TERMINATED

ANY MORE(Y/N)

[Annex VII follows]

Statistical criteria for distinctness between varieties of herbage crops

By H.D. PATTERSON[1] and S.T.C. WEATHERUP[2],

[1]ARC Unit of Statistics, Edinburgh, and [2]Biometrics Division, Department of Agriculture, Northern Ireland, and Department of Agricultural Biometrics, The Queen's University of Belfast

Summary

The paper examines the statistical properties of test criteria currently used to determine the distinctness of herbage varieties and suggests alternatives.

Introduction

Under European Economic Community (EEC) regulations the sale of seed of specified agricultural crops is restricted to varieties in a Common Catalogue. Member states are required to maintain separate National Lists of tested varieties; the Common Catalogue is a composite list of all varieties on the National Lists. The conditions prescribed for entry onto a National List have been described by Weatherup (1980). One of the most important of these is that the variety must be distinct on one or more characters from all other varieties on the list. Often distinctness can be assessed by inspection or laboratory measurement but for some crops, including herbage species, field trials are used. Results vary from plant to plant, plot to plot and year to year and statistical criteria are required to separate genuine varietal differences from chance variation. In the present paper we examine the statistical properties of the test criterion that is commonly used in herbage distinctness testing in the United Kingdom and many other European countries and suggest alternatives.

Description of trials

Data to assess distinctness are obtained from trials in which sample plants from entrant and standard varieties are grown as individual spaced plants. For herbage species 60 plants per variety are grown. These are arranged in plots using a randomised block design. In the UK a plot is made up of a single row of 10 plants from one variety and hence a design with 6 randomised blocks is used. Up to 15 characters are measured on each plant. The decision on an entrant variety is normally taken after it has been included in 3 years of trials although when the evidence is strong enough a decision can be taken after 2 years.

Differences between test criteria will be illustrated using data from trials of early varieties of perennial ryegrass (PRG) (Diploid) at Crossnacreevy, the official testing station in Northern Ireland, during the period 1979-81. The numbers of varieties included in these trials were 65, 68 and 67 in 1979, 1980 and 1981 respectively. Of these, 39 varieties were common to all years and consisted of those entrant varieties on which decisions were due in 1981 and the standard early varieties. The characters measured in these trials and their units are defined in Table 1; means for eight selected varieties are in Table 2 and the analysis of variance for the 39 common varieties is in Table 3.

The 2/3 test criterion

The present criterion for distinctness in PRG varieties (Hawkins and Clouting, 1965) is based on separate t-tests between the candidate variety and each other variety in each of three years. A t-test uses a t-value defined by

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p}$$

where $\bar{x}_1$, $\bar{x}_2$ are the means over the six replicates of the two varieties being compared and s_p is the standard error of $\bar{x}_1 - \bar{x}_2$ estimated from the plot error (varieties × replicates) mean square with ν_p degrees of freedom. In the calculations of the present paper we take ν_p equal to 370. The t-test is two-tailed and the specified level is 1% so that an absolute value of t in excess of about 2.59 is required for significance.

Two varieties are judged distinct if, for any one character, (a) either two or three of the t-values are significant at the 1% level and (b) all the significant t-values have the same sign. We call this the 2/3 test criterion. For entry to the National List a new variety must be distinct from all varieties already on the National List.

The originators of this test point out that a character "is of little value for distinguishing between varieties unless significant differences can be detected between the same varieties upon most, if not all, occasions". In the 2/3 test a large difference in a single year is insufficient to establish distinctness. Confirmatory evidence is required from at least one other year.

If accepted, a candidate variety becomes part of the 'framework' against which later varieties will be judged and must be capable therefore of reproducing the differences on which its own distinctness was based.

The 2/3 criterion can be criticized on the grounds that a within-year difference which just fails to achieve the 1% significance level contributes no more to the separation of a variety pair than a zero difference or even a non-significant difference of opposite sign. For example, three differences, all in the same direction, one significant at the 1% level and the others at the 5% level, would not be regarded as sufficient evidence for distinctness. Yet many statisticians would regard the two 5% results as providing at least as strong confirmatory evidence as a second 1% result. Again three 5% results, all of the same sign, are rejected by the 2/3 criterion but might well be claimed to provide evidence of consistent varietal difference, modest in any one year, but overwhelming in total.

General t-score criterion

Other criteria have been sought in an attempt to overcome this weakness of the 2/3 method. In one general method allowing a wide range of adjustment t-values calculated as for the 2/3 method are converted to t-scores according to the following rules. If $k_1 < t < k_2$ or $-k_2 < t < -k_1$, where t is the t-value in a given year and k_1 and k_2 are non-negative constants, then the t-score is t ; if $t > k_1$ the score is k_1 ; if $t < -k_1$ the score is $-k_1$; if $-k_1 < t < k_1$ the score is zero. Two varieties are distinct if T , the absolute sum of t-scores over the three years, exceeds a specified critical value K . This is called the generalised t-score criterion. The conversion from t-value to t-score is illustrated in Fig. 1.

The 2/3 method is a special case for which $k_1 = k_2$ and the minimum acceptable value of T is 5.18. Another special case that has been used in practice is the original t-score criterion (or simply the t-score criterion) with $k_1 = 1.97$, $k_2 = 3.32$, $K = 5.18$. The values k_1 and k_2 are the 5% and 0.1% critical values of the t-distribution with 370 degrees of freedom and K is twice the 1% critical value. Like the 2/3 criterion the t-score criterion requires more than a single large t-value for distinctness but the confirmatory evidence need not be so strong. Thus three 5% results, provided they are all in the same direction, are sufficient to ensure distincness.

Combined over-years criterion

A more serious criticism of the 2/3 method is that distinctness is much less easily achieved on a character giving consistent results from year to year than on an inconsistent character. Inconsistency is indicated by large values of λ , where

$$\lambda^2 = \frac{\text{varieties} \times \text{year mean square}}{\text{plot error mean square}}$$

and consistency by values of λ near to 1. The chance of wrongly declaring that two identical varieties are distinct is small (about 3 in 20000) when $\lambda = 1$ and large (about 1 in 4) when $\lambda = \infty$. Results for the Crossnacreevy data show that some characters are more consistent than others (Table 3). Values of λ range from 1.21 for character 11 to 2.41 for character 5. These differences are not attributable solely to sampling errors. The ratios λ^2 would have variance 0.19 if they all had the same expectation and followed a non-central F distribution; the actual variance is 1.7.

The 1% over-years criterion meets this criticism. Two varieties are distinct if the absolute value of $\bar{d}/SE(\bar{d})$ is larger than the critical 1% point in Student's t-distribution where $\bar{d}$ is the mean difference over three years, and $SE(\bar{d})$ is its standard error calculated from the varieties × years mean square with 76 (more generally ν) degrees of freedom in Table 3. The ratio, F_1 say, of the varieties mean square to the varieties × years mean square, provides a measure of discriminating power on the over-years criterion. Thus, characters 11 and 20 are the most discriminating and characters 4 and 19 the least discriminating (Table 3).

Acceptance probability

A convenient measure of the effectiveness of the 2/3, t-score and combined over-years methods is the probability of declaring two hypothetical varieties distinct on some particular character. The probability is called the acceptance probability. This measure is well known in acceptance sampling in industry. It has been used in other branches of variety testing, particularly the planhing and interpretation of yield trials (Patterson, Silvey, Talbot and Weatherup, 1977).

In calculating and using an acceptance probability we assume that the mean difference in year i for a particular character can be regarded as a sample from a normal population of possible differences for that year with mean μ_i and plot error variance σ_P^2 ; s_P^2 , an estimate of σ_P^2 , is given by twice the plot error mean square divided by six, the number of replicates per trial. We further assume that the μ_i themselves sample a normal population with mean μ and variance σ_{VY}^2 . The total variance is σ^2 , where $\sigma^2 = \sigma_{VY}^2 + \sigma_P^2$; s^2 is an estimate of σ^2 given by twice the varieties × years mean square of Table 3 divided by six. It is sometimes convenient to present an acceptance probability as a function of θ , the standardized mean difference μ/σ . Values of s and λ , the ratio of s to s_P , are in Table 3. We call s the scaling factor because it can be used to convert means to standardized means and vice-versa.

Under these assumptions acceptance probabilities can be calculated from Student's t-distribution. For the 2/3 criterion we require P_1 , the probability that a t-value in one year is significantly negative, P_2 , the probability that it is not significant, and P_3 , the probability that it is significantly positive. P_1 is equivalent to the probability that Student's t is smaller than $-\theta-C/\lambda$, where C is the 1% critical value (2.59 on 370 degrees of freedom). Similarly P_3 is the probability that Student's t is larger than $-\theta+C/\lambda$. Also $P_2 = 1-P_1-P_3$. The 2/3 criterion can be met only if (a) the t-values in all three years are significantly negative or (b) all three are significantly positive or (c) two are significantly negative and one not significant or (d) two are significantly positive and one not significant. The overall probability of accepting as distinct two varieties with the specified θ value λ is therefore $P_1^3 + 3P_1^2 P_2 + 3P_2 P_3^2 + P_3^3$.

A similar but more complicated formula is available for the acceptance probability on the t-score method. On the combined over-years criterion the acceptance probability is the sum of the probability that t is smaller than $-\sqrt{3}\ \theta - C$ and the probability that t is larger than $-\sqrt{3}\ \theta + C$. This time C is 2.64, the 1% critical value in the t-distribution with 76 degrees of freedom.

The following are typical of the questions that can be answered using acceptance probabilities:

1. What is the chance of declaring two varieties distinct on character 10 if their average plant heights at ear emergency differ in the long-term by (a) 2cm? (b) 5cm? (c) 8cm?
2. What long-term average difference in plant heights at ear emergence gives two varieties an even chance of being accepted as distinct?
3. What is the risk that two identical varieties will be judged distinct on plant height at ear emergence (character 10)?

Answers for the 2/3 criterion are provided by Fig. 2, which plots acceptance probability against true varietal difference. In acceptance sampling a plot of this type is called an operating characteristic curve or OC-curve. The chance that two varieties will be accepted as distinct on the 2/3 criterion is about 10% when the true difference in character 10 is 2cm, 44% when the difference is 5cm and 85% when the difference is 8cm.

Questions 2 and 3 are concerned with two important parameters of the OC curve. These are (1) the value of D_{50}, the true difference giving an even chance of acceptance or rejection and (2) the risk, R_0 say, of wrongly deciding that two identical varieties are distinct. We refer to this risk as the Tester's Risk or, if there is no danger of ambiguity, the Risk. Breeder's Risk can also be defined but will not be used in the present paper. The value of D_{50} on the 2/3 criterion is 5.4cm and the Tester's Risk is 3.6%.

Acceptance probabilities depend on the choice of criterion and the values of plot error variance σ_P^2, varieties × years variance σ_{VY}^2 and total variance σ^2. Table 4 gives the probabilities for character 10 using three criteria and five pairs of values of σ^2 and σ_P^2 chosen as examples to illustrate the effects of changes in design or other circumstances affecting the values of these parameters. Variances A are the original variances calculated in Table 3. The value of σ_P^2 is halved in B and doubled in D whilst σ_{VY}^2 remains unchanged. Variances C consist of the original σ_P^2 but σ_{VY}^2 is decreased to give the same total variance σ^2 as B. Correspondingly, σ_{VY}^2 is increased in E to give the same σ^2 as in D. Table 5 presents values of D_{50} and R_0 appropriate to each character when variances A are applicable. Fig. 3 plots acceptance probability against standardized difference θ for a range of values of λ. The slope of an OC-curve in midsection provides a measure of the efficiency of a testing scheme - the steeper the slope the more efficient the scheme.

The 2/3 probabilities are much more affected by changes in σ_P^2 than by changes in σ_{VY}^2. Thus, the 5cm. probabilities are about the same in A, C and E but greatly increased in B and decreased in D (Table 4). By contrast, the 1% over-years probabilities depend solely on the total variance; they are as much affected by a change in σ_{VY}^2 as by a change in σ_p^2 .

Tester's Risk for the 2/3 method depends on λ (Tables 4, 5). Values for different characters vary enormously (Table 5), from 0.2% for characters 11, 15 and 20 with relatively small λ to 9% for character 5, which has the largest λ . The Risk value for the over-years method is a constant 1% for all characters.

Relative values of the 50% and other probability points also depend on λ . Thus D_{50} is larger on the 2/3 method than on the over-years method when $\lambda < \sqrt{3}$ and smaller when $\lambda > \sqrt{3}$ (Table 5).

The t-score method exhibits the same sort of dependence on λ as the 2/3 method but is generally less stringent (Tables 4, 5) and slightly more efficient as judged by the slope of the curves in Fig. 3. When λ is large the 2/3 and t-score OC-curves are virtually indistinguishable (Fig. 3). Efficiency is then poor and Tester's Risk is very high with R_0 taking a maximum value of 0.32 when λ is about 10 and a limiting value of 0.25 for very large λ . Thus, although the 2/3 method and the t-score method both require consistency over the years, the standard set is very low and in marked contrast to the within-year standard.

Heterogeneity of varieties × years variance and its effect on the over-years criterion.

The authors recommend the combined over-years criterion in preference to the 2/3 method but with one qualification. The varieties × years mean square used in the over-years criterion is a pooled value calculated from a large number of varietal comparisons and may not be entirely appropriate to any particular comparison.

The point can be checked by calculating the ratio, F_2 say, of specific within-pair of varieties × years mean square with two degrees of freedom to the pooled varieties × years mean square.

Examples

In many cases there is agreement between the 2/3 and over-years test results but there are instances in which conclusions differ. Examples from the Crossnacreevy data set are in Table 6. Our comments are as follows:

(a) B v. C on character 20. The t-values are significantly different at the 1% level in only one year out of three and so the varieties are not judged distinct on this character using the 2/3 criterion. The value of λ for character 20 is small and distinctness difficult to achieve on the 2/3 and t-score criterion. One of the t-values was significant at the 0.1% level; although not achieving the high standard required by the 2/3 criterion the other two provide strong confirmatory evidence. The 1% over-year criterion is easily met and the value of F_2 is small. We conclude that the varieties are distinct with variety B producing taller plants than variety C in the aftermath.

(b) E v. D on character 11. These varieties are not distinct on the present 2/3 criterion. However, the over-year criterion indicates distinctness and F_2 is smaller than 1. Only one of the individual t-values attains significance at the 1% level but the other two provide confirmatory evidence. The 2/3 criterion ignores the significant 1980 t-value and the almost significant 1981 t-value. Again λ is small and it seems reasonable to conclude that the two varieties are distinct.

(c) G v. H on character 5. Differences are significant at the 1% level in two years and hence the two varieties are distinct on the 2/3 and t-score criteria but this conclusion is not supported by the over-year analysis. The λ value for character 5 is large, and in consequence the 2/3 and t-score tests are unusually relaxed.

(d) B v. H on character 17. All three criteria lead to the following conclusion: variety B is distinct from variety H because its plants have longer stems 30 days after ear emergence. Year-to-year inconsistency suggests, however, that the conclusion may be wrong. Results in 1979 contradict the results of 1980 and 1981 and the F_2 ratio is significant at the 1% level.

Discussion

The authors prefer the 1% over-years method because it is equally sensitive to plot errors and varieties × years errors. An additional advantage is that the criterion can be specified simply as a requirement on the natural scale. For example, two varieties are distinct if the mean difference in plant heights at date of ear emergence (character 10) exceeds 5.9 cm. in absolute value. More generally, a mean difference must exceed $sC/\sqrt{3}$, where s is the scaling factor (Table 3) and C the 1% critical value in the t-distribution. The agronomist is thus able to judge the biological relevance of the criterion and is not dependent solely on statistical significance.

At present values of s are recalculated each year. In consequence the natural scale critical differences are not available until the analysis is complete. Critical differences could, however, be specified in advance using long-term average values of s if these were reasonably stable.

The over-years criterion improves on the 2/3 criterion in that it weights the evidence provided by each character in inverse proportion to total error variance rather than plot error variance but it makes no allowance for the substantial correlations that exist between the characters. The deficiency can be remedied by using the Mahalanobis generalized distance D^2 as a measure of distinctness; this difference is defined for a pair of varieties as $D^2 = d^T W^{-1} d$, where d is the vector of differences between the over-year means of the variety pair for all characters, d^T is its transpose and W is the covariance matrix calculated from varieties × years mean squares and cross-products for all characters. The matrix W is the multivariate analogue of the varieties × years mean square used in the over-years criterion. Generalised distances for eight of the perennial ryegrass varieties are in Table 7.

The critical value for D^2 is given by

$$\frac{2p(m-1)(n-1)}{m(mn-m-n-p+2)} F$$

where m is the number of years, n is the number of varieties, p is the number of characters, and F is the F ratio with p and $mn-m-n-p+2$ degrees of freedom (Morrison, page 120, 1977)*. Since combining characters can dilute a single large difference on one character with several small differences on the others, this criterion for distinctness is considered to be additional to rather than a replacement for the over-year single-character criterion. Hence distinctness can be obtained either from a single character difference or from a multivariate difference.

---

*This formula differs from an incorrect formula given by Marriott (1974) and quoted by Weatherup (1980).

Results from the multivariate distance criterion are in general in agreement with the other criteria but sometimes conclusions differ. For example, varieties A and B are not distinct on any character using the present 2/3 criterion but there are several significant t-values in individual years on characters 4, 5, 17, 19 and 24. However, the multivariate squared distance is 27 and so exceeds the 1% critical value of 21.5 (Table 7). The accumulated evidence for distinctness is strong.

Varieties E and F are distinct on character 20, as judged by the 1% over-years and t-score criteria (Table 6) but not on the 2/3 and multivariate criteria (Tables 6, 7). Examination of individual t-values shows that few are significant other than those in Table 6. Not even the characters that are most strongly correlated with character 20 i.e. characters 5, 10, 17 and 24 provide any confirmatory evidence. The difference between varieties E and F on character 20 can therefore be ascribed to chance.

The main drawback of the multivariate method is that differences detected by it may be difficult to describe in botanical terms. In practice, therefore, the univariate over-years analysis must often be used to help in the interpretation of multivariate analysis. Examination of individual t-values within each year further assists in identifying patterns of differences over years and characters. Thus there is a case for using a three-stage procedure for identifying and describing distinctness in an entrant variety. In stage 1 of this procedure character differences are examined in individual years. In stage 2 mean differences over years are assessed for each character. Finally the Mahalanobis distance is used to combine results over all years and characters.

REFERENCES

HAWKINS, P.R. & CLOUTING, Grace M. (1965). The identification of varieties of perennial ryegrass, cocksfoot, timothy and meadow fescue. Journal of the National Institute for Agricultural Botany, 10, 223-242.

MARRIOTT, F.H.C. (1974). The interpretation of multiple observations. Academic Press.

MORRISON, D.F. (1977). Multivariate statistical methods. McGraw-Hill.

PATTERSON, H.D., SILVEY, Valerie, TALBOT, M. & WEATHERUP, S.T.C. (1977). Variability of yields of cereal varieties in UK trials. Journal of Agricultural Science, Cambridge, 89, 239-245.

WEATHERUP, S.T.C. (1980). Statistical procedures for distinctness, uniformity and stability variety trials. Journal of Agricultural Science, Cambridge, 94, 31-46.

Table 1: Definitions of measured characters

Character Number and Abbreviation		Definition
4	ANGLEYOS	Angle of growth in year of sowing (deg)
5	SPRNGHT	Height of pulled up leaves measured in the spring (cm)
8	DATEOFEE	Date of ear emergence (days from 1 March)
10	HTATEE	Natural plant height at date of ear emergence (cm)
11	WDTHATEE	Plant width at date of ear emergence (cm)
14	FLAGLGTH	Length of flag leaf at ear emergence (cm)
15	FLAGWDTH	Width of flag leaf at ear emergence (mm)
17	STLEEE30	Stem length 30 days after ear emergence (cm)
*19	NO HDS/PT	Number of heads/plant estimated on 0-9 scale
*20	HGTAFT	Height of plant in aftermath (cm)
24	EARLGTH	Ear length (cm)

*All plants of each variety are cut down at a defined time relative to their recorded date of ear emergence. Characters 19 and 20 are measured on the plant re-growth 8 weeks after cutting.

Table 2: Means of eight early PRG (Diploid) varieties, Crossnacreevy 1979-81 (units as in Table 1).

Varieties	Characters										
1979	4	5	8	10	11	14	15	17	19	20	24
A	30.5	24.4	94.7	40.3	61.6	18.8	6.18	87.7	0.99	35.7	22.7
B	36.3	26.5	94.8	39.7	60.6	18.9	6.21	85.2	0.60	33.9	21.3
C	30.3	16.9	94.7	29.6	50.7	13.0	5.83	72.0	0.91	26.6	17.8
D	29.2	16.6	93.4	27.5	52.3	13.4	5.22	72.4	1.38	31.8	19.9
E	33.8	25.2	96.3	43.5	58.3	19.0	5.92	90.3	0.77	38.1	24.1
F	34.8	26.0	95.7	41.8	61.7	19.3	5.97	87.5	0.62	32.6	22.8
G	45.5	27.1	96.2	52.3	49.4	20.6	6.37	88.0	1.27	44.9	23.3
H	33.5	26.6	91.2	33.2	59.8	17.3	6.02	87.6	0.68	32.5	21.3
SE	1.78	0.70	0.58	1.34	1.40	0.46	0.139	1.37	0.128	1.25	0.49
1980											
A	31.3	31.8	71.7	38.9	69.0	18.7	6.28	85.1	1.59	43.4	22.8
B	32.0	34.8	72.6	39.9	68.5	18.6	6.13	87.0	0.82	41.3	22.0
C	42.0	17.8	75.7	23.5	55.6	12.5	5.81	65.9	1.58	36.1	17.2
D	40.5	18.4	75.0	23.3	58.7	13.3	5.35	65.4	2.03	38.7	18.4
E	39.2	31.3	76.0	42.5	63.1	18.4	6.05	87.0	1.40	47.1	22.3
F	34.8	31.9	73.9	41.6	66.5	19.2	5.92	82.7	0.63	41.3	22.0
G	45.3	35.4	74.8	50.6	58.8	19.8	6.27	86.0	2.85	52.3	22.5
H	34.8	31.9	66.6	32.0	66.8	18.3	6.23	76.8	1.27	40.8	21.8
SE	1.77	0.86	0.79	1.59	1.50	0.48	0.138	1.72	0.197	1.69	0.49
1981											
A	31.8	31.4	73.6	40.8	63.1	17.8	6.06	82.0	1.25	37.4	24.3
B	33.0	34.7	75.8	39.0	66.1	18.6	6.38	88.9	0.87	36.1	24.0
C	33.8	18.5	79.9	33.3	48.9	12.9	5.58	70.4	1.15	31.0	20.9
D	34.5	17.7	76.8	28.0	52.3	13.1	5.19	67.1	1.99	32.7	21.2
E	34.0	30.9	78.5	44.2	56.5	18.5	5.96	87.1	1.07	38.7	25.5
F	35.0	35.7	76.6	46.1	59.8	18.2	5.97	86.5	0.86	38.2	24.6
G	40.1	37.4	75.1	53.1	56.8	20.8	6.35	87.9	3.88	53.1	25.6
H	31.5	32.4	63.4	31.1	63.5	19.7	6.53	76.7	0.98	37.1	22.8
SE	1.16	0.99	1.28	1.44	1.53	0.49	0.134	1.78	0.177	1.43	0.56

Table 3: Analysis of variance of 39 early PRG (Diploid) varieties, Crossnacreevy 1979-81 (units as in Table 1).

		Characters					
	d.f.	4	5	8	10	11	14
		Mean squares per plot					
Years (Y)	2	570.34	2678.61	32317.11	940.04	2461.98	30.79
Varieties (V)	38	214.03	351.99	351.85	777.98	430.37	61.95
V × Y	76	28.41	25.50	18.84	44.72	19.18	3.83
Plot error	985	15.29	4.44	5.21	12.79	13.16	1.35
		Derived statistics					
F_1		7.5	13.8	18.7	17.4	22.4	16.2
λ		1.36	2.41	1.90	1.87	1.21	1.68
s		3.08	2.92	2.51	3.86	2.53	1.13

		Characters				
	d.f.	15	17	19	20	24
		Mean squares per plot				
Years (Y)	2	0.021	1364.30	10.963	3327.77	412.41
Varieties (V)	38	2.303	533.30	3.911	396.55	38.84
V × Y	76	0.177	32.91	0.406	19.55	3.13
Plot error	985	0.113	16.06	0.174	12.96	1.60
		Derived statistics				
F_1		13.0	16.2	9.6	20.3	12.4
λ		1.25	1.41	1.53	1.23	1.40
s		0.243	3.31	0.368	2.55	1.02

Table 4. Acceptance probabilities (AP) for character 10

	A	B	C	D	E
	Values of σ^2, σ_p^2 and λ				
σ^2	14.90	12.77	12.77	19.16	19.16
σ_p^2	4.26	2.13	4.26	8.52	4.26
λ	1.87	2.45	1.73	1.50	2.12
	%AP (2/3 criterion)				
difference (cm.)					
0	3.6	9.6	2.4	1.0	6.1
2	9.6	21.8	8.0	3.0	12.5
5	44.4	68.7	44.1	19.0	44.7
8	84.8	96.0	86.7	56.0	81.6
	% AP (t-score)				
0	6.8	14.6	5.0	2.4	10.3
2	16.3	29.8	14.3	6.3	19.3
5	59.1	77.8	60.0	32.2	57.4
8	92.5	97.9	94.1	73.3	89.5
	% AP (1% over-years criterion)				
0	1.0	1.0	1.0	1.0	1.0
2	4.3	5.0	5.0	3.4	3.4
5	34.6	41.4	41.4	25.4	25.4
8	82.7	89.0	89.0	69.9	69.9

Table 5. Values of D_{50} and Tester's Risk R_0 for 2/3, t-score and 1% combined over-years criteria (units as in Table 1).

Character	λ	D_{50}			Risk R_0 (%)		
		2/3	t-score	Combined	2/3	t-score	Combined
4	1.36	5.9*	4.9	4.7	0.5*	1.3	1.0
5	2.41	3.2	2.7	4.4*	9.2	14.1	1.0*
8	1.90	3.4	2.9	3.8*	3.9	7.2	1.0*
10	1.87	5.4	4.5	5.9*	3.6	6.8	1.0*
11	1.21	5.4*	4.5	3.8	0.2*	0.5	1.0
14	1.68	1.7*	1.4	1.7	2.1	4.4	1.0*
15	1.25	0.50*	0.42	0.37	0.2*	0.7	1.0
17	1.41	6.1*	5.1	5.0	0.6*	1.6	1.0
19	1.53	0.62*	0.52	0.56	1.2	2.7	1.0*
20	1.23	5.4*	4.5	3.9	0.2*	0.6	1.0
24	1.40	1.9*	1.6	1.6	0.6*	1.6	1.0

* indicates the most stringent criterion

Table 6: Examples from Crossnacreevy trials of Early PRG (Diploid) varieties, 1979-81 (units as in Table 1).

	Variety pair				
	BvC	EvD	GvH	BvH	EvF
Character	20	11	5	17	20
λ	1.23	1.21	2.41	1.41	1.23
t-values					
1979	4.13**	3.03**	0.51	-1.24	3.11**
1980	2.18*	2.07*	2.88**	4.19**	2.43*
1981	2.52*	1.94	3.57**	4.85**	0.25
2/3 criterion	2.59	2.59	5.18+	5.18+	2.59
t-score	8.01+	5.10	6.19+	6.63+	5.54+
Over-year t-value					
1% criterion	3.98+	3.33+	1.78	3.49+	2.67+
F_2	0.23	0.15	0.61	6.54**	1.37

* significant at 5% level

** significant at 1% level

\+ distinctness criterion achieved

Table 7: Multivariate distances squared between variety pairs and distinctness decisions.

	Variety A	B	C	D	E	F	G
A							
B	27 P						
C	132	206					
D	120	206	33				
E	27	36	184	169			
F	22 P	10 PM	189	179	19 M		
G	171	198	285	289	104	174	
H	29	34	144	139	61	42	204

P Variety pair not distinct on 2/3 criterion

M Variety pair not distinct on multivariate criterion

Critical squared distance = 21.5

FIGURES

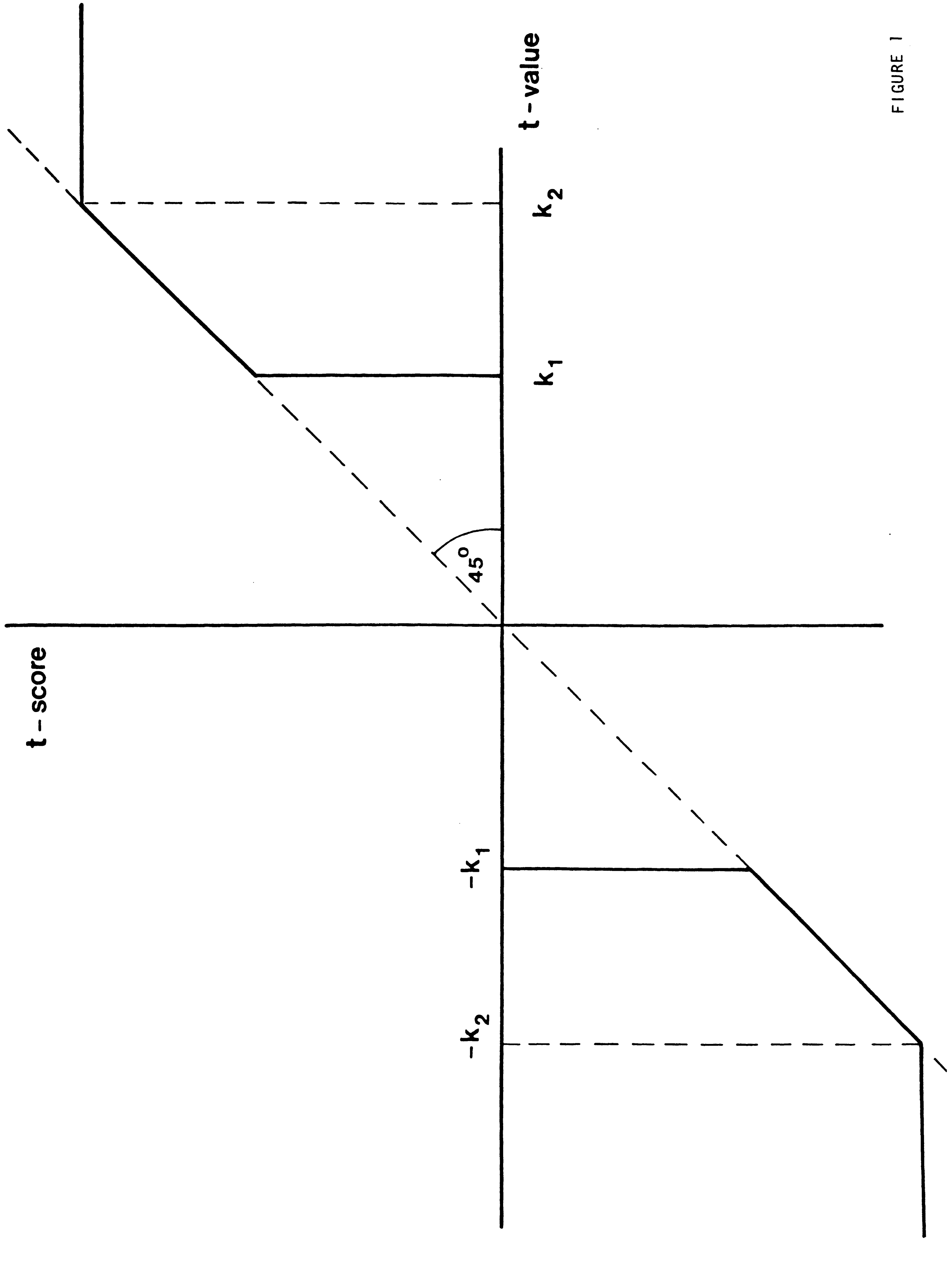
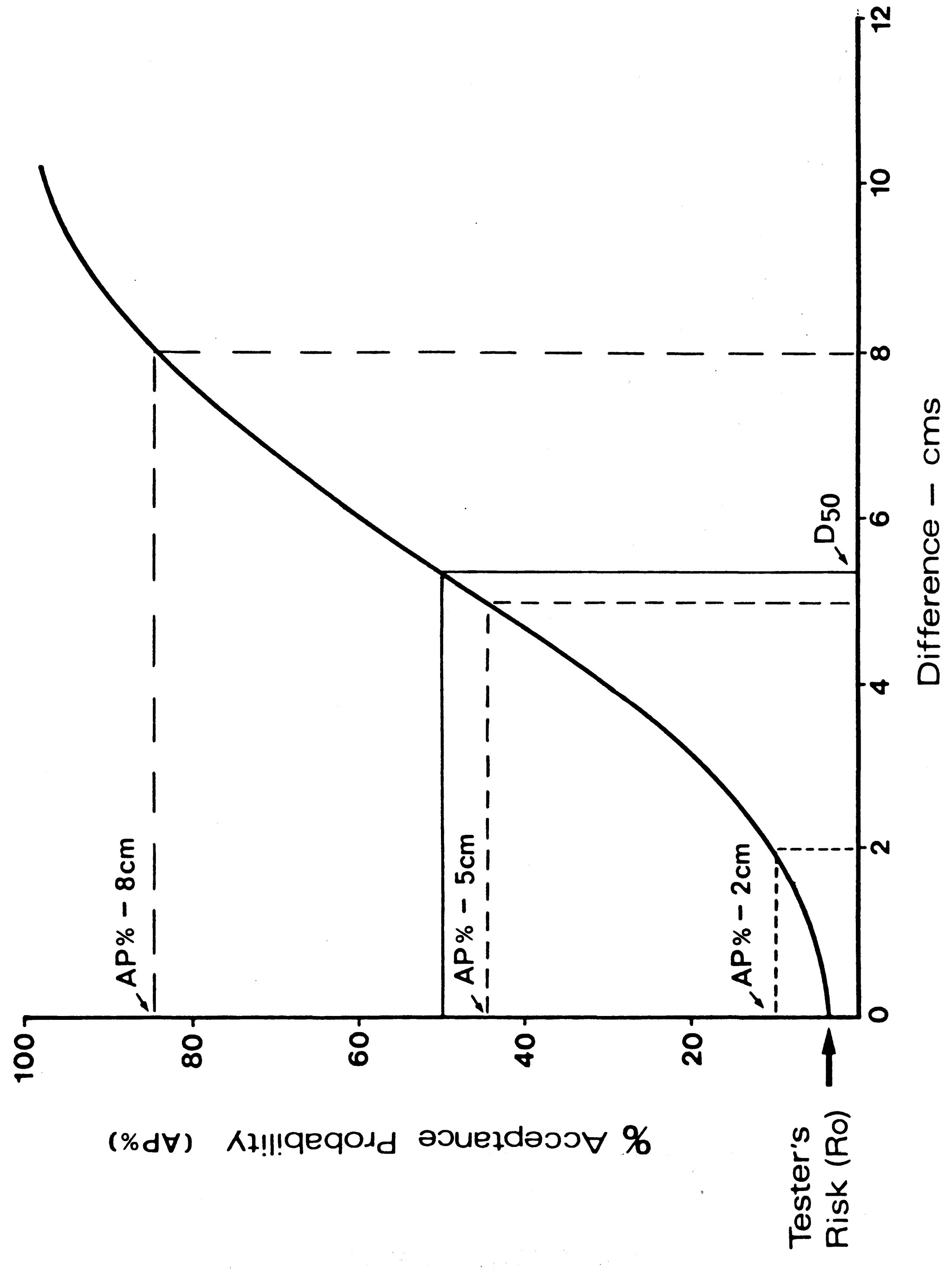


FIGURE 1

FIGURE 2


% Acceptance Probability (AP%)
Tester's Risk (Ro)
100
80
60
40
20
0
2
4
6
8
10
12
AP% – 8cm
AP% – 5cm
AP% – 2cm
D_{50}
Difference — cms

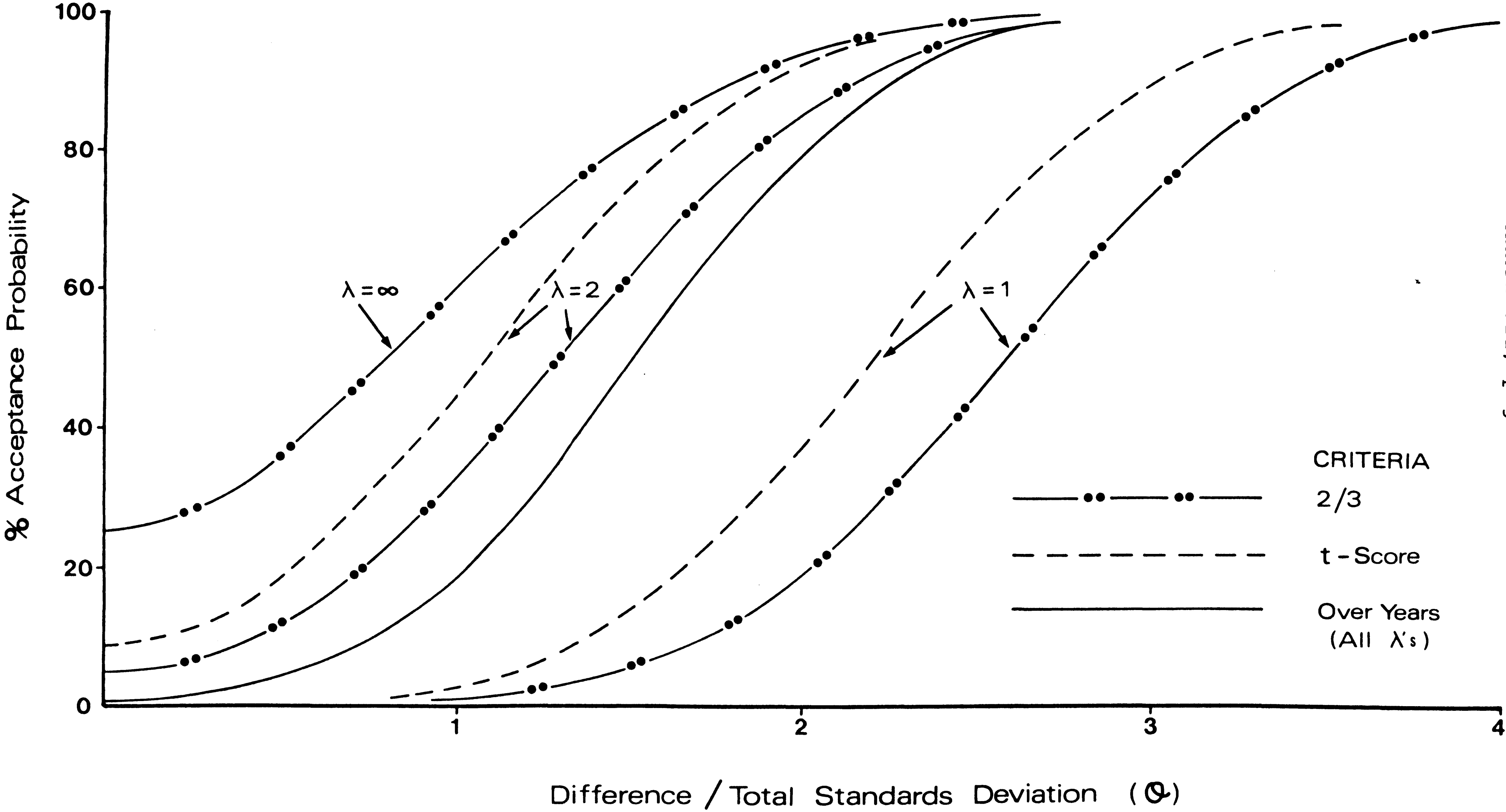

100
80
60
40
20
0
% Acceptance Probability
λ = ∞
λ = 2
λ = 1
1
2
3
4
Difference / Total Standards Deviation (σ)
CRITERIA
2/3
t - Score
Over Years
(All λ's)

FIGURE 3

ANNEX VIII

NATIONAL DATA TRANSFER NETWORKS

Table 1 shows the main national data communications networks in some UPOV-member countries. Nearly all of these national networks are linked to each other making it possible to access a computer attached to a network in one country from a terminal attached to a network in another country.

Table 1: National data networks

COUNTRY	NETWORK(S)
Switzerland	DATA-LINK
F.R. Germany	DATEX-P
Spain	NTID
France	TRANSPAC
Ireland	PSS
Japan	ICAS, VENUS(P)
Netherlands	EURONET
New Zealand	TYMNET
Sweden	TELEPAK
United Kingdom	PSS
South Africa	SAPONET

M. Talbot

Agricultural Research Council
Unit of Statistics

Edinburgh EH9 3JZ

[Annex IX follows]

ANNEX IX

Brief description of the procedure for the testing of variety denominations, as developed by A. Houwing, RIVRO, Wageningen, NL.

Proposed variety denominations can be tested both in literal version and in phonetic version.
A proposed denomination is transformed into its phonetic version by a computer program on the basis of a set of instructions to cater for the pronounciation in the Dutch language. These instructions are condensed in a table which the program can call for as data. The table can easily be adapted or replaced without knowledge of programming.

A proposed denomination (in literal or phonetric version) is compared with a name in the reference collection through opposition in a matrix.
In the matrix identical letters are indicated in the corresponding fields and these fields are counted through addition along the diagonals.

	L	A	R	E	S	A	
L	x						
O							0
R			x				0
I							0
S					x		0
A		x				x	0
		0	1	0	0	0	4

$$PSI = \frac{1+4}{(6+6)/2} * 100 = 83$$

A Literal or Phonetic Similarity Index (LSI or PSI) is calculated by adding the two highest diagonal sums and expressing this value as percentage of the average number of letters in the two compared names.
This similarity index corresponds reasonably well with our intuitive impression of the degree of similarity of names.

The computer program has been written in such a way that that all names in the reference collection with a similarity index higher than a choosen value, e.g. 65 %, are printed out in decreasing order of that index.

The final judgement of the suitability of proposed variety denominations can be restricted to the combinations that are preselected by the computer.

The computer program has been written in Fortran 77 by IWIS/TNO, Wageningen.

RIVRO, Wageningen.
30 June 1983.

[End of Annex IX and of document]