# UPOV

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## COMPARISON OF METHODS USED FOR PRODUCING VARIETY DESCRIPTIONS: RESULTS OF THE PRACTICAL EXERCISE

*Document prepared by an expert from France*

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1.      The purpose of this practical exercise is to help to develop common guidance by clarifying and comparing the different methods used by UPOV members to transform quantitative characteristics into notes.

DATASET : DESCRIPTION

2.      A common dataset on Flax varieties was produced by experts from France for this practical exercise. The dataset was based on observations made on UPOV characteristic 21 (Stem: length from cotyledon scar to top boll). It was a restriction of a larger dataset, which was restricted to observations on the first 20 plants of the varieties and years where 20 or more plants of the variety were observed in the year. This reduced common data set consists of 936 variety-by-year combinations for 153 reference varieties and 30 candidates in 10 years from 2002 to 2012, for which the variety-by-year means were calculated on the original scale of the characteristics.

METHODS USED BY THE UPOV MEMBERS

3.      The different methods used by UPOV members in order to assign notes to the candidate varieties are briefly summarized in the table below.

| COUNTRY | | Method : description | Example varieties | Crop expert judgment | Equal-spaced state |
|---|---|---|---|---|---|
| France | Method 1 | Combined use of example varieties and reference collection | x | x | |
| France | Method 2 | Adjusted means from COY program + linear regression method calibrated with example varieties | x | x | |
| Italy | | Average range of historical means + median used as "reference point" + partitioning into equal spaced states + calibration with crop expert judgment and example varieties | x | x | x |
| Germany | | Adjusted mean from COY program + partitioning based on example varieties and crop expert judgment | x | x | |
| Japan | | Adjusted Full Assessment Table (FAT) : states determined with historical data of example varieties | x | | x |
| United Kingdom | Method 1 | Range of expression of the over-year means for the reference collection varieties (for the past 10 years) divided into equal spaced states | | | x |
| United Kingdom | Method 2 | Crop experts define delineating varieties whose over-year means are used to delineate each state | x | x | |

4.      All the UPOV members who performed the exercise use example varieties in their process to assign notes except for the United Kingdom Method 1. In particular, the method used by Japan and the French method 2 rely directly on UPOV example varieties (or any other own example varieties), whereas UPOV example varieties are used by crop expert for final calibration in the German and the Italian methods.
Italy, Japan and United Kingdom (method 1) divide the total range of expression of the characteristic for the reference varieties into equal-spaced states in order to set a note and Italy and Japan also adjust each state according to crop expert judgment or example varieties.

RESULTS BY METHOD

5.      The table below shows the notes attributed to the 30 candidate varieties with each method.

| Variety | 2011 mean | 2012 mean | Over-year mean | Note France method 1 | Note France method 2 | Note Italy | Note Germany 2012 | Note Japan 2012 | Note UK method 1 | Note UK method 2 | Average note by variety |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Variety 262 | 207 | 316 | 262 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1.1 |
| Variety 287 | - | 351 | - | 1 | - | 1 | 2 | 3 | 1 | 1 | 1.5 |
| Variety 263 | 226 | 382 | 304 | 1 | 2 | 1 | 2 | 3 | 1 | 1 | 1.6 |
| Variety 284 | - | 360 | - | 2 | - | 1 | 2 | 3 | 2 | 2 | 2.0 |
| Variety 283 | - | 369 | - | 2 | - | 2 | 2 | 4 | 2 | 2 | 2.3 |
| Variety 288 | - | 436 | - | 4 | 4 | 2 | 3 | 4 | 3 | 3 | 3.3 |
| Variety 290 | - | 454 | - | 5 | - | 3 | 4 | 4 | 3 | 3 | 3.7 |
| Variety 289 | - | 455 | - | 5 | - | 3 | 4 | 4 | 3 | 3 | 3.7 |
| Variety 303 | - | 451 | - | 5 | - | 3 | 4 | 4 | 3 | 3 | 3.7 |
| Variety 277 | 381 | 481 | 431 | 5 | 5 | 3 | 4 | 5 | 4 | 4 | 4.3 |
| Variety 297 | - | 463 | - | 5 | - | 3 | 4 | 5 | 3 | 4 | 4.0 |
| Variety 269 | 329 | 462 | 396 | 5 | 4 | 2 | 4 | 5 | 3 | 4 | 3.9 |
| Variety 302 | - | 462 | - | 5 | - | 3 | 4 | 5 | 4 | 4 | 4.2 |
| Variety 275 | 329 | 474 | 401 | 5 | 4 | 2 | 4 | 5 | 3 | 3 | 3.7 |
| Variety 274 | 406 | 488 | 447 | 5 | 5 | 3 | 4 | 5 | 4 | 4 | 4.3 |
| Variety 270 | 546 | 606 | 576 | 7 | 7 | 5 | 6 | 7 | 7 | 6 | 6.4 |
| Variety 228 | 466 | 594 | 530 | 6 | 6 | 5 | 6 | 7 | 6 | 5 | 5.9 |
| Variety 267 | 525 | 652 | 589 | 8 | 8 | 5 | 7 | 7 | 7 | 7 | 7.0 |
| Variety 293 | - | 630 | - | 7 | - | 6 | 7 | 7 | 7 | 7 | 6.8 |
| Variety 295 | - | 658 | - | 8 | - | 6 | 7 | 8 | 7 | 7 | 7.2 |
| Variety 292 | - | 670 | - | 8 | - | 6 | 8 | 8 | 7 | 8 | 7.5 |
| Variety 300 | - | 655 | - | 8 | - | 7 | 7 | 8 | 8 | 8 | 7.7 |
| Variety 291 | - | 649 | - | 8 | - | 7 | 7 | 8 | 8 | 8 | 7.7 |
| Variety 294 | - | 681 | - | 8 | - | 7 | 8 | 8 | 8 | 8 | 7.8 |
| Variety 299 | - | 674 | - | 8 | - | 7 | 7 | 8 | 8 | 8 | 7.7 |
| Variety 273 | 540 | 691 | 615 | 8 | 8 | 6 | 8 | 8 | 7 | 7 | 7.4 |
| Variety 272 | 552 | 673 | 612 | 9 | 8 | 6 | 7 | 8 | 8 | 8 | 7.7 |
| Variety 298 | - | 727 | - | 9 | - | 7 | 8 | 9 | 9 | 9 | 8.5 |
| Variety 296 | - | 765 | - | 9 | - | 8 | 9 | 9 | 9 | 9 | 8.8 |
| Variety 301 | - | 744 | - | 9 | - | 8 | 9 | 9 | 9 | 9 | 8.8 |
| Mean by method | | | | 5.9 | 5.2 | 4.3 | 5.3 | 6.0 | 5.2 | 5.2 | |
| Standard deviation | | | | 2.6 | 2.3 | 2.3 | 2.4 | 2.1 | 2.7 | 2.7 | |

6.      Only 13 out of the 30 candidate varieties have been noted with the French method 2 because this method requires having data of two years for the candidate varieties in order to calculate an adjusted mean with the COY program and then to assign the corresponding note.

7.      The presence of both linseed and flax varieties in the complete dataset is responsible for a non-normal distribution with a peak of small varieties with low notes (linseed) and a peak of tall varieties with high notes (flax). Consequently, the probability for a candidate variety to obtain a medium note (between the two peaks) is low. That is why, for several methods, one of the medium note has never been attributed to a candidate variety. For example, with the Italian method, each note but the note 4 has been assigned to at least one candidate variety.

8.      Some methods try to take into account the annual effect using COY adjusted means (French method 2, German method, UK method) or by calibrating their model with data of the year, as in the Japanese method with the FAT sliding adjustment or in the French method 1.
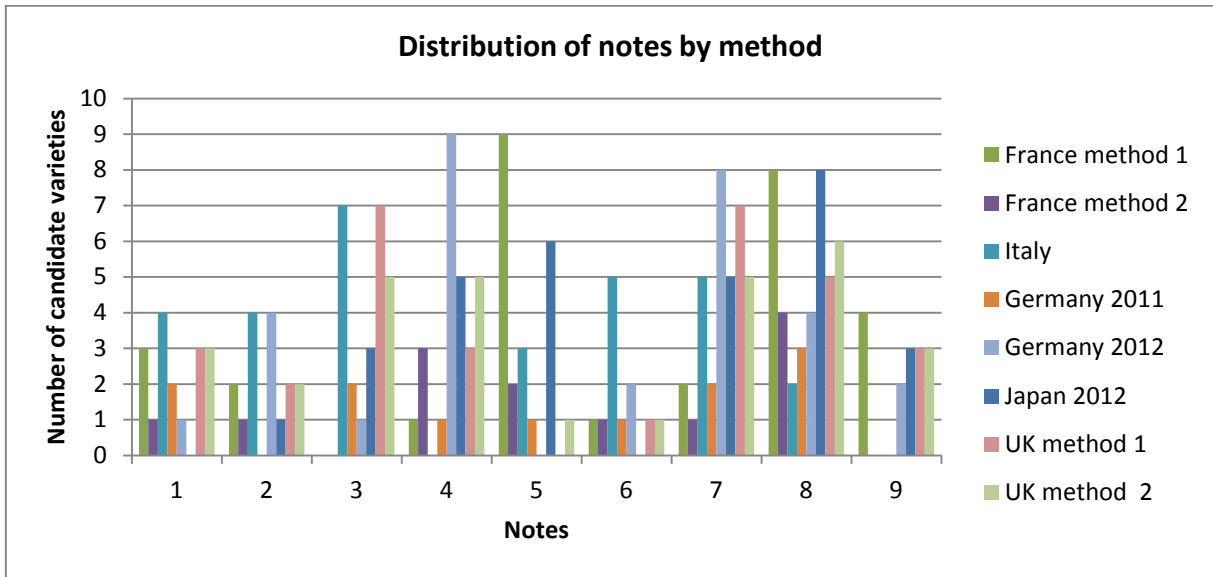

COMPARISON OF THE RESULTS



**Figure 1 : Distribution of notes by method.**


9.      The graph above shows that the distribution of notes is not normally distributed in the tested methods. But in most of the cases, distributions reveal two distinct peaks, which correspond to the two kinds of varieties: the first one corresponds to linseed varieties (smaller varieties with low notes) and the second one to flax varieties (taller varieties with higher notes).
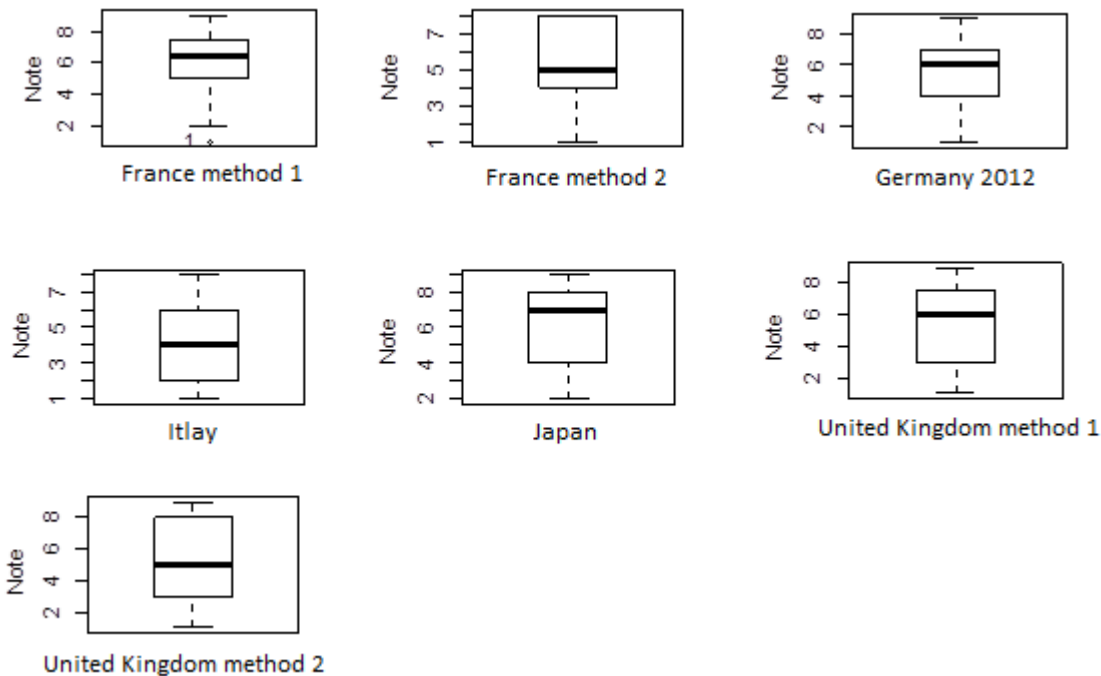


**Figure 2 : Boxplot of notes for candidate varieties by method.**

10.     The boxplots show that the median of notes is higher with the Japanese method than the median of the French method 2 or the Italian method.  50% of the candidates' notes are concentrated between 2 and 6 with the Italian method.

11.    The percentage of common notes between each pair of methods has been calculated (number of varieties with identical notes divided by number of varieties notated with both methods) and summarized in the table below.

| Method | Note France method 2* | Note Italy | Note Germany 2012 | Note Japan 2012 | Note UK method 1 | Note UK method 2 |
|---|---|---|---|---|---|---|
| Note France method 1 | 84,6% | 18,5% | 57,1% | 53,6% | 39,3% | 39,3% |
| Note France method 2* | | 8,3% | 46,2% | 46,2% | 30,8% | 23,1% |
| Note Italy | | | 16,7% | 0,0% | 26,7% | 26,7% |
| Note Germany 2012 | | | | 35,5% | 48,4% | 58,1% |
| Note Japan 2012 | | | | | 38,7% | 38,7% |
| Note UK method 1 | | | | | | 83,9% |

**Table 1: Percentage of candidate varieties with identical notes.**
**\***: total number of candidate varieties notated inferior to 30 (13 for the French method 2)

12.    The two French methods are the closest ones because 85% of the candidate varieties obtain the same note with these two methods. The Japanese method also shares nearly 50% of common notes with these two methods.  These three methods seem to assign close descriptions.
The two UK methods give very similar results (84% of identical notes) and the German method is also close to both UK methods. This can define a second group of close methods.
The Italian method doesn't share many common notes with the other methods. In particular, the Japanese and the Italian methods appear to be quite distinct because they never produce identical notes for a candidate variety. A candidate variety obtains always a higher note with the Japanese method than with the Italian method. The average note for a candidate variety varies from 4,3 with the Italian method to 6,0 with the Japanese method. Moreover, the range of notes varies from 1 to 8 with the Italian method and from 2 to 9 in the case of the Japanese one.

13.    All the methods have then been compared with a non-parametric test, namely the Wilcoxon signed rank test for paired samples, because the distributions are not normally distributed. According to that test, the notes obtained with these methods are significantly different from one method to another, except for the two French methods, each French method with the Japanese method, the two UK methods and each UK method with the German method. Therefore, we can consider three different groups: a first one composed by the two French methods and the Japanese method, a second composed by the two UK methods and the German method. The third group contains only the Italian method which seems to be significantly distinct from every other method. This confirms the groups previously defined on the percentage of common notes.
We cannot distinguish a special common point between the methods used in each group.

CONCLUSION

14.    The methods used by UPOV members to assign a note to the candidate varieties rely on a combination of division into equal-spaced states, use of the results of examples varieties and crop expert judgment.

15.    The non-normal distribution of notes in most of the methods is explained by the composition of the dataset, which includes two different types of linseed and flax varieties among the candidate varieties.
Despite the diversity between the UPOV member methods, the notes set for the candidate varieties are finally close.  Nevertheless, we can distinguish 3 groups of methods which are significantly different based on the Wilcoxon signed rank test for paired samples:
    - the two French methods and the Japan method.
    - the two UK methods and the German method
    - the Italian method. On average, a note assigned by the Italian method is lower than with the others methods.

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