

**Technical Working Party on Automation and Computer Programs** TWC/38/5

**Thirty-Eighth Session**  
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**DATA PROCESSING FOR THE PRODUCTION OF VARIETY DESCRIPTIONS FOR MEASURED QUANTITATIVE CHARACTERISTICS – INFORMATION FROM ITALY**

*Document prepared by an expert from Italy*

*Disclaimer: this document does not represent UPOV policies or guidance*

**BACKGROUND**

1. The Technical Working Party on Automation and Computer Programs (TWC), at its thirty-seventh session, held in Hangzhou, China, from October 14 to 16, 2020, considered document TWP/3/10 “Data Processing for the Assessment of Distinctness and for Producing Variety Descriptions” (see document TWC/37/12 “Report”, paragraphs 26 to 34).
2. The TWC considered the summary of different approaches used by members of the Union to convert observations into notes for producing variety descriptions of measured characteristics, as set out in document TWP/3/10, Annex II.
3. The TWC noted the request by the TC for the experts from France, Germany, Japan and the United Kingdom to provide information on the circumstances in which their methods would be suitable, including the method of propagation of the variety and other factors considered in deciding to use the method.
4. The TWC agreed that the experts from France, Germany, Italy and Japan should be invited to provide the information requested by the TC to the expert from the United Kingdom.
5. The Annex to this document contains information provided by an expert from Italy on the approach used to convert observations to notes for measured quantitative characteristics, for consideration by the TWC, at its thirty-eighth session.

[Annex follows]

GUIDANCE FOR DEVELOPMENT OF VARIETY DESCRIPTIONS: THE ITALIAN EXPERIENCE  
(Revised version August 2020 of TWC/35/10 - 2017)

The method involves the advice of crop experts and the use of example varieties.

Crop experts express opinions on the following aspects:

- distribution analysis of each characteristic
- impact of species breeding on the varietal description
- division and calibration of the range of expression into notes
- system monitoring

'Example varieties' are used for monitoring the system.

#### TECHNICAL ASPECTS OF THE METHOD

This method is based on partitioning into states of Total range of expression and Total range of historical averages. It is applied to varieties of herbage species especially for continuous quantitative data but also for discrete quantitative data

#### TOTAL RANGE OF EXPRESSION

The total range of expression of a quantitative characteristic includes samples of values observed during past trials. This range of values is the difference between the largest and the smallest item in past data, and it represents the dispersion of observations. Historical data does not cover all the possible range, and different phenotypic characteristics could be expected in the future where plant breeding might produce new or different characteristics.

The total range of expression represents the dispersion of the data observed in the varieties tested over the years for a specific characteristic. The total range of expression includes samples of each variety tested during the period of system development and stabilization, which is typically 8-10 years' trials. Each sample must contain at least 20 observations.

#### TOTAL RANGE OF HISTORICAL AVERAGES

Reference and candidate varieties can be tested over two or more years, producing means. Therefore each characteristic is represented by the range of historical averages that covers the intermediate part of the Total range of expression. The average of each variety is used to ensure that all varieties contribute equally.

The method includes data from all varieties tested during 8-10 years' trials, which are considered an acceptable stabilization period of the system. After this period, if the system is stable enough the partitioning of total ranges into notes can be done.

#### PARTITIONING OF TOTAL RANGES INTO NOTES AND CALCULATION OF MID REFERENCE

For each characteristic, the range can be represented by a different number of states. Both the smallest note (e.g. 1) and the largest note (e.g. 9) are the **extreme notes** that cover the tails of "Total expression range". Extreme notes might be equally or not equally spaced according to the symmetry of range histogram. The other notes are **intermediate** (e.g. 2,...,8) equally spaced, as submultiples of the length of "Total range of historical averages".

The midpoint of Total range of historical averages is considered a useful reference to dividing this range and it usually divides note 5 in half.

After the calculation of extreme notes, the next step is the division of "Total range of historical averages" into intermediate notes as spaces of equal width. If the range is not an exact multiple of notes number, for convenience an adjustment of the range might be necessary to make it an exact multiple. These are referred to as "adjustments" or "adjusted" below.

The partitioning of the Total range of historical averages should be regularly monitored over the years.

#### TRANSFORMATION OF CANDIDATE VARIETY MEANS INTO NOTES

Once the system is stable, notes can be calculated for candidate varieties. For each quantitative characteristic, the average of past trials means is transformed into notes. For each variety, the transformation into notes is produced according to values that limit each note.

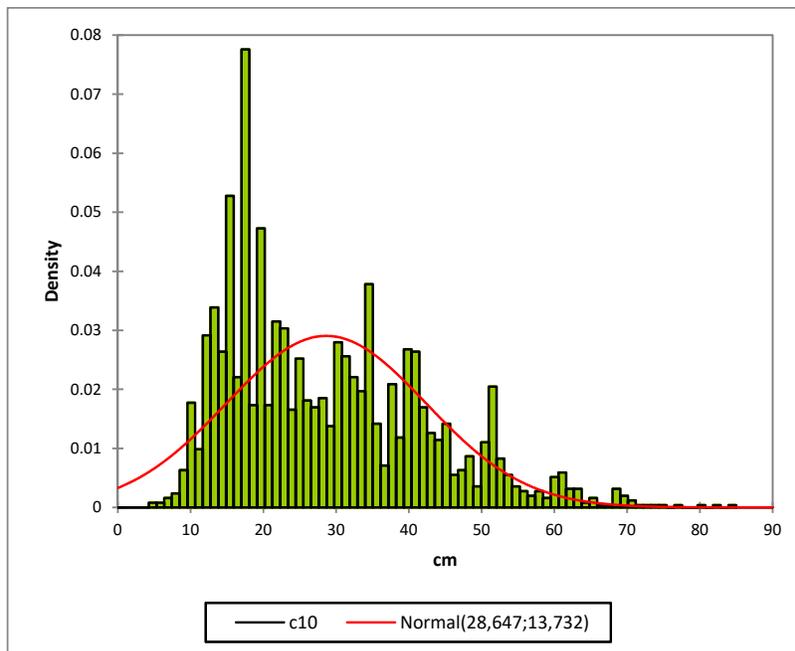
#### UPDATE OF TOTAL RANGES

The total range of expression and the total range of historical averages could be **updated** (for example every "n" years). In this case, the mid reference (midpoint) and some varietal descriptions could change slightly.

#### Example of transformation into notes in case of skewed distribution

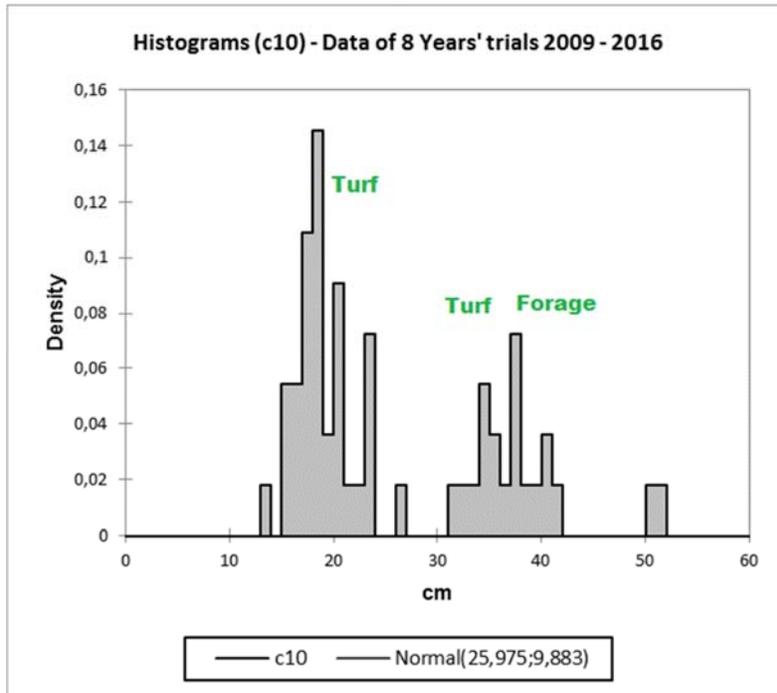
The species Tall fescue includes both turf varieties (usually not very tall) and forage varieties which are taller. The distribution of the two types of varieties (turf and forage) is shown in Fig. 1 and in Fig. 2. The data of characteristic 10 "Plant: natural height at inflorescence emergence" are continuous values with a non-symmetrical distribution (positively skewed distribution) (Fig. 1).

Figure 1 – Histogram of TOTAL RANGE OF EXPRESSION  
Char. 10 Tall fescue - Plant: natural height at inflorescence emergence



Data of 8 years' trials: from 2009 to 2016.  
Total range of expression: 5.0 - 84.0 cm

Figure 2. Histogram of Total range of Historical averages  
Char. 10 Tall fescue: Plant: natural height at inflorescence emergence



Total range of historical averages: 13.9 - 51.4 cm = 37.50 cm

Total range of historical averages *adjusted*: 14.00 - 52.50 cm = 38.50 cm

After the adjustment, 38.50 is obtained, which is a number exactly divisible into 7 equal parts, which are the intermediate notes (states from 2 to 8). Each intermediate note will be equal to 5.5 cm.

Midpoint: 33.25 cm

#### EXTREME NOTES

Note 1: up to 14.00 cm

Note 9: more than 52.50 cm

#### INTERMEDIATE NOTES

Notes between 2 and 8: 5.5 cm in length (equally spaced)

Note 2: 14.1 – 19.5 cm

Note 3: 19.6 – 25.0 cm

Note 4: 25.1 – 30.5 cm

Note 5: 30.6 – 36.0 cm

Note 6: 36.1 – 41.5 cm

Note 7: 41.6 – 47.0 cm

Note 8: 47.1 – 52.5 cm

Figure 3 - Partitioning of "Total range of historical averages adjusted" to notes

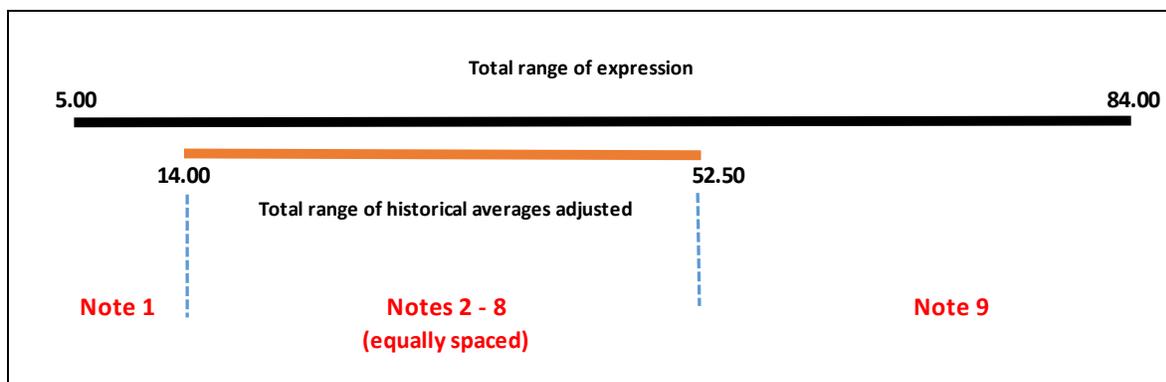


Table 1 - List of varieties of Tall fescue – Char. 10 – Data of trials and Notes appointed

Variety	Type	2009	2010	2011	2012	2013	2014	2015	2016	Car 10	Note
FA 72	turf	13.9	14.0							13.9	1
FA 50	turf	17.1	13.1							15.1	2
FA 55	turf	15.9								15.9	2
FA 66	turf	17.3	14.6							15.9	2
FA 73	turf	17.3	15.4							16.3	2
FA 75	turf	19.1	14.1							16.6	2
FA 68	turf	19.2	14.7							16.9	2
FA 77	turf	17.4	16.9							17.2	2
FA 67	turf	18.8	16.2							17.5	2
FA 82	turf	17.4	17.7							17.6	2
FA 52	turf		17.6							17.6	2
FA 63	turf	17.8								17.8	2
FA 71	turf	19.1	16.9							18.0	2
FA 59	turf		18.0							18.0	2
FA 78	turf	20.7	15.4							18.0	2
FA 76	turf	19.5	16.9							18.2	2
FA 74	turf	18.7	18.4							18.6	2
FA 80	turf	22.0	15.3							18.6	2
FA 89	turf			13.7	23.9					18.8	2
FA 70	turf	21.1	16.5							18.8	2
FA 84	turf			12.9	24.9					18.9	2
FA 81	turf	24.2	15.0							19.6	3
FA 61	turf	19.7								19.7	3
FA 56	turf	20.0								20.0	3
FA 60	turf	20.4								20.4	3
FA 85	turf			13.7	27.2					20.4	3
FA 58	turf	20.6								20.6	3
FA 79	turf	25.1	16.5							20.8	3
FA 83	turf			13.6	29.4					21.5	3
FA 87	turf			15.8	26.7				23.7	22.1	3

TWC/38/5  
Annex, page 5

FA 54	turf	23.3							23.3	3	
FA 62	turf	23.4							23.4	3	
FA 88	turf			14.1	33.0				23.6	3	
FA53	turf	27.6	20.3						24.0	3	
FA 86	turf			14.6	37.8				26.2	4	
FA 64	turf	19.4				41.4	36.2	34.6	24.6	31.2	5
FA 94	turf				29.3	43.1			25.4	32.6	5
K 504	turf	28.4	15.1	18.6	40.9	49.5	47.4	36.0	31.5	33.4	5
FA 69	forage	47.6	21.0							34.3	5
FA 97	turf				29.7	39.0				34.4	5
FA 101	turf					38.8	37.6		28.4	34.9	5
FA 103	turf						37.0	33.5		35.2	5
FA 99	turf					38.0	34.0			36.0	5
FA 100	turf					39.7	32.5			36.1	6
FA 95	turf				31.6	42.6				37.1	6
FA 98	turf				34.5	40.1				37.3	6
K 501	turf			21.1	39.3	48.6	42.2			37.8	6
FA 96	turf				34.0	42.0				38.0	6
K 480	forage								38.3	38.3	6
FA 92	forage			36.4	35.1	46.1				39.2	6
FA 93	turf				35.9	44.2				40.1	6
FA 111	forage								40.8	40.8	6
FA 57	forage	41.2								41.2	6
FA 90	forage			35.9	64.2				50.0	50.0	8
FA 65	forage	54.3						50.4	49.7	51.4	8

Table 2 - Example of transformation into notes of candidate varieties (mean of the year 2015 and year 2016)

Candidate variety	Type	Car 10: Mean of the year 2015 and year 2016 (cm)	Note
VARIETY 107	<i>turf</i>	26.7	4
VARIETY 108	<i>turf</i>	28.7	4
VARIETY 106	<i>forage</i>	43.2	7
VARIETY 110	<i>forage</i>	48.6	8
VARIETY 109	<i>forage</i>	50.4	8
VARIETY 104	<i>forage</i>	51.6	8
VARIETY 105	<i>forage</i>	52.8	9

[End of Annex and of document]