PARETO DIAGRAM IN THE QUALITATIVE EVALUATION OF WHEAT

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Abstract: *The application of the grading system generates the assurance of the constant quality of the wheat, thus supporting the performance of commercial transactions made at local, national and international level. At the same time, the grading system ensures the managers of the silos and of the transport companies that operate in Bihor county the more efficient organization of the wheat storage. Grading improves the cost/price ratio. The absence of grading generates the mixing of lower quality wheat batches with a higher quality wheat batch, thus depreciating the final quality of the mixture. Grading of wheat makes it possible to improve the results of research carried out to improve varieties. We applied the Pareto diagram to determine the deviations from the wheat product standard, deviations that will be remedial objectives.*

Key words*: wheat, grading system, Pareto diagram, TQM tools*

INTRODUCTION

The use of the wheat grading system for local producers in Bihor County guarantees that producers will get the right price for their wheat productions, according to its quality. Thus, the grading of wheat will encourage producers in Bihor County, in the sense of obtaining both yield and quality. The application of the grading system generates the assurance of the constant quality of the wheat, thus supporting the performance of commercial transactions made at local, national and international level.[3,4] At the same time, the grading system ensures the managers of the silos and of the transport companies that operate in Bihor county the more efficient organization of the wheat storage. Grading improves the cost/price ratio (cost of production and sale of wheat and its price). Grading groups wheat into quality levels, which leads to reduced transaction costs regarding its marketing. Also, grading creates opportunities to protect the quality and value of very good quality wheat. The absence of grading generates the mixing of lower quality wheat batches with a higher quality wheat batch, thus depreciating the final quality of the mixture. [6]

Last but not least, the grading of wheat makes it possible to improve the results of research carried out to improve varieties.

MATERIALS AND METHODS

We applied the Pareto diagram as a Q7- tool of Quality Control, and no a N7 tool – new tools of Total Quality Management, to determine the deviations from the wheat product standard, deviations that will be remedial objectives (Figure 1) [2]. Normally, it will be followed by confirmation of the remedy of the deviations[1,2]. We collected for the Pareto diagram the numerical data from the analysis bulletins of the wheat samples and their classification according to the degree of deviation, without taking into account the causes that produced them. The diagram applies the Pareto principle or "80-20" (80% of the effects are due to 20% of the causes). [7,10]

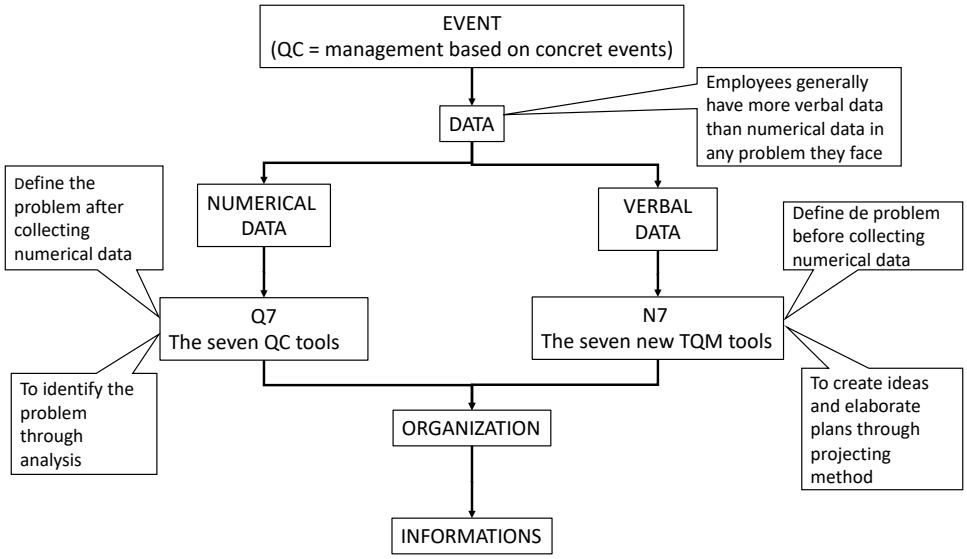

Figure 2. Relationship regardin Q7 and N7 tools

Source: AYANO KATSUTOSHI, 2006, Introduction in TQM – Program for Quality Management, The Association for Overseas Tehnical Scolarship, Yokohama, Japan

When using the Pareto diagram, we mentioned the period of time in which the data were collected [12]. Respectively, this is one week and the analyzed characteristics are:

- hectolitre mass;
- the percentage of total impurities, of which we analyzed the percentages of:
  - defective grains;
  - sprouted grains.

RESEARCH RESULTS

We analyzed the results of the analysis bulletins of 81 samples, numerical results that we used in the instrumentation of the Pareto diagram in order to identify the weights of occurrence of the different characteristics analyzed.

1. PARETO DIAGRAM FOR DETERMINING THE WEIGHT OF HECTOLITRIC MASS VALUES BY QUALITY DEGREES IN THE WHEAT SAMPLES ANALYZED

The grading plan for wheat presents for the grading factor "hectoliter mass" of the three grades, respectively Grade 1, Grade 2 and Grade 3, the following values: 77.0, 75.0, 72.0 kg / hl min.

Table 1.

The results of the qualitative evaluation of the wheat in the gradation of the hectoliter mass

GRADING INTERVALS HECTOLITRIC MASS	NUMBER OF TESTS	% OF TOTAL	% CUMULATIVE
72.0 to 72.9	11	13.58%	13.58%
73.0 to 73.9	12	14.81%	28.40%
74.0 to 74.9	11	13.58%	41.98%
75.0 to 75.9	14	17.28%	59.26%
76.0 to 76.9	15	18.52%	77.78%
over 77	18	22.22%	100.00%

Source: Wheat grading analysis bulletins

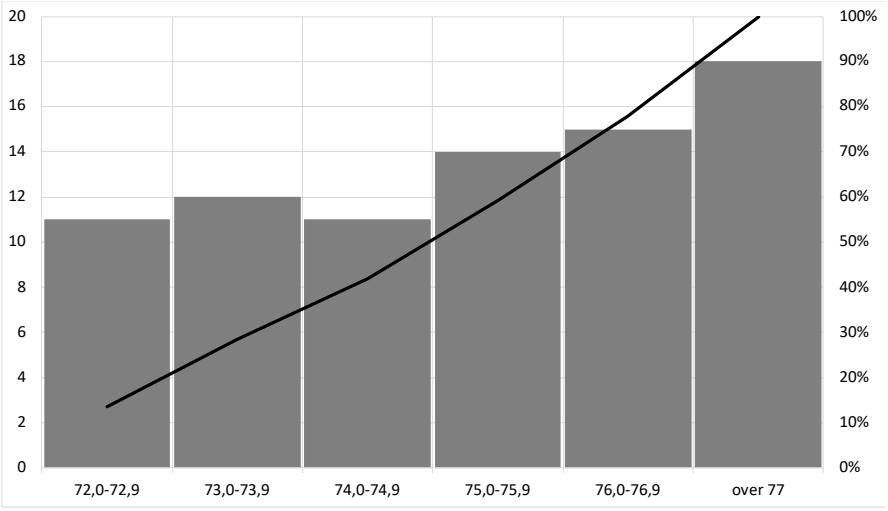

Figure 2. Pareto diagram applied for the qualitative evaluation of wheat in hectoliter mass grading

2. PARETO DIAGRAM FOR DETERMINING THE WEIGHT OF TOTAL IMPURITY VALUES BY QUALITY DEGREES IN THE WHEAT SAMPLES ANALYZED

The grading plan for wheat presents for the grading factor "total impurities" of the three grades, respectively Grade 1, Grade 2 and Grade 3, the following values: 6.0, 10.0, 12.0% maximum.

Table 2.

The results of the qualitative evaluation of the wheat in the gradation of the total impurities

GRADING INTERVALS TOTAL IMPURITIES	NUMBER OF TESTS	% OF TOTAL	% CUMULATIVE
6.0 to 6.9	21	25.93%	25.93%
7.0 to 7.9	11	13.58%	39.51%
8.0 to 8.9	13	16.05%	55.56%
9.0 to 9.9	14	17.28%	72.84%
10.0 to 10.9	11	13.58%	86.42%
11.0 to 11.9	10	12.35%	98.77%
over 12	1	1.23%	100.00%

Source: Wheat grading analysis bulletins

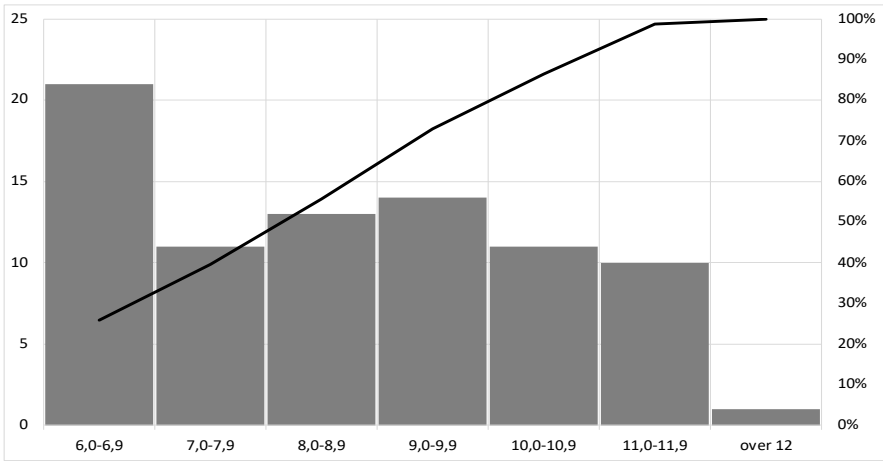

Figure 3. Pareto diagram applied for the qualitative evaluation of wheat in the grading of total impurities

3. PARETO DIAGRAM FOR DETERMINING THE WEIGHT OF GRAIN VALUES WITH DEFECTS BY QUALITY DEGREES IN THE WHEAT SAMPLES ANALYZED

The grading plan for wheat presents for the grading factor "defective grains" of the three grades, respectively Grade 1, Grade 2 and Grade 3, the following values: 3.0, 5.0 and 7.0% maximum.

Table 3.

The results of the qualitative evaluation of wheat in the grading of defective grains

DEGREE GRADING INTERVALS WITH DEFECTS	NUMBER OF TESTS	% OF TOTAL	% CUMULATIVE
3.0-3.9	31	38.27%	38.27%
4.0 to 4.9	15	18.52%	56.79%
5.0 to 5.9	13	16.05%	72.84%
6.0 to 6.9	14	17.28%	90.12%
over 7.0	8	9.88%	100.00%

Source: Wheat grading analysis bulletins

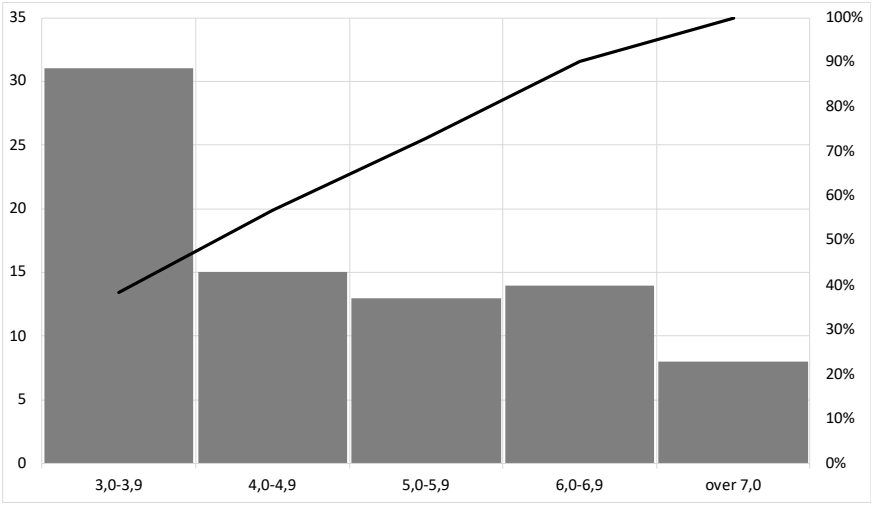

Figure 4. Pareto diagram applied for the qualitative evaluation of wheat in the grading of defective grains

4. PARETO DIAGRAM FOR DETERMINING THE WEIGHT VALUE OF SPROUTED GRAINS BY QUALITY GRADES IN THE WHEAT SAMPLES ANALYZ

The grading plan for wheat presents for the grading factor "sprouted grains" of the three grades, respectively Grade 1, Grade 2 and Grade 3, the following values: 0.5, 1.0, 2.0% maximum.

Table 4.

The results of the qualitative evaluation of wheat in the grading of sprouted grains

GRADING INTERVALS SPROUTED GRAINS	NUMBER OF TESTS	% OF TOTAL	% CUMULATIVE
0-0.50	61	75.31%	75.31%
0.51 to 1.0	10	12.35%	87.65%
1.1-1.5	8	9.88%	97.53%
1.51 to 2.0	2	2.47%	100.00%

Source: Wheat grading analysis bulletins

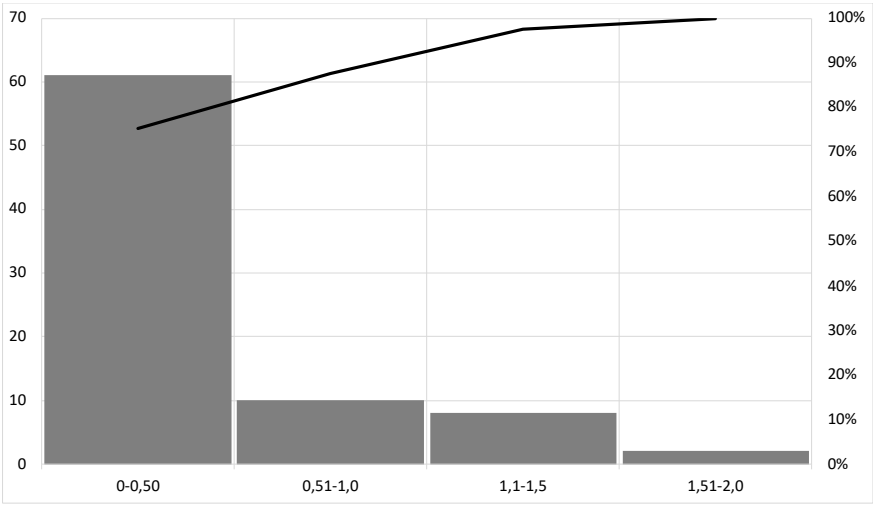

Figure 5. Pareto diagram applied for the qualitative evaluation of wheat in the grading of sprouted

CONCLUSIONS

After the 1980s, integrative concepts of quality assurance were implemented in developed countries, starting from the new philosophy in the field of quality, defined by Feigenbaum as "total quality". In economic practice and in the literature, the concept of "Total Quality Management" (TQM) has been finalized and expanded.[1,2] The elements of continuous improvement aim at the gradual and permanent improvement of product quality, as well as productivity and competitiveness, it is defined as "Kaizen" in Japan. [12,14]

The tools used to implement and run TQM are called the "seven tools". In contemporary society these seven tools are of two types [1,2]:

- Q7 - The seven tools of quality control (QC), which mostly involves numerical data (of which we have applied the Pareto diagram in this paper)
- N7 - The seven new tools for total quality management (TQM), which mostly involve verbal data.

In this context, in this paper, we analyzed 81 samples of wheat from specific crops in the area of Bihor County, near Tinca. The analyzed samples were taken according to the applicable standards regulated by the Consumer Seed Grading Manual, a document that wasapproved by Order of the Minister of Agriculture and Rural Development no. 228/2017.

For objective reasons, the companies as well as the natural persons owning the analyzed lots requested that their identity be kept anonymous in the study we conducted, opting for the confidentiality of the data related to the origin of these lots.

In the case of wheat production in Bihor County, the 81 wheat samples analyzed on whose laboratory results the Pareto diagram was applied, reveal a situation that can be improved, still using TQM tools, in their complexity.

Presentation of the distribution of the weights of the different deficiencies of the different analyzed parameters, respectively:

- hectolitre mass;
- total impurities, from which we analyzed:
  - grains with defects;
  - sprouted grains;

As the presented Pareto diagrams show, it can contribute to the more objective analysis than the current one on the qualitative level of the wheat productions made, in

order to respect the quality management principle "Continuous improvement". If the actors involved in the case study of this paper, respectively individuals and legal entities, choose to continue using the TQM tools, the improvement of the quality of their productions will be revealed.

In this context, it is recommend the implementation of the quality management system, its certification, continuing the permanent use of the presented tools.

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