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THE BASIC COMPARISION OF TOTAL GRAPE QUALITY OF VINE FROM TWO DIFFERENT LOCATIONS OF VINE (*VITIS VINIFERA*)

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Abstract

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The aim of the work was to compare the course of agro-ecological indicators according to the internationally acknowledged parameters – the balance of vine bunches, the berry balance, the weight of vine bunches, the berry weight in 7 varieties of vine in three resistant white varieties Merzling, Malverina and Hibernal and in one blue variety – Medina, then in classical varieties Aurelius, Chardonnay and Muscat Moravian in two locations Perna (sub-region Mikulovice) and Sadek (sub-region Znojmo). The evaluation of the grape quality was carried out in accordance with common standards used in the Czech Republic. The following parameters were monitored The agro-ecological indicators were compared according to the internationally acknowledged parameters in the work – the balance of vine bunches, the berry balance, the weight of vine bunches, the berry weight for 7 varieties of vine in three resistant white varieties Merzling, Malverina and Hibernal and one blue – Medina, then in classical varieties Aurelius, Chardonnay and Muscat Moravian in two locations Perna (sub-region Mikulovice) and Sadek (sub-region Znojmo). As concerns the balance of vine bunches and berries, remarkable differences between these two areas have been proved. The weight of vine bunches has shown no statistically remarkable difference. The berry weight has shown no difference at all.

vine, balance of vine bunches, berry balance, weight of vine bunches, berry weight

Vine *(Vitis vinifera)* is grown all over the world between 30° and 50° of latitude of the both hemispheres. These are the zones of a mild climate where an average annual temperature varies between 9 °C and 20 °C. The most northern parts of Germany as well as of other countries lie beyond this border and they reach up to 51° of latitude. Due to the global warming so called "Pole Circle of vine" is moved up to 52°. Vine survives here mostly thanks to the continental climatic influence which ensures warmer summers and shorter days. They slow down the growth of vine and support maturing of the fruit (BLÁHA, 1961; MUSILOVÁ; 2006).

It cannot be omitted that with every hundred meters of altitude an average annual temperature decreases by 1°C (BLÁHA, 1961; MUSILOVÁ, 2006).

We can presume on the basis of the above mentioned facts that there will be a different total grape quality in different locations. This work concentrated on the comparison of the processed vine from two significantly different locations of vine growing. The first location is found in the viticultural village of Perna in sub-region Mikulov and the second location in the viticultural village of Kojetice in the northern part of sub-region Znojmo.

MATERIAL AND METHODS

The aim of the work was the comparison of total grape quality – the balance of vine bunches, the berry balance, the weight of vine bunches and the berry weight from these two locations. The given parameters were observed in three resistant white varieties, Merzling, Malverina and Hibernal and in one blue variety – Medina, then in classical varieties Aurelius, Chardonnay and Moravian Muskat (BLÁHA, 1961; LUDÍKOVÁ, SEDLO, ŠEVČÍK, 2004; KRAUS, 1983; KRAUS et al., 2004; KRAUS et al., 2005; MALÍK, 2003; MICHLOVSKÝ,

MUSILOVÁ, 2005; MUSILOVÁ, 2006; POSPÍŠILOVÁ e al., 1988; VANEK, 1995).

The research was carried out in 2004-2006 in two different locations under completely different ground-climatic conditions. The first track „Věstonsko" belongs to the viticultural village of Perna near Mikulov and the second monitored experimental place to the viticultural track of „Pod Sádkem" in the viticultural village of Kojetice na Moravě in the furthest northern part of viticultural sub-region of Znojmo, which lies in the southern part of the former region of Trebic.

Consequently, there is a list of climatic ground characteristics of individual locations.

Perná: The experimental piece of land is found in KÚ Perná, viticultural path Věstonsko, Goldhamer and Přední Purmice. The monitored vineyards are a part of Šlechtitelské stanice vinařské Vinselekt (Viticultural centre of cultivation), Ing. Miloš Michlovský, CSc., Perná.

According to agro-climatologic regionalization KÚ Perná belongs to a warm macro-region, mostly warm area and dry sub-region and the district of generally mild winter. According to the production types it is divided into a maize production type (MUSILOVÁ, 2006).

The average annual temperature is 9 °C and the total average annual rainfall is 552 mm (normal values during the time period of 1951–1980). The altitude is about 228 m above sea-level but it continuously increases in the area of Pálava up to 350 m above sea-level. The sum of temperatures > 10 °C is at about 2700, temperature above 0 °C is on average during 152 days. The absolute annual minimum is up to –20 °C. The period of snow cover is for about 50–60 days. In winter there is 200–250 mm of snowfalls (MUSILOVÁ, 2006). For information purposes there are meteorological characteristics of the nearest accessible station ČHMÚ Brno and Brod nad Dyjí, which is in the distance of approximately 5 km (Anonym, 2006).

Ground characteristics (MUSILOVÁ, 2006):

Path Věstonsko: Rendzins, brown soil on calcareous clays, clays and Carpathian sediments, heavy up to very heavy, little water permeable.

Path Goldhamer: similar like Věstonsko, shallow ravins up to the depth of 3 m.

Path Přední Purmice: Typical carbonate and flood-plain black soils on calcareous clays and clay substrats, heavy soils with lighter top soil and heavier sediments, sometimes too wet.

Path Prostřední čtvrtky: sandy soil with the high level of underground water.

Total characteristics of a vineyard:

The vineyards in the path of Věstonsko are planted in spacing control 2.20 × 0.95m. Variety Aurelius was planted in 2000 on rootstock CR2, variety Chardonnay in 1998 on rootstock SO4. The slope orientation is rather NW up to N, rows copy the slope terrain (N-S).

The vineyard in the path of Přední Purmice was planted in 1997 in spacing control 2.5 × 0.95 m and contains varieties Malverina (rootstock CR2), Merzling and Hibernal. Rows are situated E-W, the slope has a western orientation.

The vineyard in the path of Goldamer was planted in spacing control 2.0 × 1.0m, in 1987 variety Moravian Muskat and 1988 variety Müller Thurgau. This path is found between the paths mentioned above, it is – more or less – "an elevated plateau", rows are oriented N-S.

The last variety – Medina – is planted in the vineyard in Břeclav, path Prostřední čtvrtky in spacing control 3 × 1 m.

Alternate rows of the vineyards are grass-covered in every other row and there is a herbicide strap kept under the shrubs. The vineyard in the path of Přední Purmice is included in the system of ecological viticulture and that is why the whole area is kept only with mulching and disk tillage or the places under the shrubs are mowed by hand. Chemical protection is also adjusted for the system of ecological viticulture. Triticale is sown here in autumn to improve soil conditions every year. It is mulched several times in the vegetation period and then the disk tillage is carried out. The stemmed line or strap is maintained in the herbicide way.

Lining is in all the monitored vineyards of Rhein-Hesse, of medium size, the construction is made up with two simple wires and two double wires.

For informational purposes there are meteorological characteristics of the nearest accessible meteorological station from station Czech Hydrometorological Institut, station Brod nad Dyjí (Table I and II). This station is distance about 7 km.

In 2004 total number of days with active temperature was 196 with 1 day in February, 3 days in March, 20 days in April and 4 days in November. In 2005 the number was 187 with 4 days in March, 20 days in April and 1 day in November. In 2006 the number of days with active temperature reached 197 with 3 days in March, 19 days in April and 2 days in November and 1 day in December (Anonym, 2006).

Kojetice: It is found in KÚ Kojetice na Moravě in the only vineyard path „Pod Sádkem". The monitored vineyard is the property of Ing. Lubomír Lampíř.

According to agro-climatologic regionalization it belongs to macro-region warm, area slightly warm, sub-region slightly wet and the district of mainly mild winter. It belongs to a grain production type. An average temperature is 8°C and the total average sum is lower than in Perná which is 480 mm. The altitute is 425 m above sea and it is rising towards the castle Sádek up to 480 m above sea. The sum of temperatures >10 °C is 2580, temperature over 0 °C is during 142 days, absolute annual minimum is –22 °C. Time period of snow

I: *The weather in Brod nad Dyjí (station ČHMÚ) (Anonym, 2006)*

Year	2004		2005		2006		normal 1951–1980*	
Month	temperature (°C)	rain falls (mm)	temperature (°C)	rain falls (mm)	temperature (°C)	rain falls (mm)	temperature (°C)	rain falls (mm)
January	–3.0	39.7	0.7	14.9	–6.4	37.4	–1.8	23
February	1.5	30.3	–2.1	48.2	–2.3	27.8	0.2	22
March	3.7	57.0	2.6	6.2	2.2	60.5	4.2	24
April	10.9	27.0	10.9	53.5	10.9	64.9	9.6	31
May	13.4	54.4	14.9	70.6	14.9	79.7	14.4	53
June	17.4	131.6	18.0	37.7	18.4	71.7	17.9	69
July	19.0	28.7	19.9	92.5	22.4	92.7	19.3	63
August	19.9	26.2	18.2	77.8	16.9	151.4	18.6	53
September	14.1	36.2	16.1	31.5	17.2	15.2	14.7	32
October	11.0	44.3	10.1	4.8	11.5	14.1	9.3	29
November	5.0	29.0	3.2	24.1	6.8	10.1	4.5	34
December	0.7	11.9	–0.6	55.2	2.9	10.8	0.4	27
average temperature	9.5		9.3		9.6		9.3	
Total annual rain falls		516.3		517.0		636.3		461

* source www.zf.mendelu.cz (ČHMÚ Brno)

II: *Other agro-climatic characteristics of location Perná*

0 (12) °C				5 (15) °C				10 °C			
beginning	end	duration	SAT	beginning	end	duration	SAT	beginning	end	duration	SAT
15. II	16. XII	305	3360	23. III	11. XI	234	3195	20. IV	11. X	175	2767
2. V	30. IX	152	2517	23. V	13. IX	114	2007				

cover lasts 60 days, in winter there are 228 mm of snowfalls. The vineyard Pod Sádkem is orientated south-east with sloping 8°(MUSILOVÁ, 2006).

Ground characteristics: Mild warm region, brown soil slightly acid, medium gravelly, paragneiss, no up to little skeletal soil, matrix – paragneiss. Geests from groups of granite and orthogneiss. Top soil is grey-brown, soil-sand, granulous and with the structure of binding soil (MUSILOVÁ, 2006).

The total characteristics of a vineyard: The vineyard is found on the southern slope of the castle of Sádek in the place of original feudal vineyards. The oldest known record is from military maps from 1756. The vineyards were situated here until 19th century when they were infected with phylloxera similarly as in the whole Europe (CHŇOUPEK, 2007).

Rows are situated north-south, spacing 220x100 cm, alternate rows are covered with grass in every other row and there is a herbicide fallow land kept under the rows (stems).

Lining is that of Rhein-Hesse, medium, two simple wires and two double wires.

The southern vineyards were planted in 1989 with the first 300 shrubs of resistant varieties from SZP „Jižní Morava“ (“Southern Moravia”) Velké Bílovice. Gradually, they were extended up to today‘s area 3.5 ha with 12 000 of shrubs. Ecological viticulture includes approximately 20 different varieties from inter-specific up to classical European. (Appendix 1, picture 3 and 4)

For informational purposes there are meteorological characteristics of the nearest accessible meteorological station from ÚKZÚZ, Jaroměřice nad Rokytnou (Table III and IV). This station is distance about 10 km.

In 2004 total number of days with active temperature was 171 with 3 days in March, 11 days in April and 4 days in November. In 2005 the number was 168 with 3 days in March, 15 days in April and no day in November. In 2006 number of days with active temperature reached 181 with no day in March and November and 14 days in April (ÚKZÚZ, Jaroměřice nad Rokytnou).

Continuously received results were processed in the tables of Microsoft Excel. Such created ta-

III: *The weather in Jaroměřice nad Rokytnou (ÚKZÚZ, Jaroměřice nad Rokytnou)*

Year	2004		2005		2006		normal 1951–1980*	
Month	temperature (°C)	rain falls (mm)	temperature (°C)	rain falls (mm)	temperature (°C)	rain falls (mm)	temperature (°C)	rain falls (mm)
January	–3.9	52.3	–0.4	30.1	–6.1	33.2	–3.1	28
February	0.5	28.3	–3.3	33.4	–3.5	19.8	–1.3	27
March	2.3	35.1	1.7	7.9	0.1	53.1	2.5	28
April	9.5	35.7	9.6	60.2	8.9	56.1	7.6	32
May	11.9	37.6	12.9	65.8	12.9	60.3	12.7	61
June	15.6	80.3	16.4	60.6	17.2	92.7	16.2	75
July	17.9	37.2	18.4	71.7	21.5	29.1	17.8	64
August	18.3	38.1	16.5	109.8	15.7	127.6	16.8	69
September	12.9	53.5	14.6	33.1	15.9	7.2	13.2	37
October	9.4	52.5	9.3	5.1	10.5	16.4	8.1	30
November	3.9	38.6	2.1	14.4	5.6	16.3	3	35
December	–0.7	13.3	–1.3	49.3	1.8	7.9	–0.8	31
Annual temperature	8.1		8.0		8.4		7.7	
Total annual rain falls		502.5		541.4		519.7		517

* Source www.zf.mendelu.cz

IV: *Other agro-climatic characteristics of location Kojetice (Anonym, 2006)*

0 (12) °C				5 (15) °C				10 °C			
beginning	end	duration	SAT	beginning	end	duration	SAT	beginning	end	duration	SAT
2. III	6. XII	280	2825	4. IV	31. I	211	2664	3. V	2. XI	153	2235
17. V	21. IX	128	1965	10. VI	30. VIII	82	1340				

bles served in the further statistical evaluation. The programme UNISTAT version 4.53 for Microsoft Windows was used in the evaluation.

For the total statistic evaluation with the usage of the above mentioned programme the following evaluation methods were used: the analyses of variance and the methods of the subsequent testing.

For the total statistic evaluation with the usage of the above mentioned programme the following evaluation methods were used: the analyses of variance and the methods of the subsequent testing of these parameters – the balance of vine bunches, the berry balance, the weight of vine bunches, the berry weight.

The evaluation of the grape quality was carried out in accordance with common standards used in the Czech Republic. The following parameters were monitored (POSPÍŠILOVÁ, D. et al., 1988).

The balance of vine bunches is evaluated at the time of grape maturation:
1 – totally unbalanced vine bunches
3 – more than 2/3 unbalanced
5 – medium balanced
7 – slightly unbalanced
9 – totally balanced

Berry balance on bunches is evaluated at the time of grape maturation:
1 – totally unbalanced vine bunches
3 – more than 2/3 unbalanced
5 – medium balanced
7 – slightly unbalanced
9 – totally balanced

The weight of vine bunches is evaluated at the time of maturation, it is counted as average number of all grapes from ten annual shoots:
1 – very low (< 50 g)
2 – (50–80 g)
3 – low (81–110 g)
4 – (111–140 g)
5 – medium (141–160 g)
6 – (161–190g)
7 –high (191–220g)
8 – (221–250g)
9 – very high (> 250 g)

The berry weight is evaluated at the time of maturation and it is counted as an average number out of 30 grapes collected from central parts of 10 grapes.

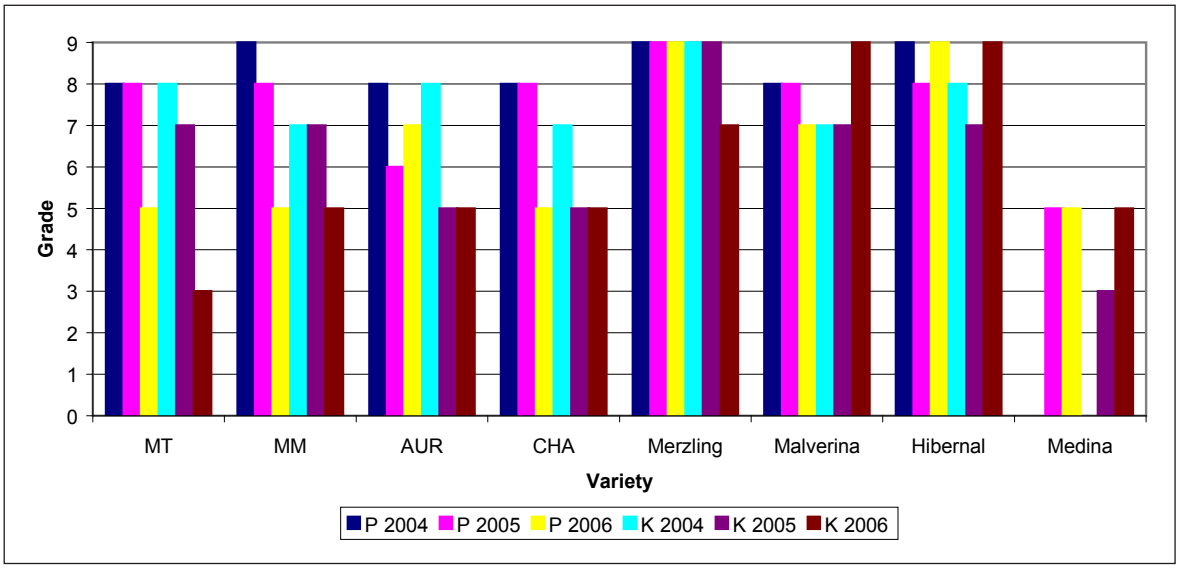
1 – very low (< 1.0 g)
3 – low (1.5–1.9 g)
5 – medium (2.3–2.7 g)
7 – high (3.1–3.6 g)
9 – very high (> 4.0g)

RESULTS AND DISCUSSION

The balance of vine bunches was on average evaluated in both locations with grade 7. The most striking difference was in variety Müller Thurgau, in location Perná was evaluated with grade 7 and in location Kojetice with grade 3. Thus the analysis approved a highly demonstrative difference between the locations.

The evaluation in individual years reached grades 8, 7 and 6. The year of 2004 was different from the years of 2005 and 2006. A statistically highly demonstrative difference between individual years was approved.

The best evaluated varieties were Merzling and Hibernal in both locations, the worst evaluated variety was variety Medina again in both locations. The analysis approved a highly demonstrative difference between the varieties. For instance variety Medina was evidently different from all other varieties; Merzling was also different from all varieties, except the variety Hibernal. Results is in graph 1.



1: *The balance of vine bunches in the monitored locations*

The berry balance was on average evaluated with grade 8 in location Perná and with grade 7 in location Kojetice. A great difference in the evaluation was shown in variety Chardonnay, in location Perná grade 7 was reached on average and in the location grade 5. A highly demonstrative difference was found between the locations.

The balance of berries was around grades 8, 7 and 7 in individual years. No demonstrative difference was found between the locations.

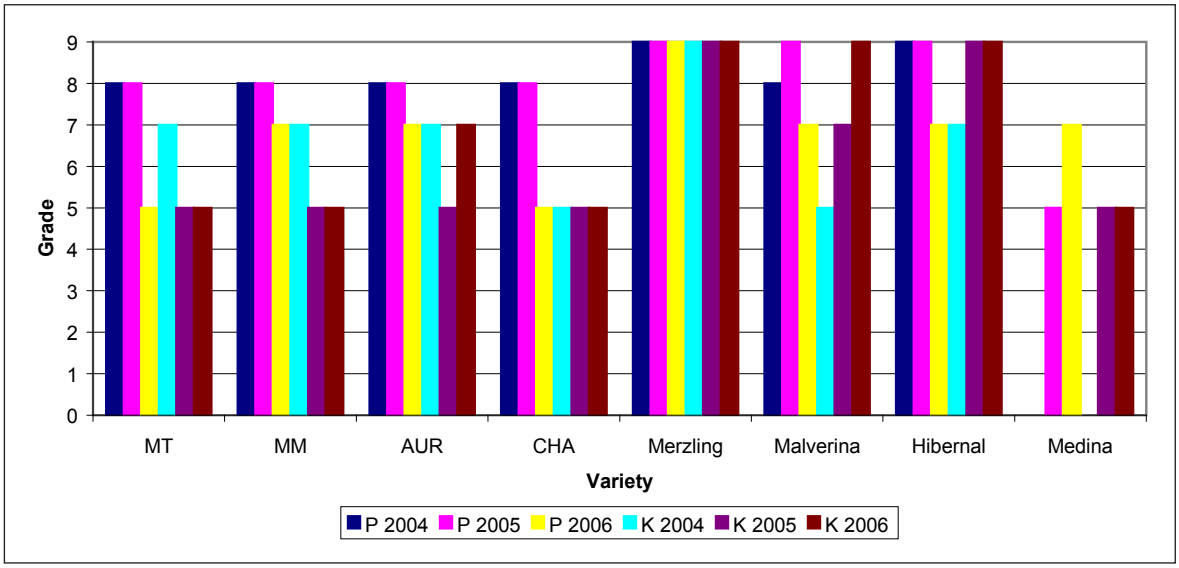
The most balanced grapes were in variety Merzling from both locations. The lowest balance was in variety Medina in both locations and Chardonnay from location Kojetice. A highly demonstrative difference was found between the varieties. In the varieties, for example variety Hibernal was evidentially different from varieties Malverina, Chardonanny, Aurelius, Moravian Muskat, Müller Thurgau and Medina.

Variety Malverina in 2004 proved the data presented by RICHTER et al. (2002) which mean that vine bunches are small and round. The Results is in graph 2.

The weight of vine bunches was on average evaluated with grade 6 in both locations, which means 180 g, or 179 g. The highest difference was recorded in variety Malverina – 230 g, Perná and 185 g, Kojetice. No statistical difference was found between the locations.

In individual years the weight of vine bunches was evaluated on average with grade 6. Thus no difference between individual years has been found out.

The highest the weight of vine bunches were shown in varieties Malverina (230 g) in location Perná and Merzlig (199 g) in location Kojetice. On the contrary, the lowest weight in varieties Char-

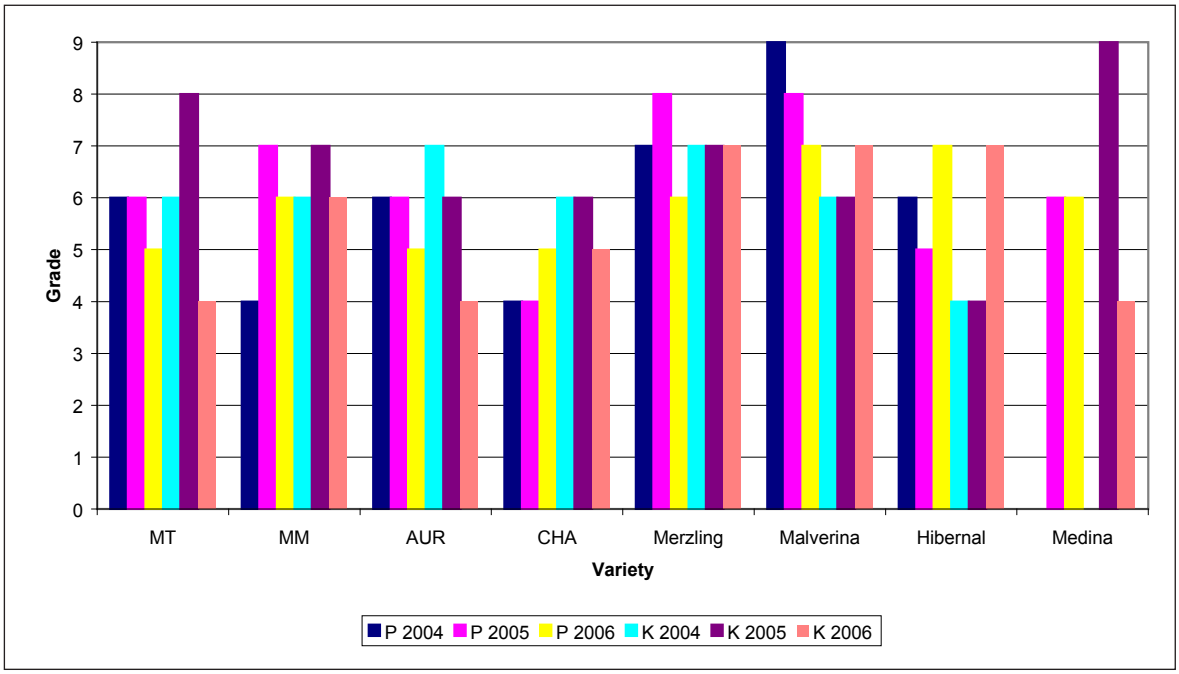


2: *The berry balance in the monitored locations*

donnay (136 g, Perná) and Hibernal (157 g, Kojetice). Varieties showed a statistically demonstrative difference.

During the analysis of point evaluation varieties Malverina and Merzling were demonstratively different from varieties Aurelius, Chardonnay, Moravian Muskat and Müller Thurgau. As concerns the weight of vine bunches in grams, varieties Malverina and Merzlig were demonstratively different from all other varieties except variety Medina and further on variety Chardonnay from variety Moravian Muskat.

Variety Chardonnay proved information which states RICHTER et al. (2002), which means that this variety has small up to medium sized vine bunches and on the contrary variety Muškát Moravský medium up to big. Results is in graph 3.



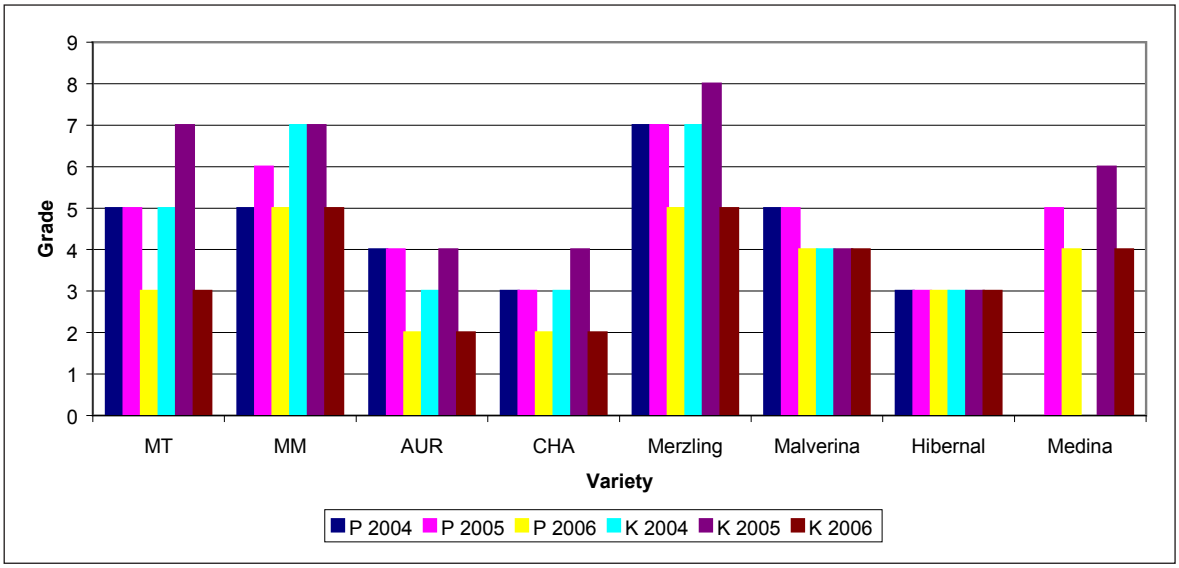
3: *The weight of vine bunches in the monitored locations*

The berry weight was on average at around 4 (Perná), or 5 (Kojetice), but expressed in grams it was in both locations 2 g. No difference was found between locations.

In individual years the berry weight was on average evaluated with grade 5, 5 and 4. The analysis proved a highly demonstrative difference between the monitored years (the year of 2006 was demonstratively different from other two monitored years).

The smallest grape was found in variety Chardonnay (1.5 g Perná; or 1.6 g Kojetice). The biggest weight of grape was measured in variety Merzling, and that is 3.1g in Perná and 3.3g in Kojetice. Statistical methods showed a highly demonstrative difference between the varieties. Results is in graph 4.

Received average results are given in a summary of the following table V:



4: *The berry weight in the monitored locations*

V: *The comparison of average values of the balance of vine bunches, the berry balance, the weight of vine bunches, the berry weight of vine of locations Perná and Kojetice (average values) in 2004–2006*

Parameter	Perná (228 m altitude)	Kojetice (480 m altitude)	Statistical comparison of locations
1. Balance of vine bunches	7	7	Highly demonstrative difference
2. Berry balance	8	7	Highly demonstrative difference
3. Weight of vine bunches	6	6	No difference has been proved.
4. Berry weight	4	5	No difference has been proved.

A highly statistically demonstrative difference was found in the balance of vine bunches and berries. On the contrary, the weight of vine bunches and berries showed no differences.

CONCLUSION

The agro-ecological indicators were compared according to the internationally acknowledged parameters in the work – the balance of vine bunches, the berry balance, the weight of vine bunches, the berry weight for 7 varieties of vine in three resistant white varieties Merzling, Malverina and Hibernal and one blue – Medina, then in classical varieties Aurelius, Chardonnay and Muscat Moravian in two locations Perna (sub-region Mikulovice) and Sadek (sub-region Znojmo). As concerns the balance of vine bunches and berries, remarkable differences between these two areas have been proved. The weight of vine bunches has shown no statistically remarkable difference. The berry weight has shown no difference at all

SOUHRN

Základní srovnání celkové kvality hroznů ze dvou odlišných stanovišť révy vinné *(Vitis vinifera)*

Cílem práce bylo srovnání průběhu agroekologických ukazatelů podle mezinárodně uznávaných parametrů – vyrovnanost hroznů, vyrovnanost bobulí, hmotnost hroznů, hmotnosti bobulí u sedmi odrůd révy vinné, a to na třech rezistentních bílých odrůdách, Merzling, Malverina a Hibernal a jedné modré – Medina, dále pak na klasických odrůdách Aurelius, Chardonnay a Muškát moravský na dvou lokalitách Perná (mikulovská podoblast). Pokusný pozemek se nachází v KÚ Perná viniční trať Věstonsko, Goldhamer a Přední Purmice. Sledované vinice jsou součástí Šlechtitelské stanice vinařské Vinselekt, Ing. Miloš Michlovský, CSc., Perná. Dle agroklimatologické rajonizace patří KÚ Perná do makrooblasti teplé, oblasti převážně teplé, podoblasti převážně suché a okrsku převážné mírné zimy. Dle výrobních typů je řazen do kukuřičného výrobního typu a Sádek (znojemská podoblast). Nachází se v KÚ Kojetice na Moravě v jediné viničné trati „Pod Sádkem“. Sledovaná vinice je majetkem Ing. Lubomíra Lampíře. Dle agroklimatologické rajonizace patří do makrooblasti teplé, oblasti mírně teplé, podoblasti mírně vlhké a okrsku převážně mírné zimy. Patří do obilnářského výrobního typu. Hodnocení vlastností hroznů odpovídalo běžným standardům používaným v České republice. Průběžně získané výsledky byly zaznamenávány do tabulek Microsoft Excel. Takto získané tabulky dále sloužily ke statistickému hodnocení. **Vyrovnanost hroznů** byla v průměru hodnocena na obou lokalitách stupněm 7. Nejvýraznější rozdíl byl u odrůdy Müller Thurgau, na stanovišti Perná byla hodnocena stupněm 7 a na stanovišti Kojetice stupněm 3. Analýzy tak potvrdily vysoce průkazný rozdíl mezi stanovišti. **Vyrovnanost bobulí** byla průměrně hodnocena stupněm 8 na stanovišti Perná a stupněm 7 na stanovišti Kojetice. Výrazný rozdíl v hodnocení vykazovala odrůda Chardonnay, na stanovišti Perná dosáhla průměrně stupně 7 a stupně 5 na stanovišti Kojtice. Byl zjištěn vysoce průkazný rozdíl mezi stanovišti. **Hmotnost hroznu** byla průměrně hodnocena stupněm 6 v obou lokalitách, tj. 180 g, respektive 179 g. Nejvyšší rozdíl byl zaznamenán u odrůdy Malverina – 230 g Perná a 185 g Kojetice. Mezi stanovišti nebyl zjištěn statistický rozdíl. **Hmotnost bobule** se průměrně pohybovala na bodě 4 (Perná), respektive 5 (Kojetice), ovšem vyjádřeno v gramech byla na obou stanovištích 2g. Mezi stanovišti nebyl zjištěn žádný rozdíl.

réva vinná, vyrovnanost hroznů, vyrovnanost bobulí, hmotnosti hroznů, hmotnosti bobulí

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