

Vine behaviour and wine composition in Italian Riesling grapes as influenced by differential cropping levels

by

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Das Verhalten der Rebe und die Zusammensetzung des Weines unter dem Einfluß abgestufter Ertragsmengen beim Welschriesling

Zusammenfassung. — Der Einfluß der Knospenzahl auf den Traubenertrag sowie auf die Most- und Weinqualität der Sorte Welschriesling wurde untersucht. Mit zunehmender Knospenzahl nahm das durchschnittliche Traubengewicht ab, und das Zucker/Säure-Verhältnis war verringert. Unter den vorliegenden Versuchsbedingungen wurden bei 72 an der Rebe belassenen Knospen — eine durchaus noch tragbare Stockbelastung — wirtschaftlich praktikable Ernten von guter Qualität erzielt.

Introduction

In a previous paper (3) the authors have reported the influence of the crop borne by the vine on the accumulation and storage of nutrient reserves in the canes. The present paper deals with the effect of the cropping level on yield and quality of the crop.

Bunch number and yield increase linearly with increasing number of buds retained at pruning within certain limits. Changes in the pruning level will alter potential crop accordingly (2). This is supported by the observations of KIRALY (6), MARTIN and TALOI (7). SUBBIAH and RAO (12) observed that crop-regulated Anab-e-Shahi vines yielded higher crops than the vines pruned to a maximum number of buds. RANGELOV (9) obtained the highest yields from Italian Riesling vines pruned to 32 and 36 buds over the range 20 to 88 buds per vine studied. The conspicuous influence of crop level on the final quality of crop has been emphasized by various workers (16, 12, 8). Straggly clusters, small or shot berries, reduced bunch weight are the results of overcropping. Grapes from overcropped vines have a lower Balling/acid ratio and develop poor colour (17, 14). Differences in sugar concentration were small and rarely significant under different cropping levels (1, 14). That crop level exerts a minor indirect influence on colour and quality of the wine was observed by WINKLER (17), WEAVER *et al.* (13), WEAVER and McCUNE (14). They found that normal cropped vines yielded wines with low pH, high acidity, more tannin, extract and colour and had better aging potential.

Materials and methods

The plant material and the treatment combinations used in this experiment as well as the methods of wine analyses for various mineral elements were the same as described in an earlier communication (3).

The sugar content of must was determined by measuring the density and expressing the sugar in weight/100 ml. The total acid content in terms of tartaric acid of the must and wine was estimated by titrating against $n/10$ standard NaOH. The wines from different treatments were analysed for various constituents: alcohol (specific gravity method using hydrostatic analytical scales), total extract using platinum container for evaporation, ash content by ashing in muffle furnace, total polyphenols using Folin and Ciocalteu reagent (10), colour with spectrophotometer at 420 nm, total protein N according to FERENCZI (5), free and total SO_2 according to Soós (11).

Results and discussion

The results, presented in Table 1, show that as the bud load increases, the yield also increases, but only up to certain limits, beyond which the increase in yield is not in proportion to the increase in bud load. Even the percentage of sprouting decreases with the increasing bud load. Although the number of clusters may be comparatively less in "crop-regulated" vines, the average bunch weight and the quality of must are markedly improved over the vines with more buds retained. The average bunch weight and the sugar/acid ratio are indices of the quality of crop. The Italian Riesling vines under treatment 5 had maximum number of sprouted shoots and inflorescences, but the average weight of the bunch was only 28.2 g, which was the minimum amongst the treatments bringing down the yield to 7.3 kg/vine. It is also interesting to note that the sugars were minimum (16.6 g/100 ml) and the acids were maximum (0.9 g/100 ml) indicating the poor quality and narrow sugar/acid ratio. The crop under this treatment is certainly not suitable for quality white wine as the sugar/acid ratio was minimum viz. 18.4. This is also evidenced by the results of analyses of wine. The vines under treatments 3 and 4 do not differ much from those of treatment 5 in respect of average yield and quality of the crop; while the vines under treatment 2 recorded a 85.5 % sprouting, with 7.2 kg/vine yield and the must was sweetest of all the treatments (19.7 g/100 ml). The yield of 19.9 t/ha under this treatment shows the economic feasibility; the yield is within the profitable range. The sugar/acid ratio being maximum 24.0 under this treatment, the crop is quite suitable for quality white wine. No significant difference in the dates of maturity amongst treatments was observed as reported by WINKLER (17), WEAVER *et al.* (13), WEAVER and McCUNE (14); however, the fruits of moderately cropped vines recorded higher percentage of sugars and less acids than the vines with a higher bud load on a given date of observation.

The observations on average bunch weight and the yield, etc. under different treatments agree with those of WINKLER (17), WEAVER *et al.* (13) and WEAVER and McCUNE (14) that the quality of the crop is reduced with overcropped vines, such as those of treatments 3, 4 and 5.

The results of wine analysis and organoleptic test etc. show that the differences noted in the musts of different treatments were also present in the wines made therefrom (Table 2). Sugar was almost nil in all the wines from different treatments. The wine from treatment 2 contains maximum alcohol (12.6 %), maximum extract, better colour and scored 17.6 points in the organoleptic test. The higher extract content, better colour, high total acidity, which are found in treatment 2 wine, show that the wine from this treatment will be of good quality and have better potential

Table 1

Effect of differential cropping levels on the cropping behaviour and quality of must of Italian Riesling vines
Der Einfluß der Knospenzahl auf die Ertragskomponenten und die Mostqualität bei der Sorte Welschriesling

Treatment	N. of buds/ vine planned	Actual n. of buds/vine retained	N. of buds/ vine sprouted	Sprout- ing %	Av. n. of infloresc./ vine	Av. bunch weight g	Av. yield/ vine kg	Yield/ ha t	Sugar g/100 ml	Acid g/100 ml	Sugar/ acid ratio
1	60	54.9	47.1	85.8	80.3	75.6	6.1	16.8	18.5	0.82	22.6
2	72	67.0	57.3	85.5	97.2	73.9	7.2	19.9	19.7	0.82	24.0
3	120	104.9	71.1	67.8	121.2	66.3	8.0	22.3	17.5	0.82	21.3
4	machine pruned	219.2	109.3	49.9	206.1	40.0	8.3	22.9	17.0	0.85	20.0
5	not pruned	338.9	208.6	61.6	259.1	28.2	7.3	20.3	16.6	0.90	18.4
6	60 (crop removed)	55.0	48.0	87.3	—	—	—	—	—	—	—

Table 2

Effect of differential cropping levels on the quality of Italian Riesling wine
Der Einfluß der Knospenzahl auf die Weinqualität bei der Sorte Welschriesling

Treatment	Alcohol %	Extract g/l	Ash g/l	Acids g/100 ml	Optical density at 420 nm	Free SO ₂ mg/l	Total SO ₂ mg/l	Specific gravity g/ml	Total poly- phenols g/l	Protein nitrogen mg/l	Organoleptic test max. 20 points
1	11.93	24.05	1.57	0.75	0.090	11.5	25.6	0.99430	0.36	45.5	17.5
2	12.06	25.95	2.06	0.76	0.165	11.0	19.5	0.99420	0.39	42.0	17.6
3	11.37	24.83	1.85	0.79	0.135	23.7	35.7	0.99487	0.44	42.0	17.8
4	11.32	21.77	2.10	0.72	0.146	35.5	46.0	0.99415	0.58	45.5	17.9
5	11.05	25.29	2.23	0.69	0.198	31.6	43.3	0.99547	0.55	56.0	17.9

Table 3

Effect of differential cropping levels on the mineral elements content (mg/l) of Italian Riesling wine

Der Einfluß der Knospenzahl auf den Mineralstoffgehalt (mg/l) des Weines bei der Sorte Welschriesling

Treatment	N	PO ₄	K	Ca	Mg	Zn	B	Fe	Mn	Cu
1	376.25	900	1300	82	48	2.90	3.75	9.6	1.44	0.13
2	393.75	1000	1350	80	48	2.46	4.25	16.9	1.36	0.13
3	350.00	900	1480	90	49	2.72	4.10	13.4	1.44	0.05
4	420.00	1650	1830	96	51	2.40	5.00	25.4	1.76	0.13
5	490.00	1050	1980	88	56	3.72	4.25	20.8	1.52	0.18

for aging. The free SO₂ in treatments 4 and 5 is high, probably because of low fixation. There was a tendency for minerals, particularly nitrogen, phosphorous, potassium, magnesium and iron to be high in heavily cropped wines. (Table 3). In general, the quality of wines from crop-regulated vines was better than from overcropped vines. The results are in agreement with the observations made by WEAVER *et al.* (13) and WEAVER and McCUNE (14), that wines made from low cropped vines were good in colour, taste and aging potential.

The results show the advantages to be gained in restricting total number of buds to be retained per vine. The physiological reasons for the several advantages outlined may be stated as better distribution of available nutrients and reserve food materials over a limited crop. Apart from the advantages of better quality, it may also be expected that the succeeding crop would also be safeguarded because of sufficient reserves in the moderate cropped vines (3). In addition, by regulation of bud number one could ensure that the growth of the vine is restricted within reasonable limits to afford enough exposure of the bunches to sunshine. A sequence of physiological processes such as development of inflorescence primordia in the buds, fruit set, development of berries and maturation of cane with accumulation of reserves in various organs are progressing at a rapid rate, all of them compressed within a short span of 4—5 months. This should lead to the inference that, if one set of processes is allowed to proceed beyond limits, it could happen only at the expense of the other. An excessive crop under these circumstances can only result in poor reserves stored in the canes and poor quality of the crop.

Summary

The effect of differential cropping level on yield and quality of must and wine of Italian Riesling vines was investigated. The average weight of the bunch was decreased, the sugar/acid ratio of the must reduced with the increase in bud load. Under the conditions of the experiment, a load of 72 buds which was well within the capacity of the vine yielded economically feasible crops of good quality.

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