EFFECT OF MECHANICAL HARVESTING ON SAUVIGNON BLANC PROTEIN CONTENT

Dr. Carien Coetzee

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Pathogenesis-related (PR) proteins are the **proteins that are responsible for hazes and sediments** in wine and are derived from the grape berry where the concentration can be affected by environmental factors such as fungal infection[1,2] and ultraviolet radiation[3]. The two principal groups of PR proteins responsible for protein instability in wine are **thaumatin-like proteins and chitinases** with the thaumatin-like proteins contributing 70% of the total protein in wine[4].

The concentration of the PR proteins in wine is largely determined by their concentrations in pre-fermentation juice which in turn is determined by the extraction of proteins from the grape berries. These proteins are highly resistant to low pH and proteolytic degradation[5] and thus **survive fermentation to potentially form commercially unacceptable hazes** in the wine. Studies have shown

that about 60% of the thaumatin-like proteins and chitinase survive during the fermentation of Sauvignon Blanc juice. **Sauvignon Blanc is in general considered to be a variety with a high degree of protein instability.**

STRESS RESPONSE

PR proteins are involved in **defence mechanisms against pathogen attack** as well as resulting from **wounding and certain abiotic stress**.[6–8] Fungal diseases such as downy mildew and powdery mildew would lead to increased levels of PR proteins in grape berries. Interestingly, grapes infected by *Botrytis cinerea* and the resulting juice contained less PR proteins compared to their uninfected counterparts. This phenomenon is possibly due to the secretion of protease by *B. cinerea*.[2,9,10]

Factors such as **damage incurred during mechanical harvesting could possibly be one of the stress factors leading to increased concentrations of PR proteins** in the grape berry and the resulting wine. Researchers tested this hypothesis by comparing the protein content of Sauvignon blanc grapes obtained by hand harvesting (HH) compared to grapes obtained from machine harvesting (MH) in a study titled:

"The effect of mechanical harvesting and long-distance transport on the concentration of haze forming proteins in grape juice" [4]

MATERIALS AND METHODS

Sauvignon Blanc from South Australia was used for the study.

Treatment 1: **Hand-harvested** (HH) fruit

- Whole bunches were harvested
- The bunches were transported 300 km (20 hours)
- Intact berries were sampled on arrival

Treatment 2: **Machine harvested** (MH) fruit

- Mainly broken berries without stalks were present in the harvester bin
- The berry/juice mixture was transported 500 km (20 hours)
- Intact berries were sampled on arrival
- Berry/juice mixture was sampled on arrival

RESULTS

Testing the stress response –

Protein content of intact berries from HH compared to intact berries from MH

After 20 hours of transport of the HH whole bunches and the MH berry/juice mixture, intact berries from each treatment were sampled to analyse the protein content in the free-run juice (manual pressing of the berries).

Results showed that HH berries contained more thaumatin-like proteins compared to the MH grapes, while the difference in chitinase concentration between HH and MH free run juice was negligible. If there were any stress responses due to the damaging action of MH, the protein content would have been higher in these intact berry MH samples, which is not the case. There was thus **no response to the stress caused by machine harvesting in the form of increased protein**. Over the centuries the grapevine has adapted to such an extent, that the PR proteins may be formed even if there is no stress factor stimulating it.

Testing the extraction –

Protein content of intact berries from HH compared to free-run juice obtained from the MH berry/juice mixture

The free-run juice obtained from the **MH berry/juice mixture** (also after 20 hours transport) contained a **considerably higher concentration of proteins** compared to the free-run juice obtained from intact HH berries. **The physical damage caused by MH facilitates extraction of protein from the skins and other berry solids, resulting in a higher protein concentration in the MH free-run juice.**

Testing the effect of skin contact and pressing

Another study tested the extraction of PR proteins in Sauvignon Blanc using different harvesting techniques, applying different skin contact times and evaluating the effect of pressing conditions.[11] Results showed that both harvesting method and processing resulted in significant differences in the extraction of proteins:

Juices obtained from **hand-harvested** grapes, juices subjected to the **least amount of skin contact** and juices collected from the **lowest press fraction** (0-0.4 MPa) showed the **lowest extraction of proteins** compared to other treatments tested.

CONCLUSION

Results showed that the **increase in the protein concentration from the grapes was not due to the physiological response of the berries to stress, but rather the extraction of unstable proteins from the berry solids and skins** especially during lengthy transports. Other additives such as sulphur dioxide can also increase the permeability of the grape skin cells, allowing greater leaching of contents from the berry into the must.

The non-**selective harvest of the mechanical harvester** would result in the harvesting of all bunches. Thus, **grapes infected with downy mildew and/or powdery mildew would be harvested, increasing the likelihood of elevated unstable proteins in the resulting juice and wine** (even prior to maceration). Hand harvesting would thus be advised in blocks where fungal infection is prevalent.

A 20-hour transport would inadvertently stimulate the extraction of various compounds from the berry skins. In a scenario where the **machine-harvested grapes can be transported in a relatively short period of time to the cellar, the extraction of unstable proteins can be minimised**.

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