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*Report*

## **Experience of Red Mountain Estate in producing tropical wine in Myanmar**

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### **Abstract**

This paper describes the experience of Red Mountain Estate in producing tropical wines in Myanmar. The enterprise has been in operation now for some 6-7 years and some of the lessons gained during this period are described. The paper also describes the vineyard management practices and the winemaking procedure, along with any problems encountered.

**Keywords:** oenology, viticulture, pruning, rainfall, water stress, shiraz, tempranillo, sauvignon, muscat, pinot, carignan, chardonnay, Burma

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### **Introduction**

The Red Mountain Estate vineyards and winery are located on 20.2°N, near the famous Inle Lake, Nyaung Shwe Township, Southern Shan State, Myanmar. Vineyards are planted at 1,000m above sea level.

The government granted permission to establish the vineyard and winery in 2002. The site was chosen for its special microclimate, cool nights and sunny days during the fruiting cycle - from October to March. The goal was to produce a high quality wine, 100% made in Myanmar. Under the supervision of French experts and after 3 years of experimentation with different grape varieties, the vineyard really commenced in 2005 with importation of grafted vines and the planting of 31 ha. Red Mountain Estate started with Sauvignon Blanc, Muscat à Petits Grains, Pinot Noir, Shiraz and Tempranillo. The vineyard was then extended to 75 ha in 2007 with additional planting of mainly of Shiraz, Cabernet Sauvignon and many other varieties of white and red as an experiment.



Figure 1. View of the winery, the Red Mountain team and the vineyard.

### Climate

Myanmar has three main seasons:

- summer (dry season): March to May,
- rainy season (wet season): June to September, and
- winter: October to February

In general, summer in Myanmar is really hot (42°C) during the day and night time temperature drops to around 30°C. However, as the vineyard is at 1,000m above sea level, it receives much less day and night temperatures (max. 30°C and 20°C min.).

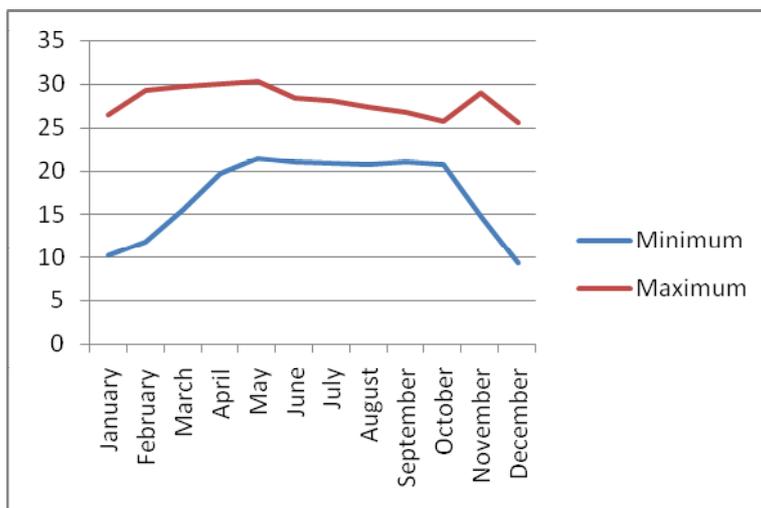
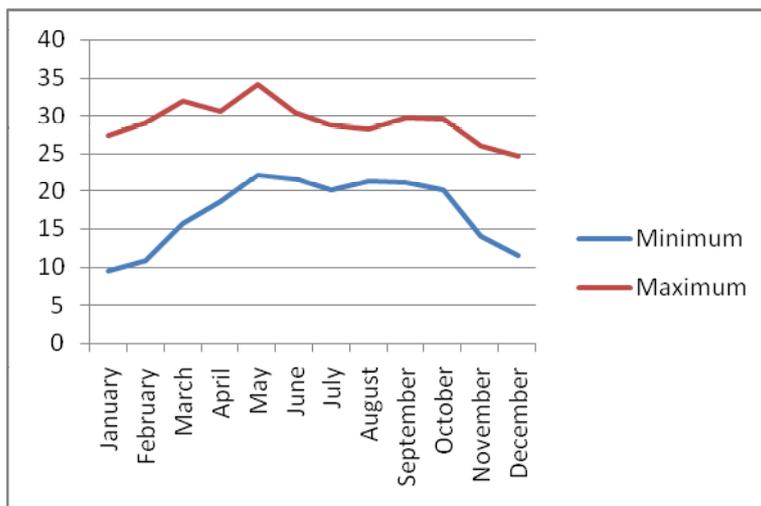
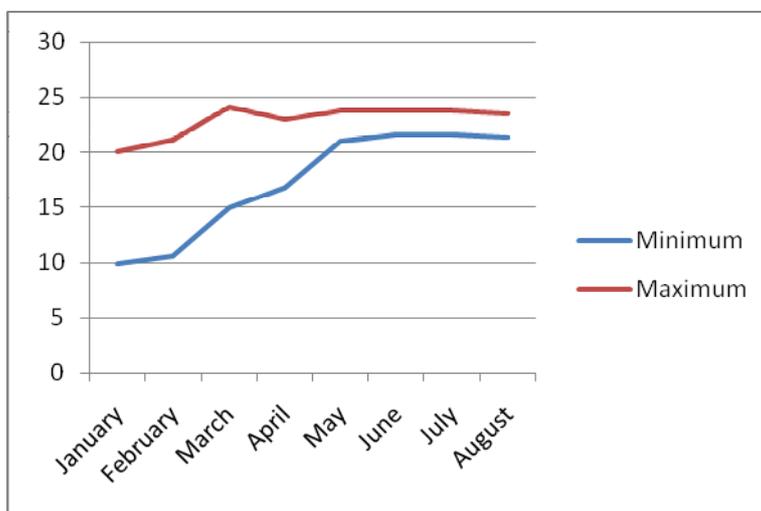


Figure 2. Average minimum and maximum temperatures (°C) for 2009.

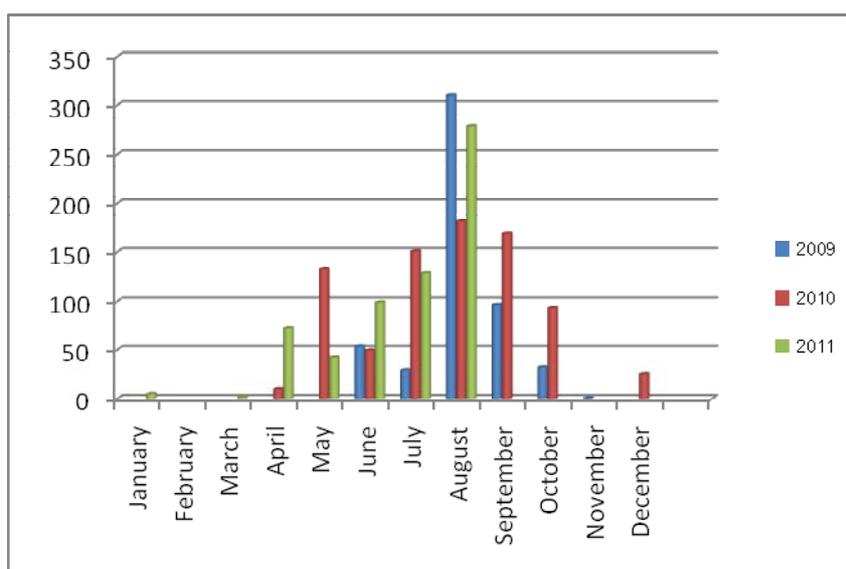


**Figure 3. Average minimum and maximum temperatures (°C) for 2010.**



**Figure 4. Average minimum and maximum temperatures (°C) to date for 2011.**

Currently, climate conditions become erratic. For example, the vineyard started to receive rain as early as January this year. It can be seen from Figure 4 that average temperatures are much milder this year and there is no summer in 2011 - this means it was raining all the summer and this continues into the wet season and the pattern is quite unusual.



**Figure 5. Annual rainfall (mm) for the last three years.**

### **Planting Density**

Planting is 5,000 vines/ha at a spacing of 2.5 x 0.8m.

### **Training system**

The training system used is the Cordon de Royat system. Trellis is VSP (vertical shoot position). The first wire is 0.75 from the ground and 1<sup>st</sup> and 2<sup>nd</sup> wires are 0.5m apart while the 3<sup>rd</sup> wire is 0.75m from the 2<sup>nd</sup>. Canopy height is thus 1.25m.

### **Soil type**

Soils at Red Mountain Estate vary from sandy clay, sandy moan and clay moan. Soil pH is 5.8 to 6.0. Compost is applied where organic matter is low.

### **Irrigation**

Grapevines that have been subjugated to prolonged water stress have a tendency to rapidly absorb large amounts of water when it is provided. This will dramatically swell the berries, potentially causing them to crack or burst which will make them prone to various grape diseases. Even if the berries do not crack or burst, the rapid swelling of water will cause a reduced concentration in sugars and phenolic compounds in the grape producing wines with diluted flavours. The irrigation system applied at Red Mountain Estate is a drip system.

### **Water Stress**

At the far extreme in tropical climates is severe water stress which can have detrimental effects on both the vine and on potential wine quality. To conserve water, a vine will try to limit losses through transpiration. The plant hormone abscisic acid triggers the stomata on the underside of the plant leaf to stay close in order to reduce the amount of water that is evaporated. While conserving water this also has the consequence of limiting the intake of

carbon dioxide needed to sustain photosynthesis. If the vine is continually stressed it will keep its stomata closed for longer and longer periods of time which can eventually cause photosynthesis to stop altogether. When a vine has been so deprived of water it can exceed what is known as its permanent wilting point. At this point, the vine can become permanently damaged beyond recovery even if later watered. Viticulturists carefully watch the plant for signs of severe water stress. Some of the symptoms include:

- Flaccid and wilting tendrils
- (During Flowering) Flower clusters that are dried out
- Wilting of young grape leaves followed by more mature leaves
- Chlorosis signaling that photosynthesis has stopped
- Necrosis of dying leaf tissue which leads to premature leaf fall
- Finally, the grape berries themselves start to shrivel and fall off the vine

Of particular focus is the connection between yield size and the potential benefits of water stress. Since the act of stressing the vine does contribute to reduced photosynthesis, and by extension, reduced ripening since the sugars produced by photosynthesis are needed for grape development, it is possible that a stressed vine with high yields will only produce lots of under-ripe grapes.

### Varieties Planted

Red Mountain estate imported grafted vines from France, Israel and Spain and currently has 9 varieties of red (Pinot Noir, Shiraz, Tempranillo, Cabernet Sauvignon, Carignan, to name some) and 10 whites (such as Sauvignon Blanc, Chardonnay, Muscat a Petits Grain, etc.).

**Table 1. Conditions Prevailing in 2011.**

Variety	Age 2011	Surface	Yield 2011	Diseases	Conditions
Sauvignon Blanc	6 years	22 ha	10 hl/ha	Not too sensitive	Very good canopy. First grapes on 3 <sup>rd</sup> year
Chardonnay	6 years	1 ha	5 hl/ha	Not too sensitive	Poor canopy, very low yield. First grapes on the 4 <sup>th</sup> year
Muscat Petit Grain	6 years	7 ha	15 hl/ha	Sensitive to Downy & Antrachnose	Very poor canopy. First grapes 2 <sup>nd</sup> year
Shiraz	4 years	27 ha	8 hl/ha	Bit sensitive to downy (DM) and powdery (PM)	Very good canopy and trunk. First grapes on 4 <sup>th</sup> year
Pinot Noir	6 years	7 ha	7 hl/ha	Bit sensitive to DM & PM	Poor canopy. First grapes on 4 <sup>th</sup> year
Tempranillo	6 years	3.5 ha	40 hl/ha	Very sensitive to all 3 diseases	Poor canopy. Some long shoots going to the 2 <sup>nd</sup> wire. First grapes on the 2 <sup>nd</sup> year
Carignan	4 years	4.5 ha	15 hl/ha	Very very sensitive to DM, PM & Antrachnose. Strong attack of PM on grapes in 2011. Loss of 60% of the grapes	Medium canopy but short shoots. First grapes on the 2 <sup>nd</sup> year.
Cabernet Sauvignon	6 years	1 ha	20 hl/ha	Not too sensitive	Growing slowly. First grapes on the 5 <sup>th</sup> year. Good conditions till the blooming, then bad fruit set.
Petit Verdot	4 years	2 ha	Low	Not too sensitive	Not working here.

The vineyard has also planted an experimental plot with different varieties:

- Chenin Blanc
- Airen
- Verdejo
- Macabeo
- Gewurtzraminer
- Merlot
- Cabernet Franc
- Different clones of Carignan and Shiraz.

## **Vineyard Management**

### **Young plants**

Six months after planting, the two strongest shoots were kept and all other shoots were cut off. When these shoots had reached the first wire, weaker shoots were cut out again. Then, two months later, the remaining shoot was trained to the first wire. The vine was trained as a double cordon.

### **Mature plants**

The length of the two cordons are 0.8m from end to end of the two cordon tips. The space of inter-buds is kept at  $\pm 3.0$  to 3.5cm. Thus it is possible to have a minimum of 28 shoots, 56 bunches and about 5kg of grapes on average per plant, leading to an expected average yield of 25mt/ha or 175hl/ha. However, the majority of the plants are still young (3 yrs.) and current yield is just 1.6mt/ha. Still a far cry to reach the goal! It is hoped that the goal could be achieved by 2034 or so.

## **Annual Growth Cycle**

### **Pruning**

Pruning is undertaken twice a year.

- First week of April for the rainy season vegetative cycle
- First week of October for the fruit vegetative cycle.

The date of the second pruning is decided according to the length of the cycle for each variety and the prevailing weather conditions.

If it is estimated that the rains will end in early November, and as we want to avoid having rain during flowering, pruning may be undertaken in early October, then flowering will commence 45 days later, in mid November. It is undesirable to prune later than this time in order to achieve berry ripening when the temperature is still cold in the vineyard area. The aim is to harvest the Sauvignon and Pinot Noir not later than mid February. For the other red it is not quite as critical and the Shiraz is usually harvested as late as March.

The two pruning techniques applied are different. In April, the old wood is pruned, just keeping 1 bud. The second time, in October, pruning is undertaken on new wood (cane) and 4 buds are kept.

### **Budbreak**

The grape starts its annual growth cycle in around April/October with bud break. Tiny buds on the vine start to swell and eventually shoots begin to grow from the buds. Inside the buds usually contain three primordial shoots. These buds appear in the summer of previous growth

cycle as green and covered in scales. Eventually the shoots sprout tiny leaves that can begin the process of photosynthesis, producing the energy to accelerate growth. After about 4 weeks the growth of the shoots starts to rapidly accelerate with the shoots growing in length by an average of 3 cm (1 in) a day.

### **Flowering**

The flowers appear approx 45 days after pruning, 3 weeks after budbreak.

### **Veraison**

Following fruit set, the grape berries are green and hard to the touch. They have very little sugar and are high in organic acids. They begin to grow to about half their final size when they enter the stage of veraison. This stage signals the beginning of the ripening process and normally takes places around 40-50 days after fruit set (see the above chart). At Red Mountain Estate, this begins around the end of January. During this stage the colours of the grape take form-red/black or yellow/green depending on the grape varieties. In a process known as engustment, the berries start to soften as they build up sugar. Within six days of the start of veraison, the berries begin to grow dramatically as they accumulate glucose and fructose and acids begin to decline.

### **Disease Management**

Despite the vineyard receiving an average of around 1,000mm of rainfall each year, no major problems are encountered with disease. At this time only three diseases have been encountered; downy mildew, powdery mildew and anthracnose. This is because the vineyard is just in its infancy and it seems certain that other diseases will be encountered in the future.

For insect pests, there have been some problems with cutting worms (at bud break) and the usual bugs. These are readily handled and do not at this stage pose a major problem.

### **Laboratory Work**

Whether the wine is aging in tanks or barrels, tests are run periodically in a laboratory at the winery to check the status of the wine. Common tests include °Baume, pH, titratable acidity, residual sugar, free or available sulphur, total sulphur, volatile acidity and percentage alcohol. These tests are often performed throughout the making of the wine as well as prior to bottling. In response to the results, the winemaker can then decide if more sulphur needs to be added or other slight adjustments made before it is bottled.

A Brix test can be run either in the lab or in the field for a quick reference number to see what the sugar content is. Baume is usually measured with a refractometer, while the other methods use a hydrometer. Generally, hydrometers are a cheaper alternative.

### **Harvest**

As seems to be the practice with most tropical vineyards, at Red Mountain Estate double pruning is practiced. In March, following harvest, the first pruning is done for the vegetative cycle. Due to heavy rainfall, the vines are not allowed to fruit during this cycle and all flower clusters are removed. The second pruning is done in October and it is from this cycle that the harvest is taken.



**Figure 6. Harvest is undertaken using locally woven wicker baskets.**

By the end of January the sampling of grapes commences. 200 berries are collected from each plot systematically and checked for sugar and acid content. At the same time they are also checked for physiological ripeness. When all requirements are met, harvesting may commence.

### **Winemaking**

Winemaking involves both science as well as art and this underlines the approach taken at Red Mountain Estate.

#### **White wine**

Grapes are harvested in 20 Kg baskets. They are then crushed (de-stemmed and crushed), going through a cylinder in a tube exchanger in order to cool then to 5 to 10°C. They then proceed to the pneumatic press. After, one night, the clear juice is separated from the deposit. This clear juice is then inoculated with selected yeasts and nutriment. The temperature is controlled at 16°C during all fermentation. When fermentation is completed, the wine is stabilized with sulphur and cold temperature, before being aged on its lees.

For the Chardonnay only, malolactic fermentation is applied and all of the process is done in oak barrels.

#### **Red wine**

Grapes are crushed and de-stemmed then loaded in a tank for maceration (skin contact). It has been noted that in the case of Myanmar, the colour and structure comes very quickly when compared with a French winery. The wine is inoculated with yeasts and after 2 or 3 days, the maceration is ended. The juice is then separated and the remaining solids sent to the press. The fermentation continues at 25°C. When AF is done, then the wine is inoculated with lactic bacteria. When the wine is controlled with no more malic acid, it is stabilized with sulphur and sent to either tanks or barrels for aging.

#### **Rosé**

In 2009 and 2010, rose wine was made from Carignan grapes. The process was the same as that for the white wine, with the grapes sent directly to the press. This year, a short maceration (4 to 6 hours) was made.

### **Fortified wine**

A white fortified wine is made from 100% Muscat grapes. The fermentation is ended by the addition of 45% alcohol derived from a kind of brandy distilled from the wastes of the previous year.

The red is made with the same process. The grapes used are Shiraz.

### **Late harvest**

This wine is made from Muscat grapes as well. The fermentation is ended by the addition of sulphur and cold temperature. The residual sugar is 24 g/l.

### **Blending and fining**

Different batches of wine can be mixed before bottling in order to achieve the desired taste. The winemaker corrects perceived inadequacies by mixing wines from different grapes and batches that were produced under different conditions. These adjustments can be as simple as adjusting acid or tannin levels, to as complex as blending different varieties or vintages to achieve a consistent taste.

Fining agents (all wine chemicals are purchased from Laffort, France, every two years) are used during winemaking to remove tannins, reduce astringency and remove microscopic particles that could cloud the wines. The winemaker decides on which fining agents are used and these may vary from product to product and even batch to batch (usually depending on the grapes of that particular year).

Besides gelatin, other fining agents for wine are often derived from animal and fish products, such as micronized potassium caseinate (casein is a milk protein), egg whites, egg albumin, isinglass (Sturgeon bladder), PVPP (a dairy derivative protein) and lysozyme.

Non-animal-based filtering agents are also often used, such as bentonite (a volcanic clay-based filter), diatomaceous earth.

### **Filtration**

The winery uses two kinds of filter:

- Earth filter for the first filtration
- Cartridge filter for the last filtration before bottling

### **Bottling**

An Italian bottling machine is used:

- Bottle rinser
- Adding of nitrogen
- Filler
- Leveler with CO<sub>2</sub>
- Vacuum before closing

## **Conclusion**

Wine culture in Myanmar is still in its infancy. It is more popular amongst the wealthy, however, wine consumption amongst the growing middle class is also becoming more popular. Especially the younger generation of the middle class has more interest in wine culture. They just don't drink wine, they want to know, for example, why wine requires the use of a special glass, why it is necessary to use different kinds of wine glass for different kinds of wine, why there is a style in holding a wine glass, why there is a preferred drinking temperature, etc. This thirst for knowledge concerning wine is an encouraging sign that wine culture is taking root in Myanmar.

Red Mountain Estate has demonstrated clearly that quality wine of international standard can be produced in Myanmar.