Nutrients and Energizers

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Winemakers who habitually use concentrates are accustomed to adding perhaps one teaspoon per gallon or a few milliliters per liter of something called "nutrient" to their must. Followers of old "country wine" recipes, or those dabbling with garden fruit, often do not, simply because no one suggested that they should. The result, in the latter case, can be a wine, which fails to ferment out completely, with the unfortunate "traditional" homemade wine characteristics of being overly sweet and unbalanced. It doesn't need to be that way, and a little knowledge of what nutrients are all about can help to ensure that it is not.

The average suburbanite realizes full well that the secret to a healthy lawn is the judicious application of fertilizer, at the right time and with the right formulation, with the various chemical balances chosen on the basis of the need for root growth, leaf growth, or general nutrition. This is actually a lot more complicated than the use of nutrients in wine-making, but the basic concept remains the same, that of ensuring healthy growth and a good crop, although in winemaking the "crop" in question is the yeast we use to ferment the must. In addition, as we are all aware, a balanced diet high in vitamins is essential to human and animal health; an unbalanced diet can easily lead to poor growth or illness due to vitamin deficiency.

Plants build carbohydrate – sugars and starches – out of the basic building blocks of air (in particular the carbon dioxide component of air) and water, using sunlight as the energy source for this miraculous process of photosynthesis. In addition, vegetable protein is created from nitrogen, phosphorous and potassium, which is why we spread either chemical or organic material rich in these nutrients on lawns and gardens at the appropriate time in the growing season. Animals in turn consume plant materials, extracting the stored energy from carbohydrates and returning them to their original state of carbon dioxide and water; and breaking down the vegetable protein into amino acids, which are then rebuilt into animal protein.

Yeast exhibits some of the characteristics of a plant, and some of those of an animal. It consumes carbohydrate – in winemaking, sugar – as does an animal, and requires nitrogen, phosphorous and other nutrients from which to build protein, as does a plant.

The important point to realize is that, from the yeast's point of view, this is not optional. If it is to grow, it must have access to nutrient material. Ideally it will find this in the juice, which it is fermenting, supplemented as required by nutrient that has been added by the wine maker. If there is insufficient nutrient present from the beginning – as would be the case with musts made from flowers or honey, without additional nutrient – the yeast simply will not grow to a viable size, and either will not ferment the must at all, or will only be able to do a partial job of it, leaving the wine sweet, weak, and prone to infection or acetification. In addition, wine yeast faces the prospect of what, in its world, is the equivalent of weeds. "Wild" yeasts, moulds and bacteria are prevalent in nature and – given the opportunity – will dominate the ferment to the detriment of flavour and alcohol development. Nutrient, in a form favoured by the yeast, is essential to establish a strong and viable yeast colony that will win out over the "weeds".

A second scenario occurs if there was enough nutrient present to start the ferment, but not enough to sustain the yeast throughout the entire process. During the course of a 3 to 4 week fermentation, many generations of yeast are created, live, reproduce and die, and each one will require adequate nutrients for healthy growth. If the later generations are starved of nutrient because that which was present at the beginning has all been used up, they will go looking for it wherever they can find it. Where do you think that might be? Well, clearly, the most readily available – in fact the only – source

of the material it requires to build protein is that of the cells of dead previous generations of yeast. Lacking a high moral standard the yeast will, if it must, revert to cannibalism and digest and rebuild this protein source. This process, which is known as autolysis, is, however, imperfect. In the process some amino acids are left unused, and this results in bad flavours in the wine – a persistent staleness or mustiness – as well as the likelihood of production of higher alcohols, or "fusel oils", which in low concentrations are headache-making, and in high concentrations dangerous to health. Besides the evident off taste, the presence of autolysis can be detected by the formation of a series of "dimples" in the layer of yeast at the bottom of a carboy.

If the yeast has sufficient nutrient in the must for growth, it will take the lazy person's route and use it, resulting both in protection of the basic flavour, and healthier growth as well, so it is obviously in the wine maker's best interest to add a reasonable quantity of nutrient salts to the must.

Many of these nutrients are similar to those used on lawns, although since the "plant" is different, with different needs, there are some differences. Those for lawn and garden, for example, may contain nitrates; yeast is unable to use these, and instead prefers ammonium salts that are high in nitrogen, such as ammonium phosphate, as well as small amounts of potassium and magnesium. These are generally available in wine maker's stores, already formulated to give a balanced amount of each of the major nutrients. A word of caution is, however, in order. Used in accordance with the recipe, these products are entirely safe. If used to excess, they may not be. News reports indicate that some commercial wine producers have, in the interest of coaxing the maximum alcohol content possible from a must, employed urea-based nutrients at as much as 26 times the level considered to be safe. The result has been a wine that contains levels of an intermediate product – ethyl carbamate -, which is potentially capable of causing severe health problems. While urea-based nutrients are suspect, other nutrients appear to be free of side effects.

Some additives such as vitamin C are necessary for wines which are light in this vitamin (such as Apples), while other ingredients have a sufficient quantity to preserve flavour and colour, such as grapes, blueberry, elderberry, and so on. These will require some supplementing with nutrient, with the amount dependent on the type of juice one is using. If in doubt, however, from $\frac{1}{2}$ to 1 teaspoon of nutrient per gallon of must is a reasonable amount for these wines, and at least double this amount for honey and flower musts.

In addition to nutrient salts, a fermentation will also benefit from a good supply of other vitamins; dried yeast, as many readers know, is an excellent source of B vitamins, so it is not surprising to learn that B-complex vitamins can have a pronounced effect on fermentation. The "yeast-based" nutrients to which we have alluded earlier are primarily a product that contains both nutrient salts and vitamins; they are sold as a "Super Nutrient" or "Yeast Energizer". This product also has the useful capability of being helpful in restarting a stuck ferment. Commercially, yeast nutrient as used by commercial operations, and available in better winemakers' supply stores, provide the following:

- Nitrogen, from such sources as Di-Ammonium Phosphate (also known as DAP) and possibly malt extract
- Usually, yeast hulls (the dried protein outer wall of yeast cells)
- Vitamins, such as calcium pantothenate, thiamin, niacin and biotin
- Minerals such as zinc and magnesium

Amateurs without access to the proprietary products can achieve more or less the same results by using equal quantities of diammonium phosphate and yeast hulls, generally available from winemakers' suppliers; failing this, use Vitamin B1 at the rate of 3 mg per gallon (1 gm in 1.5 litres), or alternatively B-complex tablets (not the ones containing liver extract!), with the optional addition in each case of vitamin B3 and a pinch – a small pinch – of Epsom Salts.

The use of nutrient is particularly important if you are a compulsive racker, since each time a must is racked the size of the yeast colony is severely reduced, and the yeast must again rebuild its population. While the original nutrient supply may have been sufficient to support the original yeast colony during fermentation, it may not be adequate in addition to supply a second or subsequent colony from the ground up, and when this happens the yeast either goes dormant, stopping fermentation, or turns to autolysis if enough dead cells made it over in the racking. The same applies when the wine maker practises "pitching", or using fermenting yeast from one batch to inoculate a second, rather than starting over again with fresh yeast.

The bottom line is that an adequate supply of nutrient – based on the type of must you are using – is essential both for a healthy ferment and to avoid the unpleasant effects of autolysis. In addition, nutrient, and a shot of energizer, can be helpful in reviving a stuck ferment. If the yeast has already picked up its marbles and gone home you may not be able to restart it, of course; but if it's only thinking about it, giving it a good meal may well change its mind.

Good luck!