CONCLUSION

This work is a product of over 23 years as a professional agronomist. I combined my practical expertise with scientific inquiry and literature review to expand upon the concept of *terroir* - the study of soil in relation to climate and agriculture. Using this framework, I have explored beyond yields to the pursuit of quality in tree fruit and vine production.

I reviewed the practices and opinions of the fertilizer industry and common practices in agriculture. I have demonstrated that there is an over reliance on nitrogen over the other major nutrients. I documented this over reliance through sales records for the U.S. and northern California. I have show that there has been some progress over the last 20 years towards a more balanced approach to fertilization. As I reviewed the problems with agriculture's over reliance on nitrogen, I added my own personal experience with local crops. Poor quality of fruit, increased pest and disease complications, and environmental problems are all possible consequences of our high-yielding, nitrogen intensive agriculture. Through a survey of every fertilizer dealer in the 5 county area of northern California, I demonstrated that the use of soil testing is the exception rather than the rule. I showed a need for further education, specifically in soil analysis interpretation. Instead of just condemning an entire industry, this project is intended to propose a universal model, using soil science to achieve positive soil building programs.

A system of soil analysis and predicting nutrient uptake by plants is already in use by many of the largest labs in the U.S. The work of W.A. Albrecht and others in researching and developing the Base Cation Saturation Ratio system resulted in a standardized testing format, reported on most lab analysis forms. This system, which fell into disuse for many years, has been promoted by

forward thinking agronomists as a tool for making fertilizer recommendations for a sustainable agriculture.

I reviewed the history and evolution of Albrecht's work on balancing major cations and promoting soil biological activity. The work of proponents and critics was examined. I examined the reliance of past fertilizer research on yield data alone, several integrated pest management projects which ignored soil fertility interactions, and the few who called for true integration of the fields of pest management, plant pathology, and soil science. In this project, I added what is missing to achieve a truly sustainable agriculture. I believe this is a model for soil science interpretation that is based on how natural systems actually work.

The benefits of a sound, workable model of soil analysis interpretation are many: best soil drainage & aeration, less erosion and compaction, potential nitrogen conservation leading to less pollution, and increased pest & disease resistance. With this model others can learn to interpret soil analysis reports and provide recommendations for fertilizer use based on sound agronomy. The pitfalls of several common tests are discussed. Tests such as pH and soluble salts, which measure conditions but not the specific reasons for the conditions, are explained. This model will be a valuable tool for fertilizer salespeople, viticulturists, farm managers, and others involved with production agriculture. Soil engineers can use the information on clay chemistry to manage problem soils. Researchers agriculturally related disciplines: pest management, plant pathology, nematology, and others without years of training or experience in soil science will benefit from its simplicity and practicality.

The principles behind the model are straightforward. By achieving optimum mineral balance according to BCSR theory, conditions for best nutrient availability and organic matter cycling exist. This allows the benefits of

biological diversity & healthy soil to co-exist with the use of chemical fertilizers. Finally, the wise use of nitrogen and all fertilizers avoids the pitfalls associated with disuse. Once the basic soil conditions are reached, actual crop nutrient utilization can be used for recommendations.

| proposed and demonstrated the use of BCSR to classify soils by mineral characteristics. By overlaying these groups with USDA Soil Conservation Survey Soil Surveys, valuable nutritional information is added to that already compiled. This system can be used anywhere in the world, showing major |i miting factors, productivity potential, and other information for use in land management.

Finally, the model shows both producers and practitioners of agricultural science a framework for locally appropriate fertilization, using Base Cation Saturation Ratios and Sufficiency Levels of Available Nutrients. Among the strengths of this model is the allowance for different philosophies of fertilization: from the wise use of chemicals to purely biologically based methods. The end results will be the same: the production of healthy crops, high quality products, and sustainable practices.