UNIVERSITY OF CALIFORNIA.

COLLEGE OF AGRICULTURE.

REPORT

OF THE

VITICULTURAL WORK

During the Seasons 1883-4 and 1884-5,

BEING

APPENDIX NO. IV TO THE REPORT FOR THE YEAR 1884.

WITH NOTES REGARDING THE VINTAGE OF 1885-6.

By EUGENE W. HILGARD,

Professor of Agriculture.

SACRAMENTO:

STATE OFFICE, ... JAMES J. AYERS, SUPT. STATE PRINTING.

1886.

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NOTE.—Names of grapes starred (*) indicate that general remarks on the variety are given at the place referred to.

LEGISLATION CONCERNING VITICULTURAL WORK.

THE PROVISIONS OF THE ACT OF 1880.

For the information of persons interested, the portion of the Act of 1880 relating to this work, is here inserted:

An Act for the Promotion of the Viticultural Interests of the State.

(Approved April 15, 1880. Stats. of Cal., 1880, p. 53.)

SECTION 8. And for the further promotion of viticultural interests, it shall be the duty of the Board of Regents of the University of California to provide for special instruction to be given by the Agricultural Department of the University, in the arts and sciences pertaining to viticulture, the theory and practice of fermentation, distillation, and rectification, and the management of cellars, to be illustrated by practical experiments with appropriate apparatus; also, to direct the Professor of Agriculture, or his assistant, to make personal examinations and reports upon the different sections of the State adapted to viticulture; to examine and report upon the woods of the State procurable for cooperage, and the best methods of treating the same; and to make analysis of soils, wines, brandies, and grapes, at the proper request of citizens of the State; also, to prepare comprehensive analyses of the various wines and spirits produced from grapes, showing their alcoholic strength and other properties, and especially any deleterious adulterations that may be discovered. The Regents shall also cause to be prepared, printed, and distributed to the public, quarterly reports of the professor in charge of this work, relating to experiments undertaken, scientific discoveries, the progress and treatment of the phylloxera, and other diseases of the vine, and such other useful information as may be given for the better instruction of viticulturists.

SEC. 9. The Board of Regents of the University shall be authorized to receive and accept donations of lands suitable for experimental vineyards and stations, and shall submit in their next report an economical plan for conducting such vineyard, and for the propagation and distribution of specimens of all known and valuable varieties of grapevines.

In accordance with the provisions of the above Act, growers and wine-makers are invited to send sample lots of grapes for analysis and experimental wine-making. As a rule each grape variety will be made into wine separately; the analysis of the must is made on the day of crushing, and will, if so desired, be at once communicated to the sender. That of the wine must, of course, be delayed until the latter has acquired a reasonable degree of maturity, after several rackings. But reports on special points that may be ascertained sooner, will be sent if desired.

Experimental blends will also be made, either in accordance with the request of growers, or such as examination or previous experience may seem to render desirable.

Ready-made wines or brandies of which the analysis or other examination is desired, will receive attention in the order of their receipt at Berkeley.

All work is, of course, done gratuitously, transportation charges being paid by the sender.

SUGGESTIONS TO SENDERS.

It is hardly necessary to say that, other things being equal, the larger the quantity of grapes worked, the more certainly and nearly will the result correspond to that which may be expected on the large scale. In the case of rare grapes, a few pounds, carefully treated, may be made to give fair results; but it is very desirable that the amount sent for experimental working should in no case be less than that which will yield five gallons of finished wine; say (considering the losses consequent from transportation, amounts required for analysis, frequent racking, etc.) 100 pounds; but twice that amount is preferable. Wine grapes, being usually very delicate, should be packed in small boxes of 20 to 25 pounds each, preferably with layers of grape leaves between; *not* packing paper, which causes them to mould. Owing to a neglect of this precaution, several of the wines made last season acquired a mouldy flavor. Be sure, also, to allow the grapes to cool before packing. Also, send promptly advice of shipment, whether by express or freight. Address, University of California, care of Professor Hilgard; if by express, to Berkeley; if by freight, to West Berkeley depot.

LETTER OF TRANSMITTAL.

President E. S. HOLDEN:

DEAR SIR: I transmit herewith a report on the work done in the Viticultural Laboratory of the University since the publication of the last report, in 1882; together with such other matter as, from its direct bearing upon viticulture, should be placed before those interested in this connection.

This report embraces, therefore, the viticultural work done for the seasons 1883–84 and 1884–85, together with such data and notes from that of the season of 1885–86 as can at this time be profitably given. It is well understood that judgment in regard to the character of wines cannot be advisedly passed until at least six months after the vintage, and in many cases even *that* may be reversed by later developments. It is not, then, desirable that reports should follow the vintage too closely.

In the present case, however, the delay in the publication of the two seasons' results is substantially due to the pressure of actual work, which rendered an earlier elaboration of the results impossible. Even at this time, much that should have been done in the way of comparisons and discussion must be laid over to a future report, from lack of the needful leisure. This results from the many and varied calls constantly made upon me, especially at this season. For many reasons, however, it seems important that the publication should not be longer delayed.

The nature of the case requires that in the presentation of the subjects discussed, not only must the data of the previous work be re-introduced to a considerable extent, but in order to facilitate comparison and understanding of the discussions, a not inconsiderable amount of repetition is required within the text itself, to avoid the need of continual cross-references, which few readers of the class most interested in this subject would be likely to follow.

Another feature of the report that may need some notice is the introduction of the documents relating to the unfortunate controversy which has arisen between my department and the State Viticultural Commission, in regard to the scope of the work to be pursued by each, and the use of the appropriation of $10,000 made, at the instance of the State Viticultural Convention of 1884, by the last Legislature. I think that justice to myself and the department under my charge, requires that this presentation of the case at least should be permanently on record, and that the issue should be fully understood by those interested in the viticultural industries of the State. Plainly stated, it involves the question whether the Agricultural Department of the University is to abdicate its practical work and usefulness in this branch of agriculture, into the hands of the Viticultural Commission, and to act simply as a subordinate to that body, in the way of making the analyses desired by it. This was the proposition made to the legislative committee by the executive officer of the Commission, as stated by himself; and it is the position into which it has since been attempted to

force me, in the various suggestions made by the Commission for the expenditure of the appropriation in question. It is hardly necessary to say that it is one which, personally, I cannot accept, nor do I believe that it would be consonant with either the functions or the dignity of the University.

Very respectfully,

E. W. HILGARD,
Professor of Agriculture.

BERKELEY, February 4, 1886.

I. GENERAL PART.

STATEMENT OF GENERAL OBJECTS AND PLAN OF WORK.

The general objects and plan of the laboratory work, hereinafter recorded, has been defined in previous reports, and prolonged experience has shown no reason for departing, in any material degree, from the views in accordance with which the work in the viticultural laboratory was begun in 1881; although additional matter has, as might be expected, come up for consideration as the work progressed. As the former reports, however, are likely not to be found in the hands of many who may see the present one, the essential portions of the definition of the scope and intent, previously given, are here reinserted by way of introduction:

The plan adopted in this matter is in conformity with my view, shared by the best vintners in the State: that among the first necessities of the present situation of California wines in the world's market, is the establishment of more definite qualities and brands, resulting from a definite knowledge of the qualities of each of the prominent grape varieties, and of their influence upon the kind and quality of the wine, in blending before, or as the case may be, after fermentation; of the treatment required by each in the cellar, during the time of ripening; and finally, of the differences caused by difference of location, climate, etc., as well as by different treatment of the wines themselves.

Heretofore, in the great majority of cases, the whole subject of qualities and brands has been in the hands of the wine dealers, who received from the producer indefinite qualities and quantities of wines made from unknown mixtures of grapes, and had to be governed almost alone by their taste in the important matter of making blends adapted to the taste of wine consumers. That under these circumstances the result should not have been altogether a happy one, or most favorable to the market value of California wines, is not surprising. When the fermentation is once over, the most important period in the life of wines is past; and the corrections that can be made afterwards, by the mere blending of ready-made wines, is like the education of a human being after the golden time of youth has passed unimproved. Something can be accomplished even then, but the best possible results are rarely attained; and in order to cover the defects as much as possible, artificial aids and high-pressure methods are employed. Thus far the reputation of purity—of containing nothing that is not of the grape—has been the preëminent virtue of California wines, which has covered a multitude of sins committed in their preparation. It is to be hoped that wine-makers will see to it that this reputation shall continue to be deserved, and that hereafter, their product shall be of such quality as not to be ashamed of its birthplace, or to stand in need of borrowing either foreign labels, names, or flavors.

To this end, a definite knowledge of the character and special wine-making qualities of each kind of grape serving in the preparation of wine, is indispensable. In the wine-producing countries of Europe this knowledge has been acquired by long experience; and chemical investigation has subsequently in a great measure ascertained the natural conditions upon which the attainment of certain results in wine-making depends. The principles thus evolved can be applied to new conditions, such as those existing in California, and thus save to a great extent the laborious and costly experimenting which has been gone through heretofore, by formulating into generally intelligible rules the knowledge which otherwise usually remains the trade secret of a few experts.

The first step to such knowledge is to obtain a definite idea of the material to be treated; and curiously enough, however numerous are the analysis of ready-made European wines already on record, there are comparatively few cases in which the must from which they were produced was also investigated in so definite a manner as to lead to broad generalizations. Clearly, what is needed is that first the must, and then the corresponding wine of the more important grape varieties, should be made the subject of detailed investigation, and that the wine should have been produced from the must under definite, or definitely varied conditions, with absolute certainty of the purity of materials, as well as of the precise manner of operating in each case. This cannot, as a rule, be depended upon

in large wineries, where the exigencies of the supply, pressure of work and weather, the necessary employment of raw hands, and above all, the necessity of yielding to financial considerations, imposes limitations and uncertainties that can but rarely be controlled at will. When this *can* be done, the large scale experiments are of course by far the more decisive and cogent, and of the greatest practical value.

In an experimental laboratory, the quantities operated upon are of necessity relatively small; and it is highly important that allowance be made for this circumstance, as well as for other points in which the "wholesale" practice must always differ from the small-scale one. For instance: the management of the temperature of the fermenting room is easier in a large winery properly constructed, than in a small experimental room and with small quantities of must, which are very quickly affected by changes of temperature such as would have remained unnoticed and without influence upon the great masses in the winery. This difficulty is very apparent in the record of the course of temperatures in fermentation.

Nevertheless, we are thus enabled to obtain a very close estimate of the results obtainable from a given grape-variety on the large scale, and of the part that each will play when blended either before or after fermentation. Few grape-varieties will, like the peerless Riesling, by themselves produce the best possible product. The art and science of blending is scarcely second in importance to the possession of good raw materials, soils, and climates; and while its last refinements depend upon a corresponding refinement of individual taste and judgment, there is a large part of it that can be intelligibly codified, thus preventing a waste of good materials upon unmerchantable wines.

Even the most cursory consideration, however, shows that this cannot be the work of one or of even a few years; but, like all other agricultural experiences and experiments, must be extensively repeated in order to become the basis of general practice. The same grape-varieties grown in different localities and in different years will differ materially in their composition; and it is only by extended comparisons of these through a number of years that the accidentals can be definitely segregated from the essentials. Hasty generalizations, based upon limited experience, are the bane of all experimental work, especially in agriculture.

While then the following record and discussion furnishes a basis of definitely ascertained facts regarding some of the more prominent varieties of wine grapes now produced in California, it cannot pretend to do more than furnish useful suggestions, to be tested by practice, and if the means for the continuation of the work be furnished, to be farther pursued and enlarged in our laboratory.

It should be fully understood and remembered that while peculiarities and defects shown by analysis are perfectly definite indications as to the conditions that *must* be fulfilled in a successful blend, yet analysis cannot as yet take cognizance of the delicate and almost intangible flavors or "bouquets," which must likewise be made to harmonize, in order to satisfy a cultivated palate. To that extent the determination of the proper blends must always remain with the expert wine-taster, but the work of the latter is immensely facilitated by being informed, through the analysis, of the prominent chemical peculiarities, which in any case must be taken into consideration, and which ordinarily are left to laborious and more or less blind guessing or experimenting.

Practically, the plan of work adopted is as follows: To make of each kind of grape, not less than seven gallons each of white, and of red wine; that is, of wine fermented on the skins for a suitable length of time, as well as such resulting from must freshly pressed. In the case of white grapes, this, of course, alters but little the ultimate tint of the wine, but imparts to it a larger amount of acid, of tannin, and of "body," or extractive matters; while in that of black, or colored grapes generally, the color extracted from the skins is added to the above ingredients, forming properly "red" wines. The difference, however, extends far beyond the mere extraction of the substances preëxisting in the grape; since especially the presence of the acids of the skins influences very powerfully the formation of the specific aromas, or "bouquet" of high flavored wines.

The above mentioned seven gallons of each kind of must, or wine, are divided between a five and a two-gallon demijohn, for the first or violent fermentation; while for the second or after-fermentation, after racking off from the lees, the five-gallon vessel, filled full, serves as the permanent receptacle. A constant daily record is kept of the temperature, condition, etc., of the wine as its fermentation progresses; the temperature of the cellar being kept, as steadily as possible, between 60° and 65° Fahr., up to the time of the first racking off.

The fresh or white wine must, the murk or red wine must pressed after the first fermentation, and finally the finished wine, are each subjected to analysis; the several wines being also ultimately tasted and their qualities recorded.

The plan outlined above has been pursued up to the present time, with some modifications suggested by experience, or rendered necessary by the pressure of work. As grapes of well known special adaptation to red or white wines came under treatment, the making of *both* kinds from *each* variety was omitted, so as to give more time and space to other work. Moreover, as time progressed, it became evident that the use of demijohns is undesirable whenever it is desired to observe the development of the wines

with age; not only because this development is very slow, but also because, despite all watchfulness, bursting by gas pressure from the inside would frequently occur, causing unfortunate losses.

In pursuance of these views the vintage work of 1884 was conducted altogether in kegs, mostly furnished by the Natoma Water and Mining Company, for use in connection with the working of the numerous important grape varieties furnished by them, for experimental wine-making. The first part of the after-fermentation was thus very successfully carried out; but it soon became apparent that the staves of the kegs furnished were too thin, and allowed undue access of air through their pores, resulting in the appearance of an acetous taint in some of the wines. There being no means available for the purchase of kegs of proper thickness in the staves, the original kegs were covered with a thick coat of refined paraffine, which at once stopped the excessive evaporation and aeration.

Much of this difficulty was obviously due to the changes of temperature, which, with all possible care, it was impossible to avoid in the small, thin-walled storage room, which then, as now, formed the only available space for these experiments. Had a well-walled underground cellar been at command, the greater part of the damage would doubtless have been avoided, even in the thin kegs.

During the vintage work of 1884, the lack of space and proper conveniences for the viticultural work, on a scale commensurate with the importance of the objects of the same, became glaringly apparent. The details of the building and arrangements which could be made on the basis of the original appropriation of $3,000, made for the purpose in 1880, have been given in a previous report (1882), and are again set forth in the report of the Committee of the Viticultural Convention in 1884, which is given in full below (p. 20). Considering the miscellaneous uses to which both the fermenting and storage rooms had to be put under the pressure of vintage work during the daily arrival of fresh lots of grapes, and the lack of sufficient help to keep everything in proper condition alongside of the current work, it is surprising that so many sound wines were made as appeared in the exhibit of the University laboratory, at the Convention held at San Francisco during the first week of December, 1884. This exhibit led the Convention to inquire what were the facilities afforded for this work by the State; and the report of the committee appointed for the purpose by the Convention was unanimously adopted. This report, after reciting the state of things, recommended that an appropriation of $10,000 be asked of the Legislature for the purpose of creating at the University a viticultural laboratory, corresponding to the importance of the work it had to do for viticulture in the State.

The subsequent history of this appropriation is in a great measure a matter of public notoriety, and need not be recited here in detail. The appropriation was made at the legislative session of 1885, but through the insertion of a clause placing it under the "joint control" of the Board of Regents of the University of California and the State Viticultural Commission, a question as to the intention of the Legislature in respect to its use became possible; and the failure of the two bodies concerned in the matter to agree upon its proper use during 1885, threw the vintage of that year upon the same inadequate resources that had partially baffled the work in 1884.

During the latter season, the laboratory had the benefit of the volunteer services of the distinguished wine expert, Mr. F. Pohndorff, and his son,

Mr. F. Pohndorff, Jr.; also, toward the end, for one month, those of Mr. Geo. E. Colby, who was employed for the purpose by the State Viticultural Commission; and without this help, it would have been impossible to carry the work to its measurably successful issue. In 1885 it was aided by the special appropriation made for working expenses by the Legislature of 1885, that allowed not only of an increase and improvement of appliances, but also of the permanent employment of Mr. Geo. E. Colby, as second assistant. We were still confronted by the impossibility of accommodating the vintage of 1885 in a storage room already occupied by the products of three previous vintages; but this obstacle was fortunately overcome by the permission granted of storing such wines in the basement of another building. Under these circumstances it became possible to handle the vintage of 1885 to some advantage. A new outfit of thick-walled kegs having been procured, together with a special chamber for the temporary storage of grapes as they arrived, and some other facilities, a measurably successful season's work has been done for 1885. Some preliminary statements regarding the same are given at the end of the present report, and such of its results as have direct bearing upon previous work are interwoven in the text. As progress is made in the elaboration, the results will be published in bulletin form, prior to their appearance in the annual report for 1886.

Throughout our work, the inadequacy of the scale upon which it has thus far been necessary to conduct it, has become more and more apparent. Small quantities of wine are too easily influenced in their character and development by slight accidental circumstances, as well as by some which, in the nature of the case, it is almost impossible to avoid. Among the latter is the "woody" taste likely to be imparted to them when the inner surface of the containing vessel bears such a large ratio to the contained fluid; an influence which in the course of time becomes less and less apparent in the same casks or kegs when due care is exercised, but is still liable to influence unpleasantly the more delicately flavored wines. The relatively larger surface offered by small packages as compared with larger ones, also implies a proportionally greater ullage-loss, and much trouble in the often repeated filling-up, for which it is difficult to keep proper material on hand. Wine kept in bottles or vials for this purpose always differs materially from that treated in kegs, and there is danger of disturbing the normal development of the latter by the addition of the former. Hence, as heretofore mentioned, the ordinary filling-up has preferably been done by the addition of carefully cleaned fragments of Folsom granite.

In working with small quantities there also arises great difficulty in finding vessels of just the right size to be filled by the odd remnants from racking and sampling, since, from the very smallness of quantities at command, it becomes important not to lose any available part thereof. Finally, a very slight amount of acetification or other injurious change that may occur near the bunghole or at a minute leak, will quickly become a matter of serious moment in a package of a few gallons, while it would have remained imperceptible in one of twenty gallons or more. It seems very desirable that hereafter twenty gallons, or a half barrel, should be considered the unit amount, instead of five gallons, as has mostly been the case heretofore. This involves, of course, not only the treatment of larger amounts of grapes—say four hundred pounds instead of one hundred—but also larger spaces both for fermentation and storage, than have been at command heretofore. That the storage space should also be better secured

against changes of temperature, has already been alluded to; hence a large and entirely subterranean cellar is among the first needs of the laboratory, which, it is hoped, may be secured in time for the vintage of 1886. The temperature of such a cellar will also, in the climate of Berkeley, be sufficiently uniform to allow of very definite experiments on the influence of the several methods of fermentation on wines, on a scale that will render the results directly available for practical purposes.

It may be asked why such experiments would not be as well, or even better, made in wineries themselves. The reply is that in wineries where the operations are of necessity conducted with a view to profit, and where experimentation is only a collateral object among the great mass of material under treatment, not only is the proper control of the surrounding conditions rendered impracticable, but the accidental interference of persons not cognizant of the nature or importance of the experiments, is most difficult to avoid. Hence such experiments reported from wineries are almost always uncertain in demonstrating what they were intended to show, and frequently give rise to incorrect conclusions, from the unknown intervention of conditions not taken into account in the experiment. The careful sifting of the evidence which is possible in a laboratory, often enables us to determine in one year, points that otherwise, amid the conflicting evidence derived from inaccurate observation and control, could not be settled in a number of years. In this respect viticultural experiments do not differ from those in other branches of agriculture.

However individual opinions may differ in respect to the hygienic and ethical features of the use of wine, there can be no question of the obligation imposed upon the University, by the acceptance of the national donation for the establishment of a College of Agriculture, to give due attention to viticulture and wine-making as a branch of agricultural industry of rapidly growing importance. The special legislation existing on the subject, and under which the work herein reported has been done (see above), merely strengthens this particular branch but does not create it. Even in the absence of such legislation, it would be incumbent upon the Agricultural Department of the University to teach the science and practice of viticulture, and to contribute to its development by experimental research.

It is, perhaps, scarcely necessary to state that while, in accordance with the provisions of the law, instruction in the science and art of wine-making is given to those desiring it, yet the wines made or received for examination are rigorously reserved for the purposes defined by the law, and that neither students nor other persons can obtain them for any other purpose. Reports to the contrary that have been circulated, whether by word of mouth, or through the press, are simply and unqualifiedly untrue.

Outside of the work in the Viticultural Laboratory itself, a series of investigations on the subject of the phylloxera, begun long ago when acting in the capacity of viticultural assistant, have been continued by Mr. F. W. Morse, assistant in the General Agricultural Laboratory. Having, besides, been frequently detailed for field examinations regarding this dangerous insect, at the request of the Viticultural Commission, and having been employed by the latter during most of the University vacations for the same purpose, Mr. Morse's experience in this matter is preëminent, and his observations deserve full confidence. I have thought it best to add to the present report a full account of the observations made by him up to this date, together with the results of an investigation on the subject of the mercurial remedy for the phylloxera, that has occupied a good deal of time during the autumn just past (1885), somewhat to the detriment of the

general work. The intrinsic importance of the subject, and the interest excited by its discussion in the public press, seemed to justify this departure from the usual routine.

A self-explanatory document, printed at the time by order of the Board of Regents, is appended to the report of this work:

REPORT OF A COMMITTEE APPOINTED BY THE STATE VITICULTURAL CONVENTION, HELD AT SAN FRANCISCO, DECEMBER 1 TO 6, 1884, RELATING TO THE WORK DONE AT THE VITICULTURAL LABORATORY OF THE STATE UNIVERSITY.

The Viticultural Convention appointed a committee to investigate the facilities at the University for such work, and to make such recommendations in connection therewith as seemed fitting. The committee visited the University on Friday, December fifth, and their report, offered on Saturday, was unanimously adopted. The report is as follows:

To the State Viticultural Convention:

Your committee appointed to visit the University of California, at Berkeley, and inspect the experimental viticultural work there in progress, and report on the same, beg leave to submit the following as their report:

There have been made, during the present season (1884), ninety-six (96) different tests of wine and blends. In previous years forty-four (44), so that there are now on hand, one hundred and forty (140) different experimental varieties to be treated, observed, and recorded. Of those of previous years, careful analyses have, in most cases, been made, and results have been published in the periodical bulletins of the agricultural experiment station, University of California. Of the test of this year, the analytical work yet remains to be done, and it will require six months constant labor of an expert, to perfect the results which are needful to complete publication of detailed information to viticulturists. This work has been done, and is being prosecuted with a grievous lack of suitable facilities, and it is to us a matter of great astonishment that so much has been accomplished in spite of such obstacles.

The room for fermentation purposes we found to be only eighteen (18) feet square, and a room of the same size has to serve the purpose of cellar to hold all the one hundred and forty (140) kinds of wine now being treated.

Few conveniences exist for the work in these ill-furnished and crowded rooms, no facilities exist for controlling temperature, except such as have been improvised by the introduction of coal oil stoves and one coal stove.

There is a great lack of suitable apparatus, books of viticultural authority, and, in fact, all perfected appliances properly considered needful accessories of such delicate work. Nothing but the skill of the Professor in charge, and the enthusiastic devotion of his assistants, and voluntary aids, have made it possible to present to this Convention the results which we have all witnessed with so much satisfaction and benefit.

So auspicious a commencement of a most valuable auxiliary for the intelligent development of the viticultural interests of the State, demands at our hands something far more than a complimentary recognition. This work should go on, and should be broadened in its scope, so that the experimental and test viticultural work of the whole State may here find prompt and adequate treatment.

Many thousands of dollars would have been saved to the vineyard planters, and the interest have been proportionally advanced, could they have had access, at the time of their planting, to the results of the tests made during the present year at the University's "apology" for a Viticultural Laboratory.

And this is but a commencement of the needful work, for, year by year, the requirements of such aids to our viticultural work will increase; so that it may fairly be said that such a laboratory, properly constructed and equipped, and skillfully conducted, will be most powerfully instrumental in the intelligent, permanent, and profitable development of our vineyard interest, which properly fostered may be safely counted on as the most promising and important interest in the State.

We therefore deem it urgently important that this Convention take measures to exert all its influence for the procurement, from the next Legislature of the State, of an appropriation for the construction, equipment, and maintenance of a suitable "Viticultural Experimental Laboratory," to be connected with the "Agricultural Department of the University of California," and operated by its Professor and his assistants, in coöperation with the Viticultural Commission of the State of California. And to that end we present the following resolution, the passage of which by this Convention we earnestly recommend:

Resolved, That the viticulturists of the State of California, in Convention assembled, hereby respectfully request of the honorable Legislature of the State of California, that it will cause to be appropriated, by the State, the sum of ten thousand dollars ($10,000) for the construction and equipment of a suitable "Viticultural Experimental Laboratory," in connection with the "Department of Agriculture of the University of California," to be operated under the charge of the Professor of the said "Department of Agriculture" and his assistants, for the benefit and advancement of the viticultural interest of this State—and for the maintenance of said laboratory, to pay for necessary services of duly

qualified assistants to perform the detail work thereof, we request that an annual appropriation of not less than three thousand dollars ($3,000) be made, said appropriation to be specifically and solely for the use of said "Viticultural Experimental Laboratory." And we further recommend that a committee of five (5) suitable persons from its members be appointed by the Chairman of this Convention to take charge of the foregoing resolution and to urge upon the Legislature the passage of such appropriations.

HORATIO P. LIVERMORE,
E. W. MASLIN,
J. B. J. PORTAL,
DR. J. D. B. STILLMAN,
JOHN T. DOYLE,
Committee.

On motion, the above committee was also constituted the Committee on Legislation, called for in the above report.

A clause of the general appropriation bill of the legislative session of 1884:

For experimental and analytical viticultural work, under the joint control of the Board of Regents of the University of California and of the State Board of Viticultural Commissioners, ten thousand dollars.

With a view to determining the action to be taken under the above clause, there was appointed by the Regents of the University, the following Committee of Conference: George J. Ainsworth, J. West Martin, J. L. Beard.

A similar committee, appointed by the Board of Viticultural Commissioners, consisted of Messrs. A. Haraszthy, C. A. Wetmore, Charles Krug, J. De Turk, George West.

No agreement having been reached at a joint meeting of these committees, held at the University in June, 1885, it was suggested that written statements of the several plans proposed should be submitted to the Board of Regents at their next meeting. These statements, accompanying the report of Regents' Committee, are given below:

[Extract from Proceedings of the Board of Regents of date of May 23, 1885.]

REPORT OF COMMITTEE ON VITICULTURE.

SAN FRANCISCO, May 23, 1885.

Honorable Board of Regents:

GENTLEMEN: We present herewith the recommendations of Professor Hilgard and of Mr. Wetmore as to the best manner of expending the ten thousand dollar appropriation made by the last Legislature for viticultural purposes under the joint control of the Board of Regents and of the Viticultural Commission, recommending the approval of Professor Hilgard's recommendation.

GEO. J. AINSWORTH.
J. WEST MARTIN.

COMMUNICATION FROM C. A. WETMORE.

SAN FRANCISCO, May 20, 1885.

GEO. J. AINSWORTH, ESQ., *Chairman Committee of Conference, Board of Regents, State University:*

DEAR SIR: In accordance with the request of your committee, I have the honor to submit a brief statement of the proposition, suggested by the Viticultural Commission, as to the manner of exercising joint control of the appropriation made by the Legislature for "viticultural, experimental, analytical, and scientific work," etc.

Our proposition in substance is to provide for the execution of the work intended, under the joint direction of those connected with our two institutions who have the most immediate charge of the studies, investigations, and popular instruction, which are to be facilitated by the proper use of the funds under joint control, so that each department may derive the greatest possible benefit therefrom, consistent with the public interest in the work to be performed.

To this end we suggest that the Board of Regents appoint, on behalf of the University, the Professor of Agriculture and the Professor of Chemistry, to unite in counsel and direction with the President and the Chief Executive Officer of this Commission, with full authority to perform "viticultural, experimental, analytical, and scientific work," and to

provide such accommodations and apparatus, and to employ such services as may be required, within the limits of the joint appropriation, each institution being free to make such use of the results of such work independently for their several independent purposes according to their individual judgment.

In order to provide for entire harmony of administration in using these funds, this Commission is willing also that a fifth person, duly qualified, shall be either selected by the gentlemen already mentioned, or shall be jointly appointed by the Boards of our two mutually interested institutions, or by the Governor of the State, to unite in the work of counsel and direction of the work to be performed.

This Commission, however, is quite willing, if the Board of Regents so prefer, to intrust the entire work, without the selection of an intermediary fifth person, to the officers and professors first mentioned, all of whom have heretofore mutually consulted, and are even now, through the efforts of this Commission, working together in a common cause.

We presume, therefore, that your Board will find no difficulty in deciding with us to whom to intrust the work to be performed.

As to the scope of the work, that might be left to the judgment of those appointed to direct the operations, with the understanding that each department is free to form such opinions and draw such conclusions, as individual judgment may require for the separate uses of the Commission and the University.

Recognizing that one of the leading objects of this work is practical and technical instruction, as well as also investigation of different methods known to the art of vinification, for the special advantage of practical men engaging in an industry with which experience has not made them familiar, or in which they encounter new questions growing out of new circumstances, our Commission has called your attention to the very great importance of conducting the experimental operations, and prescribing the products for exhibition and study under the control of a competent cellar-master in the City of San Francisco, where suitable accommodations may be leased for the purpose, and we equally recognize that work of purely analytical nature can best be conducted at Berkeley.

The University and this Commission have each their independent appropriation for their separate uses, which will enable them to make such independent use of the information to be derived by joint experimentation, as they may think proper. The experimental cellar would produce authentic samples for analytical work at the University, would assist the professors in acquiring much needed information connected with scientific researches, and would afford a good opportunity for students to witness practical cellar operations, whenever desirable, in connection with theoretical studies pursued at Berkeley.

The cellar will also enable this Commission to demonstrate the relative merits of different methods of practical fermentation to those who desire such information, and to give such knowledge as is necessary in giving to the public rules for practical use; we shall, also, be enabled, through the aid of the cellar-master, to give simple instruction to beginners in the ordinary appliances and methods of wine making, and through his assistance, also, to preserve and compare for mercantile uses, samples of our native products, together with those of other countries with which we may be in competition. By such mutually coöperative action on the part of this Commission and the University, there need be no confusion of effort, proper distinctions being made between the elementary instruction of students in sciences valuable to the viticulturist, original scientific investigation, and purely technical knowledge, and experimentation for practical uses.

Your Board is, therefore, invited to the consideration of two simple propositions, viz.: *First*—The placing of the direction of the experimental work under the Professors of Agriculture and Chemistry of the University and the President and Executive Officer of this Commission, together with a fifth person, jointly agreed upon, if desired. *Second*—The location of the experimental cellar and cellar-master in the City of San Francisco.

Respectfully submitted for the Committee of the Viticultural Commission.

CHAS. A. WETMORE, Chairman.

Communication from Prof. E. W. Hilgard.

BERKELEY, May 13, 1885.

GEO. J. AINSWORTH, *Esq., Chairman Viticultural Committee of the Board of Regents:*

DEAR SIR: In accordance with your instructions "to prepare a brief statement of the reasons why the viticultural work provided for by the appropriation of $10,000 should be done at the University, and not at San Francisco as proposed by the Board of Viticultural Commissioners," I respectfully submit the following considerations:

First—The work which prompted the call by the Viticultural Convention for this appropriation was done at the University, and the resolutions clearly and pointedly state that the enlarged facilities for its continuance and enlargement are to be provided at the University.

Second—Such provision forms a necessary portion of the means for accomplishing the ends for which the Agricultural College was established.

Experiment station work is more and more coming to be considered as an indispensable adjunct to the directly educational work of the colleges, and is now in progress at every one of the colleges based upon the national land grant, so far as their means permit. Farms, orchards, and vineyards, for illustrative and experimental purposes, are connected with all those so located as to render it feasible.

It is and has been a matter of great regret that our institution is not in the latter cate-

gory; and this fact has led to a great deal of bitter criticism on the part of the agricultural population. It is notorious that the experiment station work, inaugurated and carried on in accordance with my recommendation, has been powerfully instrumental in quieting this opposition; since while we are not given the opportunity to instruct many students in agriculture, such useful instruction has, through the experiment station work, been extensively given to farmers at large.

Third—If, then, we are admittedly deficient in the means of practical demonstration and experiments in general farming, it is the more necessary that we should have such means in whatever branch they are attainable. This is preëminently the case in respect to wine making, which can readily not only be illustrated, but actually taught in an experimental cellar on a moderately adequate scale, in connection with the instruction in the sciences pertaining to the subject. We are now offered the means and opportunity for doing this; and if it should be allowed to escape us, the time for the establishment of such a cellar and laboratory would simply be deferred, and demands for it would come before future Legislatures. The Agricultural College of the State cannot permanently resign to other hands that which it is its natural province to do, viz.: to give practical as well as theoretical instruction in that branch of agriculture which is likely to become the overshadowing interest in the State.

But in addition to the inherent merits of the case, there is an Act of the Legislature which distinctly recognizes the need of such instruction and experimental work, and very specifically imposes certain duties upon the Regents and the Professor of Agriculture. The following are the points of the law under which we have been acting for nearly five years past:

"It shall be the duty of the Board of Regents of the University to provide for special instruction to be given by the agricultural department of the University, in the arts and sciences pertaining to viticulture.

"In the theory and practice of fermentation, distillation, and rectification, and the management of cellars, to be illustrated by practical experiments with appropriate apparatus.

"Also, to direct the Professor of Agriculture, or his assistant, to make personal examinations and reports upon the different sections of the State adapted to viticulture. To examine and report upon the woods of the State procurable for cooperage. To make analyses of soils, wines, brandies, and grapes at the proper request of citizens of the State.

"The Regents shall also cause to be prepared, printed, and distributed to the public quarterly reports of the professor in charge of this work, relating to experiments undertaken, scientific discoveries, the progress and treatment of the phylloxera and other diseases of the vine, and such other useful information as may be given for the better instruction of viticulturists."

Another article provides for the establishment of experimental vineyards, under the direction of the University.

This law, now in force, has been complied with to the full extent of the means provided, and the appropriation now under discussion was made clearly in view of this law, which was read before the Viticultural Convention by the Chief Executive Officer, Mr. Wetmore, at the time when the resolutions, subsequently adopted, were under consideration. It is not easy to see how the University can divest itself of the obligations thus imposed, by the proposed surrender of the work to the Viticultural Commission.

Fourth—The proposed establishment in the City of San Francisco would not only lack that permanency which the acceptance of the national grant has inalienably imposed upon the State in the case of the College of Agriculture, but it would be practically useless so far as the educational and experimental purposes of the University are concerned. So far as any joint control goes the daily duties of the two University professors, who are proposed as two of the Directors, confine them so closely to the University that the work in the city would be practically in the hands of the Viticultural Commission alone. My experience in connection with the late Board of Silk Culture has taught me the uselessness of attempting to exact any close supervision of any concern located in the city, and I should respectfully decline to assume any such responsibility in matters where my professional reputation is involved. Admitting all the practical ability of the Commission members as wine-makers, I cannot concede to them, or to a cellar-master employed by them, the habit of close and accurate observation necessary in systematic investigation of such delicate and complex subjects, involving some of the most intricate problems of chemistry and physics, even as concerns the proper observance of external conditions. If any proof of this were needed, my experience of the past few years has amply taught me the need of the daily and hourly supervision of every detail, in order to secure reliable results. I cannot afford, and the University cannot afford, to subscribe to and be responsible for results obtained outside of such close professional supervision.

Fifth—It is not denied that such an establishment as is proposed by the Viticultural Commission would be very useful in its sphere, and that a sum of money would be very properly devoted to such purpose; and furthermore, I may say, both for myself and for my colleague, that all the aid we could give it would be most freely given, not only directly in the way of suggestions, analyses of products, etc., but also in carrying out at the University laboratories any experiments desired by the Commission that would require means and appliances not at their command. Such coöperation has heretofore been freely offered, although only very partially utilized, viz.: in the matter of examinations respecting the phylloxera. I am unable to see why such coöperation cannot be enlarged to the full extent to which it can benefit the general interest, without crippling either of the working bodies. The latter would be the condition of the University Viticultural Laboratory if

the proposition of the Commission were acceded to, for it would not only be unable to receive the students now actually applying for instruction therein, but would also, for want of cellar room, be unable to carry on the experimental work during the coming vintage. The large appropriation, $30,000, at the command of the Commission, seems to render such a state of things uncalled for, to say the least; nor would it in any respect conform to the expectations of those through whose influence the appropriation now under discussion has been obtained.

Respectfully,

E. W. HILGARD,
Professor of Agriculture.

On motion, duly seconded, the plans proposed by Professor Hilgard were adopted by the Board of Regents.

WINE FERMENTATION.

It is admitted on all hands that the period of fermentation is the most important one in the life of wines, and that whatever may be the excellence of the grape used, the quality of the wine may be made or marred in the management of its fermentation—that portion of it known as the violent fermentation being of predominent influence. A brief statement of the main points involved in this important process is the more called for, as much discussion, and not a little wild and random enunciation on the subject has occurred in this State during the past two years. We should not cut loose from the long and dearly-bought experience of the past, and hastily adopt practices derived from one-sided hypotheses, based upon a few ill-devised and inconclusive experiments.

The Several Fermentations.—That the *vinous* fermentation is characterized by the transformation of sugar into about equal proportions of alcohol, which remains in the fermenting mass, and of carbonic acid gas, which escapes, and causes the "boiling" and sizzing of the fermenting liquor, are matters of common note. It is also now pretty commonly understood that there are several other kinds of fermentation, yielding different products. Among these, those of chief importance to the wine-maker are the *lactic*, the *butyric*, the *mucous*, and the *mannite* fermentations, in which sugar is transformed, respectively, into lactic acid (the acid of sour milk), butyric acid (that of rancid butter), a mucilaginous substance resembling gum, and mannite, a non-fermentable sugar of purgative, medicinal properties; and the *acetous*, in which alcohol is further transformed into acetic acid or vinegar. One or several of these processes often seriously injure the quality of wines, and their occurrence must be avoided as much as possible. Hence the conditions that bring them about should be fully understood.

As regards the four first mentioned—the vinous, lactic, butyric, and mucous fermentations—it is well understood that their occurrence is conditioned upon the presence of certain minute vegetable cells, known in general as *ferments*, and in the case of the vinous fermentation, more especially designated as *yeast;* and it is furthermore well established that the predominance of certain physical conditions apart from the presence of the specific ferments or germs, tends to promote one or the other of the above kinds of fermentation, or what is equivalent, the development of its peculiar ferment. Chief among these controlling conditions, are: First, the *temperature;* second, the greater or less *acidity* of the fermenting liquid. A necessary condition of *all* is the absence, or presence in minute quantity only, of such substances as are commonly known as disinfectants, or antiseptics,

and poisons. Such substances (arsenic, chlorine, sulphurous gas, carbolic, salicylic, boracic, sulphuric, and other strong mineral acids, also strychnine, morphine, and related poisons, etc.), not only arrest the action of the ferments, but, according to circumstances, may completely kill them, so as to render them incapable of reviving their action even in an uncontaminated fluid or mass.

It should be remembered in this connection, that alcohol itself is one of the substances which arrest fermentation; hence its use in preserving fermentable substances, as in the case of brandied fruits, alcoholic specimens of animals or their parts, and the like; and hence, also, the practically important fact that the vinous fermentation arrests itself so soon as the alcohol formed rises to from 15 to 16 per cent (by volume) of the fermented liquid, the possible maximum varying somewhat with the temperature at which the fermentation takes place, and with the presence or absence of other substances that influence fermentation. Hence the alcohol-percentage of unfortified wines can never exceed a certain, slightly variable, maximum; hence also, fermentation can be stopped at any time, by the addition of as much alcohol as will raise the contents of the liquid above such maximum; as is done in the manufacture of ports and some sherries, the alcohol-percentage of which ranges from about 18 to 24 per cent. The other fermentations above referred to are similarly arrested by the presence of a large proportion of alcohol; hence, wines naturally strong, or fortified, are thereby preserved, not only from a recurrence of the alcoholic fermentation, but also from the others which, in weaker wines, constantly threaten their permanence and quality.

Wines naturally possessing such alcoholic strength are, however, the exception, although more common in California than elsewhere, outside of the Mediterranean countries. It therefore becomes necessary to consider what other conditions influence the keeping qualities, both during and after fermentation.

Ingredients of Must.— Besides the two prominent ingredients, namely water and sugar, must contains in smaller, but very variable proportions, other matters of which those that greatly concern the wine-maker are the following: Bitartrate of potash (argol, or when pure, cream of tartar), tartaric acid, malic acid. These are usually, when stating the analysis of a must or wine, given under one head, referred to tartaric acid only (in Europe sometimes to sulphuric acid), in tenths of per cent or "pro mille;" from three to six pro mille being the usual amounts in ripe grapes, although in some years it may rise to eight and even ten.

Besides the acids, the must contains at least two other classes of important substances, which together constitute the main part of the "body" or "extract" of wine. Without going into details, these ingredients may be classed under the heads of "albuminoids" or substances resembling flesh, white of egg, etc., and gummy matters, or those belonging to the same class as starch, sugar, and the vegetable jellies. Of these the former are usually present in minute quantities only (one to three pro mille of the must); but their presence is of the highest importance, inasmuch as they enter largely into the composition of the yeast cells, without which fermentation can not take place. Their presence *to a certain extent* is therefore highly essential to fermentation; but after this is completed, whatever remains over constitutes a grave danger to the stability of the wine, these substances being themselves very unstable. They should therefore be gotten rid of as much as possible. Some of the "gummy" class, likewise, are very easily changeable, especially under the influence of the air. These, also, should be got-

ten rid of as soon as practicable, whether before or after fermentation; they always form a greater or less proportion of the lees.

When air is allowed to bubble through freshly pressed and filtered must, the clear fluid becomes turbid and a brownish sediment, consisting of the above two classes of substances, gathers in flocks. Such aerated must ferments more quickly and completely than must not so treated, and the wine clears quicker and keeps better. But when no such treatment has been given, these substances come down gradually during the after-fermentation and racking, when air comes in contact with the wine to a greater or less extent.

Constituents of Wine.—The changes wrought in must by fermentation may be thus summed up:

The *sugar* is transformed, on an average, into—

Alcohol	48.4 per cent.
Carbonic acid gas	46.6 per cent.
Glycerine	3.3 per cent.
Succinic acid	.6 per cent.
Yeast ingredients	1.2 per cent.
	100.0 per cent.

It will be noted that the alcohol in the above statement amounts to somewhat less than half the total sugar: but in the usual mode of stating the alcoholic contents of wines (by "volume"), it may be pretty closely taken at one half. The gas and yeast are in the end eliminated entirely from the wine. The rest, of course, remain, the glycerine exerting a marked influence upon the "body" and "smoothness" of the wine; while not much is known as regards the office of succinic acid, which has faintly acid, slightly pungent taste.

As regards the *acids*, they are almost always found sensibly diminished at the conclusion of a healthy fermentation. This arises mainly from the throwing down of the tartar or argol with the lees by the alcohol, in which it is difficultly soluble. Malic acid is also changed into succinic acid. So soon, however, as the after-fermentation approaches its end, the acid again begins to increase, in consequence of the action of the air, which, apart from other influences, constantly tends to transform the alcohol into acetic acid or vinegar. In the large-scale production of red wines especially, the acid is very commonly found to be increased instead of diminished at the end of even the violent fermentation; and this is usually traceable mainly to the formation of acetic acid, which, however, should not exceed a few tenths of a "pro mille" in perfectly sound and well made wines. The amount of acid to be desired in wines varies somewhat with their character, but in general should not fall below 4, nor rise much above 6 pro mille.

The *body* or *extract* of perfectly dry wines (*i. e.*, those containing no residue of sugar), ranges from a little over 1 in the lightest white wines to a little over 3 per cent in the heaviest reds. A portion of the substances classed under this head always, of course, consists of glycerine. In sweet wines the solid contents, including sugar, range all the way from 4 to as much as 24, and even 39 per cent; 5 to 6 being what is usually found in ports and sherries, 14 to 15 in Angelica.

The *odorous ingredients* of wine are, with one exception, present in such minute quantities that chemical analysis can only partially determine even their nature, much less their quantity. Their appreciation and distinction, however important and decisive as to the estimation in which the wine is held, belongs exclusively to the province of the taster. The exception

referred to is that of the "oil of wine" (œnanthic ether), which imparts the "vinous" flavor, and is prominent in Cognac brandies. It is the "fusel oil" of grape pomace. In "pricked" wines, acetic ether also becomes prominent, so as to be quantitatively determinable.

CIRCUMSTANCES THAT DETERMINE THE SEVERAL FERMENTATIONS.

Outside of the presence of the specific ferments belonging to the several fermentations, and of the materials upon which their life depends, *temperature* is the controlling factor in all; governing not only their intensity—the rapidity with which the transformations progress—but also determining to a very material extent the predominance of one over the other, as well as the quality of the product within one and the same fermentation. As regards the vinous fermentation, this fact is familiar enough to bread-makers in their daily experience; it is no less true and important in the making of wines. The neglect of the proper management of the temperature is the cause of by far the greater proportion of faults in commercial wines; and the elaborate and costly precautions taken to secure its control, in the countries where wine-making is conducted under the best professional skill, are ample evidence of the almost paramount importance of this point. It is not a little singular that while this perfect and accurate adaptation of the fermenting temperature to the desired result has become a settled practice in the case of beer, in which the thermometer and the ice machine now control the whole process, there is as yet in the case of the higher-priced product—wine—a lingering disposition to trust to haphazard and "doctoring," rather than to the well demonstrated principles that govern *all* vinous fermentation; and this is true even of many whose pretensions to professional knowledge are of the loudest.

Ferment Germs.—The presence of the ferment germs may fairly be assumed to be universal in the lower portions of the atmosphere, at least outside of remote desert regions. On the summits of high and especially of snow-capped mountains, they have at times been found to be either very scarce or entirely absent. But wherever vegetation is abundant and where, therefore, its decomposition currently serves as food for the several fermentative germs, their absence is impossible and their occasional scarcity not well demonstrated. When the surface of a sound grape berry is fully disinfected, and the juice is pressed and left to itself where only perfectly pure (filtered) air can reach it, fermentation does not occur until yeast or impure air is admitted to it. This experiment shows that the germs adhere to the outside of the berries, so that by the ordinary methods of wine-making they pass abundantly into the must. There, under a favorable temperature, they develop and start active fermentation within from twenty-four to forty-eight hours. During this interval, however, the must may be subject to various injurious influences, apart from the loss of time involved in waiting during this "period of incubation." It is, therefore, better to follow the example of the brewer, who starts the active fermentation within a few hours by the addition of the proper yeast, ready formed and active. The delicacy of wine flavors, and the requirements of long keeping, render the use of ordinary yeast, even of that of beer unless first washed, altogether inexpedient; and it is quite unnecessary in any well-arranged winery to resort to any means beyond the introduction of a few bucketfuls of must already in active fermentation, from other tanks, or from a cask previously started for the purpose; with washed beer yeast, if necessary, but ordinarily

of its own accord, in advance of the regular vintage operations. The new must will thus be started promptly in the right direction, and time is also saved.

Use of Flour Yeast.—Regarding the recommendation of the use of common "compressed" or bread yeast, or sponge made therefrom, it need only be said that in doing so the vintner introduces into his wine substances which are not only likely to impair the taste and flavor of the wine, but which tend to injure materially its keeping qualities. These disadvantages are well known to accompany the use of glucose, which contains only a small proportion of the dangerous ingredients of grain flour; and how easily the latter turns into the milk- and vinegar-sour fermentation, is too well known to housekeepers to require comment. As above stated, among the most important points to be accomplished in the after treatment of wines, is the elimination of the decomposable glutinous ingredients naturally contained in the must, that constitute a standing menace to the keeping of the wine. To add to these, unnecessarily at that, by introducing the still more unstable gluten of cereal flour, is too irrational a proceeding to be countenanced for a moment.

When, in the absence of fresh grapes, a new start for fermentation is needed, it can be given in the most efficacious and unobjectionable manner by preparing a mash of raisins, which, after the fermentation has set in, can be used instead of the fermenting must from the tanks.

INFLUENCE OF TEMPERATURE.

Low and High (or Bottom and Top) Vinous Fermentation.—The most obvious effect ordinarily observed as to the influence of temperature upon fermentation, is that within the ordinary limits, it appears the more intense the warmer the fermenting liquid becomes. But close observation shows that not only does this rule not hold good for temperatures above certain limits, beyond which fermentation is weakened and finally stops altogether, but also that the product varies essentially in quality according to the temperature at which the fermentation has been conducted. In the manufacture of beer, this has long been recognized and carried out in practice, in the commercially established difference between low-fermented and high-fermented beers; the former yielding the higher quality and best keeping and shipping product. Low fermentation proper occurs at temperatures between 40° and 62°, and in the case of beer, is kept near the former figure; while high fermentation takes place above 62°, and is the one to which wines in California, France, and Southern Europe generally, are habitually subjected. The wines of Germany, and especially the high bouquet Rhine and Moselle wines, are on the contrary fermented, as a rule, below 60° and are distinctly low-fermented.

It should be understood that the yeasts of the two kinds of fermentation are in a measure distinct, and that a wine or wort once started in on one kind of fermentation cannot be started on the other kind by a mere change of temperature, unless the change be very slow. The low-ferment acts but feebly at a high temperature, and the high-ferment as feebly at a low one. Of course it may easily happen that at intermediate, or frequently changing temperatures, the fermentation is also a mixed one; but since in that case neither of the two kinds of yeast finds the circumstances best suited to its development, the fermentation lags and other processes readily take possession and precedence. It is therefore best, in the fermentation of

wine as well as in that of beer, that one or the other kind should be distinctly aimed at by the appropriate regulation of the temperature.

Probably no low-fermented wine has as yet been produced in California; hence, it is quite natural that nothing exactly like the low-fermented Rhine and Moselle wines has ever yet appeared among the wines of the State, although the same varieties of grapes are commonly grown; for the fermenting rooms in which the appropriate temperature prevails could here only be commanded by means of artificial refrigeration, unless, perhaps, on the highest part of the foothills where grapes can be successfully grown.

The distinctive characters of the products of high and low fermentation may be thus summed up: The low-fermented possess more delicate aromas than the high-fermented, and less of the coarser "fusel oils," and keep for a great length of time, even with low alcohol percentages. They mature slowly, and retain their best qualities for many years. High-fermented wines acquire their best condition more quickly, but their qualities are also much sooner lost; *i. e.*, they soon cease to improve with age. In order to keep and ship well, they require a higher alcohol percentage than the low-fermented wines; hence, if this greater strength does not naturally exist, it must be reached by fortification. The latter is, therefore, a very commonly prevailing practice in the southern wine countries, where high fermentation is the rule.

The naturally high temperature of the California vintage season, and the slight protection usually afforded by the light winery structures against its access to the fermenting rooms, have thus far secured exclusive high fermentation; so high, in fact, that among the commonest faults of our wines are those resulting from this high temperature, which favors the development of other ferments than the vinous, while repressing that of the latter, and not uncommonly entirely killing it, completely arresting fermentation while there is yet abundance of sugar present.

Temperature of Most Active High Fermentation.—The greatest activity of the proper fermentation of must—that is, that corresponding to the most rapid formation of alcohol and carbonic gas—is found by actual trial to lie between 65 and 75 degrees, or, according to others, between 70 and 77 degrees, doubtless varying somewhat according to the character of the must. Now, the temperatures found in our fermenting tanks range mostly between 85 and 105 degrees, and very many are under the impression that these high temperatures accelerate the vinous fermentation. As a matter of fact, *the very reverse is true. Not only is the desired fermentation retarded thereby, but the undesirable processes of the lacto-butyric and mannite fermentation are thereby afforded an opportunity for development, since their greatest activity lies between about 77 and 95 degrees.* This fact alone accounts for a large proportion of the cases of "milksour" wines; and, broadly speaking, the high temperatures occurring in fermentation are doubtless among the most prominent causes of the defects in the keeping and shipping qualities of California wines. It follows that *measures for keeping the temperature of fermentation within lower limits, are among the most pressing needs of our wine-making industry.*

The Lacto-butyric, Mucous, and Mannite fermentations may as well be considered jointly, since the circumstances favoring their occurrence are substantially the same. As stated above, the most favorable temperature for the lacto-butyric fermentation lies decidedly higher than that for the vinous. Hence the extreme care given in the manufacture of beer and whiskies to the rapid cooling of the wort or mash to the temperature most favorable to

the alcoholic fermentation. When this is omitted the *lactic* ferment soon develops and quickly transforms the sugar into lactic acid and water; and this happens the more readily the less acid the liquid originally contains. If nearly neutral, or slightly "alkaline" (as when lime or soda is added to the mash), the lactic fermentation is accompanied or quickly followed by the *butyric* fermentation, in which not only the sugar, but also the tartar present is attacked, and is partly transformed into the cheesy-smelling compounds of *butyric acid*, leaving in the end a stale but slightly sweetish liquid, which contains more or less of the unfermentable "*mannite*" sugar.* At times, and under circumstances not fully understood, the formation of a gummy or *mucous* substance out of the sugar takes precedence of all else, and a stale, ropy liquid, or ropy wine, is the outcome.

Importance of the Initial Temperature.—It should be distinctly understood that the greatest importance attaches to the first start in the fermentation. Whichever kind makes the first start gains a material advantage relative to the rest. We are under the necessity of assuming that the germs of *all* are present at the beginning, whether entirely distinct in their nature, or (as is known to be true in the case of top and bottom fermentation, at least) capable of passing into one another under favoring circumstances. When the must enters the tank at a temperature most favorable to lacto-butyric fermentation (as is so commonly the case in the interior of California, where grapes fresh from the vineyard show a heat of from 90 to 110 degrees, and are immediately crushed into a tank, also exposed to the outside temperature, in wineries built of single-board shells) the germs of that character are sure to develop, and to influence unfavorably the character of the wine, even if afterward the vinous fermentation sets in at a lower and more favoring temperature. But if, as not uncommonly happens, the high temperature continues, and, perhaps, even rises in consequence of the beginning of vinous fermentation, the lacto-butyric and mannite processes may finally gain the precedence altogether, when the wine is definitively spoiled.

A similar state of things may, of course, occur when after a proper starting of the vinous fermentation, the temperature rises too high, in consequence of a too large mass of fermenting liquid. The vinous germs will weaken and cease to increase; may cease action altogether, or finally may be entirely killed, leaving the field open for the lacto-butyric germs, which are hardier at high temperatures. In some cases, however, even these succumb to the heat, after which a new supply of yeast must be introduced, in order to start any fermentation whatsoever. This "arrest of fermentation" has been of common occurrence during the vintage of 1885, which took place mainly during very hot weather, and was hastily gathered, the grapes being crushed hot as they came from the vineyard. As a consequence, very many of the wines contain a remnant of unfermented sugar, which will greatly endanger their soundness, unless promptly dealt with.

The *Acetic fermentation* differs from all the rest, in that its continuance is essentially conditioned upon a continued supply of air, without which the ferment cannot transform the alcohol into acetic acid or vinegar. It is, therefore, much more easily controlled than the other fermentations, which continue even in the absence of air, when once started.

Like the fermentations just discussed, the acetic is most energetic at

*The formation of the latter seems in all cases to accompany the butyric fermentation, in consequence, doubtless, of an easily intelligible process of reduction by the hydrogen eliminated in the process alongside of carbonic acid gas.

temperatures *above* those at which the alcoholic fermentation is most rapid; that is, temperatures ranging from 77 to 95 degrees are most favorable to it. But like other fermentations, it progresses slowly at much lower ones. The high temperatures of fermenting tanks of red wine are, therefore, most favorable to it; and, other things being equal, it is the more energetic the larger the surface exposed to air. There can, therefore, be nothing better adapted to this process than the "cap" of floating pomace, which is still, in most cases, allowed to be formed in red-wine tanks; for, not only is the temperature there the highest, but the wine just formed is exposed to the air in thin layers overspreading the grape skins, and abundance of ferment is everywhere. When, therefore, this cap is allowed to be formed and exposed to the air during the fermentation, a regular vinegar manufactory is established on top of the tank; and if afterward that cap is submerged, or pressed with the rest of the pomace, not only does it impart to the wine a large proportion of acetic acid ready formed, but it also communicates to it an abundance of the inciting germs. Such wine, if not already "pricked" when drawn off, will inevitably become so under the ordinary manipulations of the cellar, that would leave a well-made wine unharmed.

Other things being equal, a strong wine is much less liable to acetic fermentation than a weak one; apparently from the same cause which stops alcoholic fermentation when a certain alcohol percentage has been reached. The presence of a large proportion of alcohol, as of other poisons or disinfectants, paralyzes or kills the ferment, and thus stops the process. Hence, well-fortified wines are not liable to "pricking." But there are some wines which resist acetification much better than others of equal alcoholic strength. Such is the case with the "natural" sherries and ports, which may remain exposed to the air to acquire their peculiar flavors, without any sensible increase of acetic acid at least; while, *e. g.*, the Zinfandel, with equal alcohol percentage, would promptly turn into vinegar. In the case of wines derived from grapes not of that peculiar character, the necessary exposure to air can be given under the protection of a higher alcohol percentage; *i. e.*, fortification to from 18 to 24 per cent of alcohol. The necessity of the most thorough cleaning and disinfection by means of "sulphuring," of casks, or liming tanks that have been emptied of their contents, depends, also, upon the principles stated above, since, otherwise, the acetic ferment formed on the sides would be sure to contaminate any wine subsequently introduced, and predispose it to "pricking" at the least opportunity. So with the presses, troughs, and, in fact, every wooden surface that, after being soaked with wine, has to be left in contact with air for some length of time. Simple washing with water is not enough to forestall this danger, because the germs are not killed thereby, and can scarcely be fully removed by any mechanical process.

The want of strict attention to these needful precautions against "pricking," explains the too common occurrence of an excessive proportion of acetic acid in California wines, which, even when it does not reach the point at which the taster would place the wine into the "pricked" class, yet leaves within them the germ of disease, ready to develop at the first favorable opportunity. When, on entering a winery during the vintage season, the nostrils are assailed by the odor of vinegar, whether from the tanks themselves, or from pomace or other offal carelessly left around to sour, the experienced wine dealer will at once mark down the price of the product to a corresponding extent, to cover the risks he will have to incur in the handling of wines so liable to deteriorate on his hands, or on those of his customers.

CONSERVATION OF WINES.

As a rule, wines thoroughly well made from sound, ripe grapes, will, under proper care, become clear and remain sound without any addition, whether of finings or preservatives, unless in certain cases, where fortification is necessary. Well-made wine needs no "doctoring," beyond the blending with such other wines as may impart to it the particular qualities desired by consumers; but such blends should, whenever practicable, be made prior to fermentation.

When working on a small scale there is no difficulty in fulfilling the conditions needed for the production of such typical wines, when the proper knowledge and appliances are at command; and it is well known that the highest class wines of commerce are nearly all produced in small establishments. The reverse is, however, not true; for a very large proportion of wines made by small peasant proprietors in Europe is very faulty—in the case of Italy too often grotesquely so—vinegar-sour, milk-sour, and rank-flavored from excessive maceration on the skins and stems. This of course results mostly from ignorance of the art of wine-making; and the faulty wines gathered in by the wine merchants test severely the skill of their experts, in the attempt to disguise and modify their faults, so as to render them fairly merchantable. On the other hand, in very large establishments, it is not easy, in the hurry of the vintage, to oversee as closely as should be done, every detail of the several operations, or to guard the progress of fermentation in each tank, without employing a larger number of experts than is commonly thought necessary. Hence, such establishments are more likely to produce fair average wines, none probably as faulty as those made by an ignorant peasant proprietor, yet rarely of the best quality that could be produced from a given material under more careful surveillance than the wholesale mode of procedure usually permits.

In a report made to the State Viticultural Commission in May, 1884, I have made a summary statement (reprinted below, p. 39) of the chief causes that contribute to unsoundness in our wines. They are there placed under three chief heads, viz.:

1. Want of care in respect to the exclusion of unsound grapes from the crushing process.
2. Excessive rise of temperature during the violent fermentation.
3. Undue access of air, allowing of partial acetification.

I might add a third, which, while not rendering the wines positively unsound, injures materially their marketable condition, viz.:

4. Want of sufficient aeration prior to or during one or both fermentations, preventing the final clearing of the wine.

While the latter fault (which, however, is not incompatible with the simultaneous existence of one or several of the others) can only be remedied by a proper subsequent aeration, the faults resulting from improper fermentations are usually remedied by antiseptic treatment, intended to kill the germs, upon the presence of which the several fermentations are conditioned. This treatment is substantially of two kinds, either the addition of antiseptics to the wines, or the heating process known as "pasteurizing."

A. Addition of Antiseptics.—As before stated, any of the fermentations above referred to may be stopped by the action of the substances known as disinfectants, antiseptics, or poisons. It should be unnecessary to argue regarding the admissibility of additions coming properly under the latter designation; yet it is true that in Europe such additions have not unfre-

quently been discovered in wines that, if left to themselves, would soon have become unsaleable. It is not easy to draw the exact line between poisons proper, and those substances of which the use to a certain degree, and in a certain way, may be considered admissible for the purpose of stopping undesirable fermentations in wines. There is, however, one point of view which covers the whole ground in connection with the use of wines for hygienic purposes, namely: that whatever impedes fermentations, also impedes digestion, which is itself in a great degree a process of fermentation. The habitual use of wines containing antiseptics will, therefore, inevitably result in functional derangements; and this is so well understood that in Europe the extreme amounts of those allowed at all, is strictly limited by law. Thus in the case of *sulphuric acid*, one of the germicides most commonly employed, partly in the form of the acid itself, but more commonly in that of plaster (sulphate of lime) added to the grapes, or to the wine itself. The tartaric acid of the wine is thus partially or wholly replaced by the sulphuric, tartrate of lime being thrown down; and thus badly made wines may be prevented from passing onward into the improper fermentations, and becoming undrinkable. *Salicylic acid* is effectual in much smaller quantities, and at one time it was thought that it would be admissible to employ it freely. But while its effects upon the human system are not apparent at first in most cases, yet the decided and unpleasant results often produced in the case of persons of weak digestion, have but served to emphasize the general axiom, that we cannot, with impunity, continue to introduce into the human body substances foreign to the vegetable and animal products that have from time immemorial constituted the nutriment of mankind. If some persons are able to bear for a time, doses of salicylic acid that will completely stop digestion for some hours in the case of others, it is altogether unlikely that even the strongest person could continue its use indefinitely without injury. After some years of toleration, the legal prohibition of its use in articles of food or drink seems, in Europe, to be only a question of time; the more as in the case of wines, the process of "pasteurizing" removes all legitimate reason for the longer continuation of a doubtful practice, liable to gross abuse.

In view of this fact, it is curious that its use for the conservation of must in the unfermented condition, has not only been extensively introduced in this country, but the resulting beverage is specially recommended as a healthful and harmless substitute for wine, by those who consider alcohol as necessarily harmful in any form and quantity. A few years' experience will doubtless show how unfortunate has been the choice of a substitute in this case.

"*Sulphuring.*"—The substance most widely used for stopping all kinds of fermentation in wines is the gas from burning sulphur—*sulphurous gas.* The great efficacy of this substance, the ease with which it can be produced and used, and gotten rid of when not wanted any more, without detriment to the wine, constitute strong recommendations, especially in view of its disagreeable odor, which prevents its being consumed in any considerable quantity. Its proper use in the art of wine-making is constant and indispensable; and the amount of sulphuric acid ultimately introduced into wine by its reasonable use is usually insignificant. But in the case of red wines especially, its employment is limited by the injury to color as well as flavor that would ensue if the action were continued too long. It is therefore inadmissible to apply it to such wines for conservation during long storage or shipment. But it would be difficult to replace

it, in the cellar, by anything that would so well subserve its proper object—the prevention of acetification and moulding, whether of wines or empty packages.

B. Pasteurizing.—The process of "pasteurizing" consists simply in heating the wine to a temperature sufficiently high to insure the killing of all fermentative germs. The lowest temperature at which this can be accomplished with certainty was ascertained by Pasteur to lie at or about 140° Fhr., or 60° Centigrade; and he also found that when the heating and subsequent cooling of the wine is quickly done, so that it remains at the high temperature only a very short time, in a closed space, it suffers no sensible change in flavor or bouquet, and is thereafter subject to no further fermentative change without a new introduction of germs. "Pasteurizing" is simply an application of the same principle under which the putting-up of fruit in sealed cans or jars is daily done, to the particular case of wines, in which the delicacy of the aromas, and especially the necessity of avoiding a "cooked" flavor, are specially guarded. From 140° to 150° Fhr., are the usual limits observed for wines.

The pasteurizing apparatus embraces properly two separate parts, the heater and the cooler; but in the lower grades of wine especially, the latter is sometimes omitted, and the wine after passing the heater flows directly into the casks in which it is to be stored or shipped.

Both heater and cooler are commonly given the form of still worms, longer and of smaller diameter than in ordinary condensers; one immersed in water heated by steam (or, not so well, by direct fire), and so arranged that the temperature of the outflowing wine can be readily observed at the point where it passes into the cooler. Still better results are obtained by passing the wine through a bundle of small short tubes immersed in hot water, in which the needful temperature is very quickly acquired and then as quickly lost in the cooler. This form is, however, more difficult of construction and more costly than the former. Bottled wine may also be pasteurized in the bottle by immersion, first in suitably hot and then in cold water. In this case the heating as well as the cooling is of necessity much slower than in the continuously working open worm, and breakage is liable to occur; but when carefully performed, the operation does not impair even delicate bouquets, doubtless in consequence of the complete closure of the bottles. The Muscat aroma seems, however, to be seriously impaired by any such lengthy heating.

Since in pasteurizing we have a complete, effective, and wholly unobjectionable means of stopping all fermentative changes in wines, once for all, it should supersede the use of all antiseptics for the preservation of wines; and it is difficult to see why, upon the completion of the after-fermentation, its use should not form the rule instead of the exception; that is, why its use should not pass beyond the case of wines actually unsound or of doubtful soundness, and become the customary safeguard, especially for all shipping wines that have acquired a satisfactory condition in which it is desired to retain them—not, however, to the detriment of the proper process of maturation, with which pasteurizing does not in the least interfere. In any case, the needful apparatus should now be made to form an indispensable adjunct to every well ordered winery and storage cellar; and its presence should be an earnest that those having charge of such establishments desire to avoid, to the utmost extent possible, the dubious expedients of "doctoring up" their products or goods by the use of chemicals.

POINTS IN THE FERMENTATION OF RED WINES.

In connection with the preceding presentation of the principles governing fermentative processes, it will be proper to consider their practical application in the making of red wines, which appears by common consent to be the most important branch of wine production in this State. Unfortunately it is also the most difficult, in consequence of the numerous accidents and influences to which the must is liable during its long contact with the solid parts of the grape, in tank fermentation. Good white wine can be made with comparative ease, by rule-of-thumb methods; but the first fermentation of red wines requires, throughout, constant and intelligent care and judgment on the part of the maker, if the best, or in many cases, even tolerable results are to be attained. It is therefore not surprising that the greater part of our faulty wines, and especially the most thoroughly faulty ones, are to be found among the "reds." Without going into minute details, I will state and discuss briefly the main points of difficulty.

1. *The exclusion of unsound grapes* from the red-wine tank being of the utmost importance in order to exclude the germs of improper fermentations carried by them, the sorting-out of mouldy or otherwise faulty bunches must be much more rigorous than in the case of white wine, into the must of which a few improper germs may pass only to be promptly overslaughed by the vinous fermentation. But the mouldy grape itself, within the pomace floating in the red wine, constitutes much greater odds to contend against; and sooner or later, its influence will make itself felt in the tendency to the lacto-butyric fermentation, even if the taste of mould should not be communicated. *But any wine in the preparation of which unsound grapes have entered, should be pasteurized so soon as permissible with respect to the after-fermentation.* The latter should be carefully watched, and if any tendency to "go wrong" be noted, pasteurizing, and a re-starting of fermentation with sound grape yeast, should be promptly resorted to.

2. In white-wine fermentation, the yeast formed is more or less continuously expelled from the bunghole, or forms a frothy mass on top, so as to throw a large portion of the possibly active yeast out of its field of action. In red-wine fermentation, the yeast, with the pomace, remains much more largely in contact with the fermentable liquid; hence, the fermentation progresses and passes more quickly, and is therefore more liable to raise the temperature to an objectionable degree, resulting in the partial or complete arrest of fermentation.

3. The exposure of a large surface to the air renders the contents of the red-wine tank liable to be affected by outside changes of temperature, to a degree not easily equaled in the case of white-wine fermentation in casks or puncheons. The fermentation of red wines is, therefore, more often unduly checked by cold, or excessive heat, unless the tanks are protected by covers of some kind.

4. The greatest source of difficulty is the "cap," or "hat," formed on top of the mash by the carrying-up of the pomace by the escaping gas. The tendency is to raise a large part of the pomace, with the adherent liquid and yeast, entirely above the surface of the liquid, exposing it to the air under circumstances most favorable to the development of objectionable fermentations (notably the acetic), and to the formation of mould. The emerged portion of the pomace is also withdrawn from the desired extraction of its ingredients (color, acid, and tannin) by the wine, and thus, at best, the effect is the same as though only one half or two thirds of the

grape skins had been used; the wine is, as it were, half white. The withdrawal of a notable portion of the yeast also depresses the fermentation in the general mass, while it intensifies it correspondingly in the portions immediately beneath the cap, to such an extent that there the temperature may rise to that which kills the yeast, while in the lower portions of the tank, as well as in the upper part of the cap, the thermometer may show twenty, and even thirty degrees less.* From all points of view, therefore, the formation of this "cap" is extremely undesirable.

Prevention of the Cap.—Three chief methods for the prevention of the troubles arising from the formation of the cap are in use, and may be defined as follows:

A. Often repeated (twice daily) submergence of the floating pomace by means of variously shaped implements—rakes or prong-hoes, poles (club-stamp, or ladder-shaped), etc. This often-repeated stirring-in (*foulage* of the French) is justly considered as one of the best methods for promoting fermentation by bringing all the yeast into action, and for fully extracting the pomace; while at the same time it serves to equalize and (if necessary) to lower the temperature of the tank charge, and, by the aeration of the same, promotes the deposition of the undesirable ingredients of the wine, greatly facilitates the subsequent clearing, and favors quicker maturity. But unless faithfully and carefully done, it exposes the wine more or less to the evils resulting from the formation of the cap, among which a slight acetification is scarcely avoidable unless the tanks are covered in the intervals between successive *foulages*. Such acetification should not, however, exceed the allowable measure which remains unperceived by the taste, or, rather, to which the taste of claret consumers is accustomed.

B. The second chief method is to *keep the pomace permanently submerged* by what is known as Perret's frames. When this is done according to the original plan of the inventor, namely: to have three or four such frames, twelve to eighteen inches apart, fastened down upon the mash in the tank as the filling progresses, so that the pomace is divided into as many thin layers as there are frames, through which the gas has to force its way to the surface, the object of a full activity of all the yeast and of complete extraction of the skins is very perfectly attained; and when the tanks are not too full, and are kept covered, so as to prevent acetification of the top layer of wine, the result is excellent; always provided, that the temperature is guarded against rising too high, whether in the whole, or especially in the upper part of the charge. As *foulage* cannot be practiced, this must be controlled by pumping-over the wine from the bottom to the top of the tank, and this can readily be so done as to give the wine the benefit of a certain amount of aeration at the same time. Thus conducted, the red-wine making by the aid of Perret's frames is probably the one securing the best control of the process with the least liability to injury from slight neglect, and yields very satisfactory results.

It is not so, however, with the modifications of Perret's arrangement, by which a single frame, holding the pomace down a few inches beneath the liquid surface, in one solid mass, is made to do service for the set of frames, and in which the pumping-over is omitted. The greatest evils of the open "cap" are thus avoided, viz.: the acetification and moulding of the pomace.

* It has been very positively stated in regard to the vintage of 1885, that many cases have occurred in which the fermentation, very vigorous at first, was suddenly checked while the tank temperature did not exceed 85 degrees. But before arguing on this basis, it should be stated how that temperature was ascertained. It is in reality the maximum occurring *at and near the lower surface of the cap* that determines the stoppage, since it is there that the killing off of the yeast, as it rises, takes place consecutively.

But the great thickness of the pomace layer prevents, as in the former case, the complete extraction of the color and tannin, since but little wine can pass *through* it from the lower to the upper liquid layer; the gas escapes mostly along the edges and through false channels; the yeast adhering to the pomace is thrown out of action on the *whole* mass, but incites a very hot fermentation within the submerged cap, which may easily rise so high as to kill the yeast and cause the lacto-butyric fermentation to develop. The relatively thin layer of wine *above* the frame is scarcely displaced from the beginning to the end of the fermentation, and being continuously agitated in presence of more or less air, becomes partly acetified, the more as the heat of the submerged cap is communicated to it and causes evaporation of the alcohol. Hence, this top layer of wine is not unfrequently found, at the end of the fermentation, to be utterly unfit for intermixture with the sound wine below the cap, has a stale, sour taste, and is infected with a variety of noxious germs. Yet, when the wine is drawn off below, it follows it, and thus thoroughly infects the whole charge with its dangerous conditions.

It is thus extremely doubtful whether this "transmogrification" of Perret's method is much preferable to the open fermentation, with cap and all. For in the latter case the wine is commonly drawn off from beneath the emerged, soured portion of the pomace layer, and the amount of unsound fluid mixed with the sound wine below will generally be very much less than in the other case. But neither practice should find a place in California wineries.

When a single frame only is used, it should be submerged as deeply as possible, and at least one regular daily pumping-over of the charge to the top of the tank should be insisted on; and if the slats of the frame be not too close, even a certain degree of *foulage* may be usefully done by opening ways for the gas where it is not passing, so as to insure a quicker and more uniform extraction of the pomace ingredients than is otherwise possible in the thick layer.

C. A third method, used in some portions of France, combines some features of both the above, and is especially useful in the case of small tanks. In this, the fixed frame, held down by stays or wedges, is replaced by *a solid board cover, smaller than the mouth of the tank, that is laid directly on the surface of the mash, and rises and falls with it* in the successive stages of fermentation, the ring-shaped space around its edges, about two inches wide, giving an outlet for the gas. In this arrangement, the formation of the cap in a single mass is not prevented, but its worst features, caused by the access of air to the porous emerged mass, are done away with by the solid cover. The latter, moreover, can be easily removed by turning up or hoisting out of the way, so that the stirring-in or *foulage* may be practiced as mentioned under A, above. In fact, the use of the floating cover is a most useful addition wherever the *foulage* system is used, and when properly managed produces wine entirely free from acetic taint, as well as from all others not due to unsound grapes or other extraneous causes; while at the same time possessing all the advantages belonging to the *foulage* system.

Practically, the use of these floating covers is limited by the fact that in the case of large-sized, and especially very wide tanks, the cover becomes difficult to handle, and must be divided into two or even three sections. Again, it is necessary, in order to guard against all possible danger of acetification toward the end of the fermentation, to wash off from the upper surface the froth that may have gathered near the edges of the cover.

When this is done, the red wines so made will be found as free from acetic taint as white wines fermented under the "bubble-pipe" valve; and it is largely for this reason that this method of fermentation has been adopted, for all red wines, in the University laboratory. Of course, in operating upon small quantities, the use of the floating cover offers not the least inconvenience.

The protecting cover of carbonic gas.—So many wine-makers place too implicit reliance upon the protection against the air afforded by the carbonic gas evolved during fermentation, that some special remarks on this subject seem to be in order.

It is true that, during the first stages of the violent fermentation, the layer of heavy gas, filling the empty part of the tanks, and overflowing its sides, affords a very effectual protection against injurious access of air, especially if a considerable space is left above the fermenting mass. But so soon as the fermentation slackens, and the evolution becomes slower, the natural process of intermixture of gases by "diffusion" begins; and such intermixture is especially favored by the currents created in consequence of the difference of temperature between the tank contents and the outer air. The canvas covers used by our more careful wine-makers, toward the end of the fermentation, tend of course to diminish greatly the chances of undue access of air to the liquid surface. But they are not sufficient when, as is not uncommonly done, the wine is left undrawn for some time after fermentation has ceased. Except in special cases, the latter is a very undesirable thing to do, as it tends to render the wines harsh, and of herby taste. But when, for any reason, it has to be done, the sealing of the tanks by means of a tight plank cover, cemented with plaster, should be considered of absolute necessity.

When *foulage* is used the gas cover is pretty effectual removed each time, or at least so commingled with air as to render it of little use. The same occurs when, in the use of submerged frames, the wine is pumped-over. Generally speaking, the protecting cover of gas is not to be relied upon after the brunt of the fermentation is over, unless the tank has a considerable empty space above the mash surface, and is kept effectually covered.

The habitual neglect of the needful precautions against acetification during the first fermentation, is by far the commonest fault committed by our wine-makers, few of whom realize the extent to which "pricked" wines prevail in California. As this is the one fault that can *always* be avoided with proper care in the preparation of wine, its existence at once impresses the consumer with the idea of carelessness on the part of vintners; for there is and can be no mystery in the premises, whatever may be said of other faults of which the causes are not only less obvious, but also less easily avoided.

It should not be forgotten that the use of packages not well protected against acetification of the wine that has soaked into the wood of the casks, by sulphuring as soon as emptied and rinsed, may also be very effectual in imparting a taint that will develop whenever an opportunity is afforded. But so far as my observation goes, the latter cause is far less common, and much less liable to produce such lasting effects, than the neglect of the proper precautions in the first fermentation. I have seen cases in which that process had really been successfully carried through, on the submerged-frame plan, so that an excellent sample of wine could be drawn from the spigot, while the surface of the liquid above the frame was completely covered with a white scum of the vinegar yeast, which had formed during the delay in drawing off, incurred on the supposition that the gas would effectually protect the wine for weeks. Such delusions cannot be too soon dispelled; it

should be accepted as a maxim, that whatever delay in drawing off occurs after the fermentation and extraction of the skins are completed, is of evil, and that, if the delay is to extend beyond a few days, serious injury to the wine can only be prevented by securely sealing up of the tanks. When, instead of the submerged frame, a floating cover has been used, the access of air is so limited that even after the wine has become perfectly quiet and gas has ceased to come off, the drawing off may be reasonably delayed, without material injury.

Some additional points in this connection are given in the subjoined extract:

ABSTRACT FROM A REPORT ON "STUDIES ON WINE FERMENTATION," MADE TO THE STATE VITICULTURAL COMMISSION IN MAY, 1885.

GENERAL CONCLUSIONS.

As a summing up of the chief causes of imperfections in our wine, as connected with the present practice of wine making, the following statement might be made:

1.—Want of Care in Respect to the Exclusion of Unsound Grapes from the Crushing Process.

This cause is especially potent with respect to red wines, in the manufacture of which the wine remains in contact with the pomace for so great a length of time, that the germs of the several different fermentations will have time to contaminate the product to a very considerable extent before the drawing off, and thus form a standing menace against the keeping and improvement of the wine, unless the latter is "sterilized" by the pasteur process of heating.

This cause is of course controllable by reasonable care in the picking out of imperfect bunches before crushing, whether in the field, as is commonly done in Europe, or on a table in which each box of grapes is emptied before passing on the apron or stemmer. The rejected bunches will, according to the value of the grape variety, be either again picked over, or consigned to the still as a whole. But if a batch of wine has been made from unsound grapes, it should be kept in mind that it is liable to disease, and that to use it in blending is to leaven the whole mass of the blend with dangerous germs. This undoubtedly constitutes one of the greatest dangers threatening the reputation of our wines abroad.

2.—Excessive Rise of Temperature During the Violent Fermentation,

Whereby the true wine yeast is either seriously checked in its development or at times entirely killed, so that the wine cannot be fermented dry without the addition of fresh yeast, and, sometimes, of fresh material for its formation. There can be no doubt that this has been one of the most prominent causes of unsound and half fermented wines in early times, when the large tanks were in general use. It is undoubtedly still a frequent cause of imperfect fermentations in the hotter portions of the State, or in particularly hot vintage seasons. It is too commonly supposed that when a temperature of a fermenting tank has risen high, with stormy fermentation, which then subsides quickly, that the fermentation is happily over in a short time; whereas it may simply have been stopped by the killing or at least weakening of the yeast by the excessive rise of temperature. Again, such rise, while checking the vinous fermentation, will in the presence of other germs, derived from unsound grapes, favor the development of the lacto-butyric fermentation, which may not perhaps proceed very far for the time being in consequence of the cooling down of the tank, but will ultimately, on the occurrence of favorable conditions, take its course and definitively spoil the product for all but the still.

The same conditions occur to a greater or less extent whenever the formation of a "hat" is permitted, in which oftentimes the hand will find an almost uncomfortable temperature. A certain proportion of the wine is thus subjected to undesirable influences in many respects, as is more fully stated below.

3.—Undue Access of Air, Allowing of Partial Acctification.

This is by far the commonest fault of California wines as found in the market, and especially so in the red wines. Even a casual inspection of the manner in which the fermentation of these is mostly conducted explains the cause. Almost throughout we find that the objectionable "hat" is allowed to form in the tanks, which but too often are left without any cover whatsoever. If this is considered an objectionable practice in countries where the temperature of the vintage time is such that from 10 to 17 days elapse before the cessation of active fermentation, how much more fatal must it become to the wine's soundness where the temperature of the air is actually that which is purposely maintained in vinegar factories in order to promote the most rapid conversion of the alcohol into acetic acid. It is true that in the first stages of fermentation the rapid evolution of carbonic acid gas affords a protecting cover; but so soon as the violence of action

subsides, the unhindered access of the outer air with its varying temperature soon destroys the efficacy of that protection, and I have seen cases in which the heat in the "hat" was evidently being maintained quite as much by the rapid oxidation of the alcoholic vapor, rising from below into acetic acid, as from the direct effect of the fermentation. When afterwards the vat remains untouched until the pomace sinks of its own accord, or when even the otherwise desirable practice of agitating a mash is performed under such circumstances, the conditions for the formation of vinegar are the most favorable, and it is no wonder that the wine becomes incurably tainted with the acetic ferment.

I have seen in many otherwise very well arranged wineries, tanks long past fermentation, in which the "hat" had sunk to the bottom and was replaced by a whitish scum that had formed on the surface while a decidedly acetous odor filled the empty part beneath the loose cover. It is vain to expect that such methods of work should result in a sound wine, no matter how perfect that appliance may be; and it cannot be forgotten by those who tasted the wines exhibited at the late Viticultural Convention, that among those made from fine grape varieties there were many whose acetous taint completely spoiled and overshadowed their otherwise excellent qualities.

There can be no doubt that both with a view to the safety of the wine and the full extraction of the color and tannin from the grape skins, either the formation of the "hat" ought to be wholly avoided in our climate, by the introduction of one or several false bottoms to keep the pomace submerged; or else that the access of air be prevented by the simpler expedient of "floating covers," leaving only a narrow space around their edge for the escape of the gas. The latter expedient is, of course, a compromise; as, while it does not prevent the formation of the "hat" it renders it innocuous so far as acetification is concerned by preventing the access of air, and allows of the stirring needed for the full or prompt extraction of the color and tannin, when the cover (formed of halves) is raised out of the way.

The use of these "floating" covers allows us to dispense with the full size covers for the tanks that are needed even when the latticed false bottoms are used, if there is to be any delay in the drawing off; for the narrow annular space around the cover resting on the "hat" allows so little access of air that a reasonable delay in drawing off is of little consequence.

It is presumable that those who take so little heed of the danger of acetification as to allow it during fermentation, will not exercise all due care when it comes to the after treatment and ullage. But it is worthy of mention in this connection, that, owing to the presence of a large contingent of the acetic ferment in such wines, they are very much more liable to farther damage, and most commonly get their full share of it.

As an illustration of the above three points in practice, I present the record made of a visit to a winery in which, at the time at least, all the rules for the production of sound wines were flagrantly sinned against—happily and altogether an exceptional case, yet resulting in an unjust prejudice against the capabilities of the whole neighborhood for the production of wine.

Around the lower end of the crusher apron stood scores of boxes filled with grapes in all stages of mouldiness and rottenness, unfit for any use whatsoever, whether connected with wine-making or distilling. Among them could be found samples of all kinds of fermentation—vinous, generally far gone into the acetic; viscous, the grapes drawing out into long slimy threads when pulled apart; lacto-butyric, soft and smelling of cheese; no end of moulds of several kinds, black, green, and white. In the absence of the proprietor, I did not care to press the inquiry as to what was going to be done with the material before me, but received an intimation that it was intended for the still. It certainly would have made any animal fed upon it sick; and any brandy made from it would have contained a predominant flavor of the essence of mould, among a multitude of other uncanny ingredients. But supposing it to have been considered as useless refuse, it is impossible to imagine that any practicable amount of hand picking by ordinary workmen could have even approximately segregated the clean grapes from those that were more or less attacked by the several fermentations. In using grapes so contaminated for wine-making at all, the maker incurs so great a risk of producing a wine liable to all kinds of diseases after it leaves his hands, as no business man selling goods of his manufacture can safely or fairly carry.

On entering the winery building, a strong, acetous odor at once assailed the nostrils; the provision for ventilation was very scanty, and thus a distinct musty flavor was superadded. Large tanks of the olden time, holding from 6,000 to 8,000 gallons, formed the main portion of the fermenting caskage, and the acetous odor proceeded from those in which red wine was being made, as well as from others whose contents were intended for distillation. The pomace, which was just being removed from one of the tanks, after drawing off the piquet, had not only a strong vinegary taint, but also that peculiar valeriano butyric odor so intensely suggestive of milk-sourness, and it contained a great many mouldy grape skins.

In view of these observed facts, it cannot but be strongly suspected that the conclusions as to the nature of well-made wines of the locality, based upon the outcome of such practice, would be very unsafe, for while some of the wines might remain perfectly sound, even under the apparent neglect of the usual precautions, yet many would undoubtedly have suffered, and it would be very difficult to discriminate between them, or come to an intelligent judgment upon the general subject. I could not help making this mental reservation during a subsequent tasting of some of the older wines of the establishment, in several of which the same faults that will inevitably be found in the past season's wines, were clearly apparent.

While the above three points must be considered the most important factors in the production of wines absolutely unsound, it will be proper to consider, in this connection, some of the points in the general policy of wine-making in California, that should be clearly kept in view.

If what I have stated at the beginning of this report be admitted, viz.: that the wines of California must in the main seek their market outside of the State, and must therefore be adapted to shipment to long distances; then it follows that, if we adopt the wine-making processes of southern France, Spain, Portugal, and Italy, we must adopt the all but universal practice of fortifying export wines. If, on the contrary, we wish, in our climate, to produce also wines similar to those of Bordeaux and northward to the Moselle, we must of necessity so vary our practice that with grapes of a more or less southern character we may nevertheless be able to impart the characters of the cooler climates to our products. To this end we must distinctly deviate, in some respects, from the exact practice of either the southern or northern region of Europe.

Our wine-makers should be made to distinctly understand these differences, arising from the management of fermentation nearly as much as from the character of the grapes used. While some of these latter, as, *e. g.*, the Malvoisie, cannot safely form an ingredient of any dry wine, and others, like the Burger, and apparently the Mondeuse, will stand unharmed any reasonable amount of stress; yet the great majority will depend upon their mode of fermentation for their claim to greater or less stability under favorable influences; and hence the destination of the product should be definitely considered when handling it. Of the numerous grape varieties now being naturalized in California, from all parts of the earth's vine-growing belt, each one yields its commercially known product not merely by virtue of its intrinsic qualities, but largely as the result of certain methods of treatment to which it is habitually subjected, and among which the mode of fermentation is doubtless the most important. Southern countries have, by a natural process of selection, adopted those varieties which yield desirable results with the rapid fermentation, which is the natural outcome of the high temperature prevailing at the vintage season; while northern countries, as naturally, have chosen prevalently those grape varieties that yield the best results under slow fermentation, upon the maintenance of which the peculiarities of their products largely depend. If then we desire to reproduce the wines of other countries exactly, we must adopt not only their grape varieties, but also their methods of treatment in fermentation especially. A different treatment may produce wines intrinsically good, but after all resembling only remotely the type it was intended to duplicate. It will not, then, do to prescribe uniform conditions and methods of fermentation for all alike. When a Riesling must is rushed through a four or five days' fermentation, under the influence of a hot September in the Napa Valley, it is no wonder that its relationship to the product of Johannisberg is scarcely suspected; while, had the fermentation been carried out in one of the cool, rock cellars, its true nature would as surely have been revealed.

It is clear, then, that our wine-makers must learn to keep clearly in mind, not only the grape variety they have in hand, but also the use they expect to make of it, from the very outset. And wine merchants in disposing of their purchases in blends or otherwise, should also distinctly understand how such wines have been made and to what extent they can be trusted for shipment to a distance. There can be no doubt that the failure to pay attention to such points as these is responsible for a great deal of the reproach that has been brought upon California wines by their "going wrong" in the hands of purchasers abroad, and there can be none that, however difficult it may seem to make the practice conform to these considerations, established by all previous experience, yet it is eminently incumbent upon us to do all in our power to make these matters understood as soon as possible. Even in the old world the proper discrimination in these respects is far from being fully established among the wine-makers at large, and a great deal of faulty wine is brought into commerce from districts noted for the excellence of a portion of their product. This is largely because of the extreme difficulty of overcoming the predilection for the practices of the forefathers. For that very reason, it is the more important that we, in the beginnings of the formation of our practice, should not blindly follow the practices of any one particular country, but consider, with our eyes open, the teachings of the best experience of all countries, especially as elucidated by the systematic observations of the several European experiment stations. That with our great diversity of climates and the great variety of grapes already introduced, we stand in the most urgent need of similar systematic work in order to avoid widespread costly mistakes, hardly needs discussion.

It has been said, by way of comfort to beginners, that wine-making is, after all, an easy thing, which can be done by any one with a few casks and a little common sense. It is quite true that something that will pass for wine, for awhile at least, can be so made, and also that, where a certain practice with certain materials has long been established, any one can make good wine by following exactly the established rule-of-thumb. But no such state of things exists in California, and it is not safe to persuade the public that it will take no more than the above outfit to make wines that will find profitable sale, from the indefinite materials found in our vineyards. More than this, it is not well to allow the inexperienced wine-maker to make, on "common-sense" principles, wine that will bring him fifteen cents per gallon, when, if properly instructed, he might have obtained double that price.

Very respectfully,

E. W. HILGARD.

BERKELEY, May 9, 1885.

PART II.

RECORD OF WORK IN THE VITICULTURAL LABORATORY FOR THE SEASON 1883-4.

GENERAL REMARKS.

The work for this season began late and followed upon an interval of nearly a year's enforced inactivity, caused by the exhaustion of the appropriation. Hence the arrangements were not well made beforehand, and the single assistant who, without previous experience in this line of work, came in at the very beginning of the vintage, could not accomplish as large a volume of work during that year as was accomplished during the succeeding season, nor could that work be done as systematically and advisedly; hence the deficiency of a number of data, such as tastings, tannin determinations, etc., which thereafter have been regularly made in each and every case.

The grapes worked during this vintage were partly contributed voluntarily by the producers, partly (in the case of Mr. Krug) purchased by the University, in order to obtain typical samples from important localities of the more important grape varieties and wines. It was intended to pursue this plan in the succeeding season also, on an enlarged scale; but the overwhelming volume of voluntary contributions rendered it necessary to suspend the operation of this general plan, and without a material enlargement of the working facilities, it will only incidentally be possible to pursue it hereafter.

In the following record, there is given, first, a general list, and then a descriptive list of the grapes worked and wines made at the laboratory, with table of analyses of the same; next, a descriptive list of the wines sent in, ready made, for examination, with analyses thereof; and finally, such discussions of the results as were either made at the time, in bulletins currently published, or have since been suggested by the enlargement of the scope of the work. The latter policy is especially carried out in reference to the Zinfandel grape, the record of analyses of whose wines is probably one of the largest ever made of one single grape variety; a result of the very exceptional relation of that grape to the viticultural industry of California.

The issue of bulletins of the experiment station work, which had before been reported only in annual reports or correspondence, was begun in February, 1884; and ten bulletins relating to viticultural subjects were issued during that year. The object of these bulletins is best expressed in the preliminary paragraph which is prefixed to most of them:

> In order to render the results of investigations and experiments conducted by the Agricultural Department of the University of California more quickly and more generally available than has heretofore been done through the annual or biennial reports, it is proposed to embody hereafter, in the form of "bulletins," to be issued as often as may seem desirable, reports of results, as well as such other discussions, information, or answers to questions as may be of general interest. It is intended to make these bulletins, as a rule, short enough for insertion in the daily or weekly papers of the State, and proof slips of the same will be regularly mailed to papers applying therefor. The substance of these bul-

letins will ultimately be embodied in a more complete and connected form, in the annual reports of the College of Agriculture.

List of Grapes Received at the Viticultural Laboratory in 1883.

Variety.	Grower.	Place of Production.
Mataro	M. Denicke	Fresno.
Mataro	J. P. Smith	Livermore.
Grenache	M. Denicke	Fresno.
Grenache	J. P. Smith	Livermore.
Carignane	M. Denicke	Fresno.
Carignane	J. P. Smith	Livermore.
Zinfandel	Natoma Company	Natoma.
Zinfandel	F. T. Eisen	Fresno.
Chauché Gris	Chas. Krug	St. Helena.
Chauché Gris	W. G. Klee	Happy Valley, Santa Cruz Co.
Franken Riesling	Chas. Krug	St. Helena.
Chauché Noir	W. G. Klee	Happy Valley, Santa Cruz Co.
Seedless Sultana	R. B. Blowers	Woodland.

DESCRIPTIVE LIST OF WINES MADE AT THE VITICULTURAL LABORATORY, 1883.

Matarô, or Mourvèdre.—As the Matarô is coming largely into favor for new plantations, it is desirable that its origin and uses in Europe should be more generally understood.

The Matarô is the predominant red wine grape of Provence, the extreme south of France. It belongs to the region of the olive, and its somewhat tardy maturity renders it unadapted to colder regions. In Provence it produces, not large quantities, but dark tinted and heavy bodied, healthful wines. Their richness in tannin renders them harsh when young, but imparts durability, and they acquire with age, in a high degree, the best qualities of a table wine.

The Matarô is of strong and vigorous growth, very hardy, and of a remarkably erect habit (which in this State has given rise to the local but eminently improper name of "upright Burgundy"). It is best adapted to strong, calcareous soils, not too poor in vegetable matter, and likes to bury its roots in a deep, pervious subsoil; but it succeeds well on a great variety of soils.

As will be seen from the analyses given below, the Matarô agrees very nearly with the Zinfandels from the same localities in its contents of tannin, being generally below the normal amount expected in clarets. Its body appears to be only medium (average of seven, 2.38), and its alcohol percentage remains rather below that of the Pinots and Zinfandels of the same localities and vintages. It is, therefore, eminently adapted, in California as in Provence, to the production of good table wines, corresponding in their use to the Medoc clarets, though with less tannin and acid, and hence not so well adapted to dilution. As the foundation for blend wines of a more pronounced character, it will also find extensive use.

No. 83. *Matarô.*

From the vineyard of M. Denicke, Fresno. Grapes arrived in good condition, and 76.12 pounds were crushed September 7, 1883. The juice showing 21.69 per cent of sugar. The fermentation was not at all violent, commencing at a temperature of 65 degrees Fahrenheit and reaching its maximum at 77 degrees, when it fell gradually to the temperature of the room. The murk was drawn off pomace September fifteenth, having a color of reddish garnet. The wine was drawn off the lees November, 1883, and again racked March, 1884. An analysis was made February 15, 1884. Soon after the March racking the demijohn containing the wine burst and contents were lost before a satisfactory tasting could be made.

ANALYSES.

	1885.	1884.	1883.						1882.
	L. D. Combe, Los Gatos.	J. B. J. Portal, Burgundy Vineyard.	*M. Denicke, Fresno.	Jesuit Fathers, Cupertino.	Capt. Merriher, Cupertino.	J. B. J. Portal, Burgundy Vineyard.	*J. P. Smith, Livermore.	H. W. Crabb, Oakville.	H. W. Crabb, Oakville.
Must.									
Sugar by spindle	------	------	21.69	------	------	------	20.94	------	------
Acid	------	------	.53	------	------	------	.69	------	------
Wine.									
Alcohol: Volume	11.18	12.36	11.50	9.37	9.00	12.30	10.60	13.10	12.36
Alcohol: Weight	8.98	9.92	9.20	7.50	7.23	9.85	8.48	10.63	9.92
Body	2.56	2.90	2.69	2.44	2.26	2.18	2.13	2.69	2.24
Tannin	.11	.14	.08	.07	.08	.10	.06	.09	.10
Acid	.59	.60	.56	.32	.53	.38	.47	.35	.49
Ash	.39	.27	.49	.35	.25	.27	.35	.32	.31

* From grapes sent to the laboratory by the producers.

No. 87. *Carignane.*

From vineyard of M. Denicke, Fresno. The condition of the grapes was excellent, on their arrival at the laboratory, September tenth. They were worked September eleventh. The juice contained 22.67 of sugar by copper test; 68.42 pounds were crushed. Fermentation commenced September twelfth; temperature remaining quite constant; the highest being 74° F., with the room at 70°. Pressed from pomace on September nineteenth. The wine was racked from lees October thirtieth, and again racked in March, 1884; analyzed February 15, 1884.

Record of Tasting—April 20, 1885.—A wine of good aroma, but color much faded.

January 26, 1886.—Color *very* light red. A very light-bodied wine of fair astringency and well developed bouquet and flavor.

ANALYSES.

	1884.	1883.				
	*Natoma Co., Natoma.	H. A. Pellet, St. Helena.	*J. P. Smith, Livermore.	J. B. J. Portal, Burgundy Vineyard.	*M. Denicke, Fresno.	M. Denicke, Fresno.
Mu t.						
Sugar by spindle	19.56	----------	19.87	----------	22.67	----------
Acid	.59	----------	.68	----------	.68	----------
Wine.						
Alcohol: Volume	9.90	12.00	10.60	11.54	11.00	12.36
Alcohol: Weight	7.92	9.63	8.48	9.27	8.84	9.92
Body	2.18	2.18	2.05	2.06	1.93	3.04
Tannin	.06	.16	.06	.06	.07	.10
Acid	.53	.53	.67	.63	.58	.47
Ash	.29	.23	.36	.23	.40	.37

*From grapes sent to the laboratory by the producers.

No. 85. *Grenache.*

From vineyard of M. Denicke, Fresno. The grapes arrived in good condition, though not evenly ripened, September thirteenth, and were worked the following day. Fermentation of the crushed grapes (66.22 pounds) commenced on evening of fourteenth, at a temperature of 69° F.; on the sixteenth the temperature rose to 77°, and the fermentation was quite violent, remaining so until the eighteenth, when the temperature began to fall, and gradually reached that of the room. The unfermented juice showed 22.15 per cent sugar. Pressed from pomace September twenty-first. The young wine was racked from the lees October thirteenth; again racked, March, 1884. Was analyzed February 15, 1884.

Record of Tasting—April 20, 1885.—A neutral wine, of no bouquet and very faint color.

January 26, 1886.—Condition of sample, bright; color, nearly gone; body, medium; bouquet and flavor, well developed; acid, excessive, owing to slight acetification.

ANALYSES.

	1885.	1884.		1883.		
	L. D. Combe, Los Gatos.	*Natoma Co., Natoma.	*Wm. Pfeffer, Gubserville.	*J. P. Smith, Livermore.	J. B. J. Portal, Burgundy Vineyard.	*M. Denicke, Fresno.
Must.						
Sugar by spindle	----------	21.82	18.12	21.69	----------	22.15
Acid	----------	.62	.41	.75	----------	.44
Wine.						
Alcohol: Volume	12.20	10.50	9.27	11.50	12.17	11.90
Alcohol: Weight	9.85	8.48	7.43	9.20	9.78	9.70
Body	2.69	1.66	1.93	2.56	2.17	2.69
Tannin	.13	.11	.07	.09	.09	.11
Acid	.40	.48	.53	.51	.54	.53
Ash	.24	.28	.28	.32	.22	.43

*From grapes sent to laboratory by the producers.

No. 88. *Carignane.*

From vineyard of J. P. Smith, Livermore. Grapes arrived at laboratory in good condition, September twenty-sixth, and were crushed the same day, juice showing 19.87 per cent sugar; 73.37 pounds were crushed, and fermentation began September twenty-seventh; temperature, 66°; action was quiet until about noon on the twenty-eighth, when it commenced to be violent, and continued so for two days, temperature rising to 78.9 F., after which no violence was noticeable, and the temperature fell slowly to that of the room, about 70. The murk, amounting to 6.07 gallons, was drawn off the pomace October third. The young wine was racked from lees in November, and again racked March, 1884. This sample was analyzed February 15, 1884. Subsequently, owing to an accident to the demijohn, it was lost, without a critical tasting having been made.

No. 86. *Grenache.*

From vineyard of J. P. Smith, Livermore. The grapes, amounting to 97 pounds, were crushed September twenty-seventh, having arrived in good condition the same day. Sugar percentage of juice, 21.69. Fermentation commenced on the evening of September twenty-seventh at a temperature of 65° F. Violent action was noticed by noon of the next day, the temperature reaching its maximum of 76.8° on the twenty-ninth, after which fermentation was quiet. The must, amounting to 7.84 gallons, was pressed from pomace on October fourth, the color being dark red. The young wine was racked from the lees in November, and again racked in March, 1884; analysis of wine was made on February 16, 1884.

Record of Tasting—April 20, 1885.—Sample in 8 oz. vial: a light-colored wine of good bouquet, decided and adequate acid. Sample in five-gallon demijohn is bright, with light body, pale color, and good acid. Bouquet less developed than in sample from vial; fairly drinkable wine.

January 26, 1886.—A bright, red-colored wine, of low astringency, medium acid, rather light body, and claret-like flavor. Bouquet: fairly developed, but not as high as in the Fresno sample.

No. 84. *Mataro.*

From vineyard of J. P. Smith, Livermore. Grapes arrived in good condition on September twenty-seventh, and 63.25 pounds were crushed the same day, the juice containing 20.94 sugar.

The fermentation, which commenced September twenty-eighth at a temperature of 66.2, remained quiet during the entire time. The maximum temperature reached was 76°, after which it gradually fell to 68°, the temperature of the room. The must was pressed from the pomace October fourth, and yielded 5.28 gallons; color very deep, much more so than either of the other two varieties from the same locality. The young wine was drawn from the lees in November, and again racked in March, 1884. Analysis of wine made February 19, 1884.

Record of Tasting—April 20, 1885.—Bouquet, characteristic and fairly developed; color, light; acid and astringency, fair.

January 26, 1886.—A sound, bright wine, of deep purple color, light body, faint, claret-like bouquet, moderate acid, low astringency, and good vinous flavor.

The following discussion of the results deducible from the working into wine, and analysis of the six preceding numbers, was published in February, 1884, constituting Bulletin No. 6:

COMPARATIVE EXAMINATION OF CLARET GRAPES FROM FRESNO AND LIVERMORE VALLEY.

The influence of locality in determining the peculiarities, quality, and quantity of grapes and wine, is among the most important questions before the grape grower; since they will, in a great degree determine, also, the ultimate profits of the business.

During the first two years of its work, the viticultural division of the experiment station has only been able to accumulate scattered data bearing upon these points. A wider interest taken in the work by intelligent growers during the past season, renders it possible to present, among other points, an interesting comparison of three important varieties of claret grapes from two widely different districts, but of the same year and of grapes gathered from vines of nearly the same age, viz.: three and four years from the cutting. The varieties presented are the Grenache, Mataro, and Carignane; the lots were furnished, respectively, by Mr. R. Denicke, of Fresno, and Mr. Julius P. Smith, of Livermore Valley. The first was received between September sixth and September thirteenth; the second, September twenty-seventh; both were well ripened, but not overripe, and all were in excellent condition; only the color of the Fresno grapes was light, in consequence of the damage to the leaves by the vine hopper. All were stemmed, crushed, fermented, and pressed alike as nearly as possible, and by the same persons, so as to render the data as rigorously comparable as possible. The following table exhibits the results as regards the yield of the grapes in stems, pomace, and murk:

Name.		Stems, per cent.	Pomace.		Murk.	
			Fresh, per cent.	Dried, per cent	Per cent.	Gallons, per ton.
		1.	2.	3.	4.	5.
Grenache	F.	4.23	11.4	5.1	84.4	177.6
	L.	5.54	13.8	5.0	80.7	161.4
Mataro	F.	3.76	17.6	6.5	78.6	167.3
	L.	5.39	11.5	5.0	83.1	167.1
Carignane	F.	2.63	10.3	4.7	87.1	179.6
	L.	4.65	11.1	5.7	84.3	165.6

The first column shows a notable difference as to the weight of stems contained in a given weight of fruit from each locality. The percentage of stems is smaller in the Fresno grapes in all cases—in the Carignane, to the extent of nearly 50 per cent. Inspection shows the Fresno stems to be more slender and less succulent than those from Livermore Valley, owing, doubtless, to the drier climate of Fresno.

The two next columns show that, throughout, a larger percentage of juice was extracted from the Fresno grapes than from the others, the difference being least in the case of the Mataro, yet perceptible even there. The dried pomace amounts throughout to somewhat less than half of the weight of the fresh, but varies in opposite directions in the Mataro and Carignane, while equal in the Grenache. This may be partly due, of course, to a difference in ripeness. The number of gallons of murk per ton furnished by the several lots, as given in the fifth column, are the result of direct measurement of the liquid. Here, also, Fresno yields are somewhat higher than those from Livermore grapes; the difference being very slight, however, in the case of the Mataro.

In the following table are given some of the chief points determined in the examination of the must, excepting the alcohol and tannin, which were estimated in the young wine:

Name.		Total Solids by Spindle.	Total Sugar by Copper Test.	Alcohol in Wine.		Tannin.	Acid in Must.
				By Weight.	By Volume.		
		1.	2.	3.	3.	4.	5.
Grenache	F.	22.2	*	9.70	11.90	.109	.436
	L.	21.7	21.38	9.20	11.50	.087	.750
Mataro	F.	21.7	21.75	9.20	11.50	.076	.525
	L.	21.0	20.24	8.48	10.60	.055	.691
Carignane	F.	*	22.67	8.84	11.00	.073	.675
	L.	19.9	20.24	8.48	10.60	.063	.677

* Determination lost.

The first column shows that in the Grenache and Mataro the spindle indicated a heavier must for Fresno, and the same is doubtless true of the Carignane, as appears by reference to the next column, No. 2. This gives the total sugar as determined by the "copper test," which usually yields results slightly too high; but it will be noted that here the differences between the two localities appear to be increased, the Livermore must containing, evidently, a larger proportion of "non-sugar" than that from Fresno. This relation is corroborated by the next column, No. 3, which shows the alcohol percentages as determined in the young wines at this date. These percentages range very closely with those of Bordeaux clarets, the Grenache showing the highest, and the Carignane the lowest average, viz.: 9.45 and 8.66 per cent respectively; the Mataro about midway between.

A striking regularity appears in the next column, No. 4, showing the tannin percentages. Here, also, the differences all fall one way, showing more tannin for Fresno than for Livermore—a somewhat unexpected result, but which tends to strengthen the presumption that Fresno will find a specialty in the production of ports of good keeping qualities. On the whole, however, these tannin percentages are considerably *below* the average on record for the Bordeaux clarets, most of which range near .20 per cent, or 2 *pro mille*.

It may be added that the determination of the tannin of Zinfandel wines, now in progress, corroborates in general the increase of tannin to southward, but shows a much wider range for the musts of that variety.

In the percentage of acid, as shown in column No. 5, Fresno falls uniformly behind Livermore; most strikingly so in the case of Mataro and Grenache, but little in that of the Carignane. This was to be expected in view of the climatic differences, and it conveys a strong hint in regard to the kind of wines that Fresno should not attempt to make, unless from grape varieties which, like the Carignane, maintain a respectable acid percentage even there. It must not, however, be forgotten that the grapes from both localities were first crops from young vines, so that while their relative qualities will probably remain the same, the absolute percentages of body and alcohol, and probably of tannin, will ultimately be found higher.

It is to be regretted that no European analyses of these grape varieties are available for comparison, which is therefore possible only so far as the commercial wines known to be largely made from them, may be considered representative, and may hereafter be compared with the wines made from these musts. It is as yet too early in the season to test these wines; but it is highly desirable that the comparison, when made, should be as extensive as possible; and therefore persons who have during the past season, or previously, made wines exclusively from *one* of these, or other important wine grapes, would confer a favor and a benefit upon the progress of rational wine-making and blending in California, by transmitting to us samples of not less than two bottles each of such wines, for analysis. It is certainly by the light of such definite determinations of the influence exerted upon the composition of wines and musts by the several climates and localities, that the solution of the problem of proper coadaptation of grape varieties, climates, soils, and blends can be most rapidly approached.

BERKELEY, CAL., February 19, 1884.

No. 89. *Zinfandel* (white). Second crop.

From vineyard of Natoma Water and Mining Company, Natoma. Grapes arrived October second, and were worked the same day. The condition of grapes was excellent. Of the total amount of 173.25 pounds, 73.81 pounds were crushed, yielding 5.28 gallons must, and made into "white" wine, the juice showing 19.41 per cent sugar. During the first few days after the starting of the fermentation, the action was quite violent, after which it gradually calmed down.

The maximum temperature reached was 78° F.; room, 70°. The wine was drawn from the lees October twenty-third, and again racked in March, 1884. Analyzed February 20, 1884.

Record of Tasting—April 20, 1885.—The wine has Zinfandel bouquet strongly characterized, but is rather thin.

January 26, 1886.—A light-bodied wine of unsatisfactory bouquet, and quite light body. Acid; decided, not unpleasant. Has not developed as at first promised.

ANALYSIS.

Must.

Sugar by spindle	19.41
Acid	.67

Wine.

Alcohol: Volume	11.25
Alcohol: Weight	8.98
Body	1.88
Acid	.55
Ash	.21

No. 90. *Zinfandel.* Second crop.

From vineyard of Natoma Water and Mining Company, Natoma. 99.44 pounds were crushed and fermented with the skins. Fermentation, which started October second, at

temperature of 64° F., was quiet throughout. The maximum temperature reached was 77°, room being at 70°. Murk, amounting to 8.39 gallons, was pressed from pomace October ninth.

The young wine was racked from lees in November, and again racked in March, 1884. The wine was analyzed on February 21, 1884. In the latter part of March the demijohn containing this wine, burst, and only a bottle sample was saved.

Record of Tasting—January 26, 1886.—A light red-colored wine of light body, strong Zinfandel bouquet, and low astringency.

ANALYSIS.

Must.

Sugar by spindle	19.41
Acid	.67

Wine.

Alcohol: Volume	10.60
Alcohol: Weight	8.48
Body	2.05
Tannin	.04
Acid	.81
Ash	.27

No. 91. *Zinfandel.*

From vineyard of F. T. Eisen, Fresno. Grapes arrived in medium condition, October second, and 64.79 pounds were crushed the same day, the juice showing 24.43 per cent sugar. Fermentation was quiet throughout; starting at a temperature of 64°, and reaching a maxim of 71° F., room being then 70°. The murk was pressed from pomace, October ninth, yielding 5.55 gallons. The young wine was racked from lees in November, and again racked in March following. Analysis of wine was made February 22, 1884.

Record of Tasting—April 20, 1885.—A light-colored wine with good astringency. Bouquet less pronounced than the Natoma sample; acid somewhat in excess. Sample was lost soon after by bursting of demijohn.

ANALYSIS.

Must.

Sugar by spindle	24.43
Acid	.47

Wine.

Alcohol: Volume	13.70
Alcohol: Weight	11.20
Body	2.69
Tannin	.05
Acid	.44
Ash	.30

No. 92A. *Chauché Gris* (with skins).

From vineyard of Charles Krug, St. Helena. 78.43 pounds were crushed and fermented with the skins, like red grapes. Fermentation started October sixth, the day after crushing, at a temperature of 64°; reached its maximum on the tenth, thermometer indicating 75°; temperature then gradually fell to that of the room; murk pressed from pomace October twelfth, yielding 6.67 gallons.

The young wine was racked from the lees in the early part of November; again racked in March, 1884. The wine was analyzed February 25, 1884.

Record of Tasting—January 26, 1886.—A heavy-bodied wine; harsh, and inferior in taste to the same wine fermented without skins; bouquet covered by general vinosity.

No. 93A. *Chauché Gris* (with skins). From young vines.

From vineyard of W. G. Klee, Happy Valley, Santa Cruz County. Fermentation of the 75.79 pounds crushed began October eleventh, at a temperature of 67.6° F., the room being at 70°. The action was quiet during the whole process. The maximum temperature reached was 75.2°.

Murk pressed from pomace October eighteenth. Wine racked from lees in latter part of November, and again racked in March, 1884, at which time the wine was analyzed.

Record of Tasting, April 20, 1885.—A wine of pleasant bouquet, but not as agreeable as No. 14.

January 26, 1886.—Condition of sample, bright; color, straw yellow; body, medium; bouquet not as well developed as in No. 14; neither is the quality as good. The fermenting with skins evidently makes the wine harsh.

ANALYSIS.

	C. Krug.	W. J. Klee.
Must.		
Sugar by spindle	20.94	18.96
Acid	.51	.52
Wine.		
Alcohol: Volume	11.10	11.27
Alcohol: Weight	8.91	9.05
Body	1.93	1.73
Tannin		
Acid	.63	.63
Ash	.38	.25

No. 92. *Chauché Gris.*

From vineyard of Charles Krug, St. Helena. The condition of the grapes on arrival at the laboratory, October fifth, was not very good. 169.40 pounds were received, of which 90.47 pounds were crushed and fermented without skins, the yield being 6.076 gallons. The juice contained 20.94 per cent of sugar. The fermentation, which started at a temperature of 66° F., was rapid and violent. The maximum temperature attained was 87°, with the room about 70°.

The wine was drawn off the lees, October thirtieth, and again racked in March, 1884. Wine was analyzed February 25, 1884.

Record of Tasting—April 20, 1885.—A bright wine, with a fairly developed bouquet; acid slightly in excess.

January 26, 1886.—Bouquet decided, nutty; acid moderate and agreeable, but body thin, and the wine, on the whole, not well developed.

No. 93. *Chauché Gris.* From young vines.

From vineyard of W. G. Klee, Happy Valley, Santa Cruz County. Grapes arrived in fair condition, October tenth, and were worked the same day. Of the total amount 167.75 pounds, 91.96 pounds were crushed for the purpose of fermenting without skins, and the remainder, 75.79 pounds, to be fermented with skins.

Fermentation of the former amount, which yielded 5.81 gallons juice, containing 18.96 per cent sugar, started at a temperature of 67°, room 69°, and rose to a temperature of 83°, on October thirteenth, and continued at that point until the next day; temperature then gradually fell to that of the room. Wine was racked from lees during the first week of November; again racked March, 1884, when an analysis was made.

Record of Tasting—April 20, 1885.—A light pleasant wine; bouquet well developed and agreeable; acid good.

January 26, 1886.—A light-bodied wine of bright condition, very pleasing and well developed bouquet and moderate acid. General quality very good.

In two-gallon demijohn stood with $\frac{3}{4}$ gallon ullage for six months, or so.

ANALYSIS.

	C. Krug.	W. J. Klee.
Must.		
Sugar by spindle	20.94	18.96
Acid	.51	.52
Wine.		
Alcohol: Volume	12.54	11.54
Alcohol: Weight	10.07	9.27
Body	1.42	1.52
Tannin		
Acid	.68	.59
Ash	.23	.17

No. 94. *12 Franken Riesling.*

From vineyard of Ch. Krug, at St. Helena. Grapes arrived October fifth, in only medium condition, and were worked the same day. Total amount received was 154.00 pounds, of which 80.85 pounds were crushed, yielding 5.53 gallons juice, showing 20.16 per cent sugar, which was fermented without skins.

Fermentation commenced October sixth, at a temperature of 63.5°, room being 68°; and on October ninth, was quite violent, on which day the maximum temperature of 78.8° was attained. Temperature gradually fell until October thirteenth, when it reached that of room.

Wine was racked from lees October twenty-seventh. Owing to the bursting of the demijohn containing the wine, it was lost before a satisfactory analysis or tasting could be made.

No. 94 A. *Franken Riesling* (with skins).

From vineyard of Ch. Krug, St. Helena. The amount crushed for purpose of fermenting with skins was 73.15 pounds.

Fermentation started October sixth, the day after crushing, at a temperature of 65.3°. On the fifth day the action was quite violent, with a temperature of 74.76°—the maximum attained during the fermentation.

Murk pressed from pomace October thirteenth. Young wine racked from lees in November. Soon after lost by the bursting of the demijohn.

No. 95. *Chauche Noir.* From young vines.

From vineyard of W. G. Klee, Happy Valley, Santa Cruz County. Grapes arrived in fair condition, October tenth, and were worked the same day. 85.25 pounds were crushed, the juice showing 20.78 per cent sugar.

Fermentation commenced October eleventh, at a temperature of 67° F., and rose gradually to 78°, the action increasing in violence as the temperature rose and decreased with the fall.

Murk was pressed from pomace October eighteenth. Young wine racked from lees during latter part of November, and again racked in March following. An analysis was made at the same time.

Record of Tasting—April 20, 1885.—A wine of pale color, and nothing characteristic. Taste, somewhat flattish.

January 26, 1886.—Color, faded. Bouquet, unsatisfactory; not well developed, and the wine, as a whole, not acceptable. Being from young vines, it is probably not a fair test of what may be expected of this grape in the Santa Cruz Mountains, from where very good samples of its wine have been received.

ANALYSIS.

Must.

Sugar by spindle	20.78
Acid	.58

Wine.

Alcohol: Volume	11.64
Alcohol: Weight	9.34
Body	2.05
Tannin	.03
Acid	.53
Ash	.27

No. 96. *Seedless Sultana.*

From vineyard of R. B. Blowers, Woodland, Yolo County. Condition of grapes on arrival at laboratory, October seventeenth, was fair; some berries being converted into raisins. Total weight of grapes received was 95.82 pounds, of which 54.45 pounds were crushed and juice fermented without skins; the remainder, 40.37 pounds, fermented with skins. The former amount yielded 3.37 gallons juice, showing 23.21 per cent sugar. Fermentation remained quiet during the entire process. It started at 65° F. Maximum temperature reached was 75°.

Wine was drawn off the lees on the first week of November, and again racked in March, 1884, at which time the wine was analyzed.

Record of Tasting.—A wine of no definite bouquet, but of more character than the same wine made by fermenting with skins.

No. 18. *Seedless Sultana* (with skins).

Fermentation of the 40.37 pounds commenced October eighteenth, and was quiet through the entire process. Highest temperature attained was 75°. Murk was pressed from pomace October twenty-fourth, yielding 3.43 gallons.

Young wine was racked from lees during last week of November; again racked in March, 1884, when an analysis was made.

Record of Tasting.—A wine of no bouquet and nothing at all characteristic.

	White.	With Skins.
Must.		
Sugar by spindle	23.21	23.21
Acid	.46	.46
Wine.		
Alcohol: Volume	11.90	11.27
Alcohol: Weight	9.56	9.05
Body	1.57	2.05
Tannin		.06
Acid	.60	.67
Ash	.20	.27

TABLE No. 1.

Grapes Worked in the Viticultural Laboratory, 1883.

No.	VARIETY.	Vine Grower.	Place of Production.	Date of Receiving Grapes.	Weight of Grapes in Pounds.	Percentage of Pomace.	Gallons of Must resp. Murk.	Gallons of Must per ton of Grapes.
83	Mataro	M. Denicke	Fresno	September 6	76.12	17.63	6.37	167.29
84	Mataro	J. P. Smith	Livermore	September 27	63.25	11.48	5.28	167.08
85	Grenache	M. Denicke	Fresno	September 13	66.22	11.38	5.88	177.53
86	Grenache	J. P. Smith	Livermore	September 27	97.24	13.80	7.84	161.42
87	Carignane	M. Denicke	Fresno	September 10	68.42	10.29	6.14	179.55
88	Carignane	J. P. Smith	Livermore	September 26	73.37	11.09	6.08	165.64
89	Zinfandel (white) second crop	Natoma Co.	Natoma	October 2	73.81	26.95	5.28	145.17
90	Zinfandel (red) second crop	Natoma Co.	Natoma	October 2	99.44	12.94	8.39	168.70
91	Zinfandel	G. Eisen	Fresno	October 2	64.79	11.21	5.55	171.26
92	Chauche Gris	Ch. Krug	St. Helena	October 5	90.97	29.02	6.08	133.69
92A	Chauche Gris (with skins)	Ch. Krug	St. Helena	October 5	78.43	11.22	6.67	170.10
93	Chauche Gris	W. G. Klee	Happy Valley, Santa Cruz Co.	October 10	91.96	27.50	5.81	126.41
93A	Chauche Gris (with skins)	W. G. Klee	Happy Valley, Santa Cruz Co.	October 10	75.79	14.51	6.60	174.29
94	Franken Riesling	Ch. Krug	St. Helena	October 5	80.85	26.12	5.53	131.68
94A	Franken Riesling (with skins)	Ch. Krug	St. Helena	October 5	73.15	9.92	6.41	175.17
95	Chauche Noir	W. G. Klee	Happy Valley, Santa Cruz Co.	October 10	85.25	11.87	7.32	171.68
96	Seedless Sultana	R. B. Blowers	Woodland	October 17	54.45	26.67	3.37	123.72
96A	Seedless Sultana (with skins)	R. B. Blowers	Woodland	October 17	40.37	7.08	3.43	170.15

TABLE No. 2.

Composition of Musts and Wines made in the Viticultural Laboratory, 1883.

Number	Variety.	Vine Grower.	Place of Production.	Date of Receiving Grapes.	Must.							Wine.					
					Solid Contents by Spindle.	Ash.	Grape Sugar.	Fruit Sugar.	Total Sugar by Copper Test.	Acid as Tartaric.	Acid after Pressing.	Body.	Alcohol. By Weight.	Alcohol. By Volume.	Tannin.	Acid as Tartaric.	Ash.
83	Mataro	M. Denicke	Fresno	Sept. 6	21.69	.355	11.51	10.24	21.80	.525	.210	2.69	9.20	11.50	.076	.555	.485
84	Mataro	J. P. Smith	Livermore	Sept. 27	20.94	.412	10.57	9.67	20.24	.691	.456	2.13	*8.48	10.60	.055	.465	.348
85	Grenache	M. Denicke	Fresno	Sept. 13	22.15	.331	*	*	*	.436	.417	2.69	9.70	11.90	.109	.528	.434
86	Grenache	J. P. Smith	Livermore	Sept. 27	21.69	.300	11.34	10.04	21.38	.750	.526	2.56	9.20	11.50	.087	.510	.324
87	Carignane	M. Denicke	Fresno	Sept. 10	*	.330	12.28	10.39	22.67	.675	.447	1.93	8.84	11.00	.073	.581	.403
88	Carignane	J. P. Smith	Livermore	Sept. 26	19.87	.410	10.94	9.29	20.24	.677	.455	2.01	8.48	10.60	.063	.666	.357
89	Zinfandel (white)	Natoma Co.	Natoma	Oct. 2	19.41	.270	10.38	9.16	19.54	.669	.583	1.88	8.98	11.25	------	.550	.210
90	Zinfandel (red)	Natoma Co.	Natoma	Oct. 2								2.05*	8.48	10.60	.035	.810	.266
91	Zinfandel	G. Eisen	Fresno	Oct. 2	24.43	.440	12.90	11.74	24.64	.474	.466	2.69	11.20	13.70	.050	.435	.296
92	Chauche Gris	Ch. Krug	St. Helena	Oct. 5	20.94	.328	11.32	10.06	21.38	.511	------	1.42	10.07	12.54	------	.684	.226
92 A	Chauche Gris (with skins)	Ch. Krug	St. Helena	Oct. 5	------	----	------	------	------	------	4.32	1.93	8.91	11.10	------	.625	.377
93	Chauche Gris	W. G. Klee	Happy Valley, Santa Cruz County	Oct. 10	18.96	.292	10.95	8.94	19.89	.522	------	1.53	9.27	11.54	------	.595	.166
93 A	Chauche Gris (with skins)	W. G. Klee	Happy Valley, Santa Cruz County	Oct. 10	------	.*	------	------	------	------	.443	1.73	9.05	11.27	.035	.630	.251
94	Franken Riesling	Ch. Krug	St. Helena	Oct. 5	20.16	.423	10.60	9.64	20.24	.519	------	1.57	[9.02	11.22	------	.375	.292
94 A	Franken Riesling (with skins)	Ch. Krug	St. Helena	Oct. 5	------	----	------	------	------	------	.444	†	------	------	------	------	------
95	Chauche Noir	W. G. Klee	Happy Valley, Santa Cruz County	Oct. 10	20.78	.370	11.74	9.25	20.99	.575	.395	2.05	9.34	11.64	.025	.525	.266
96	Seedless Sultana	R. B. Blowers	Woodland	Oct. 17	23.21	.560	11.80	11.33	23.13	.460	------	1.57	9.56	11.90	------	.600	.201
96 A	Seedless Sultana (with skins)	R. B. Blowers	Woodland	Oct. 17	------	----	------	------	------	------	.413	2.05	9.05	11.25	.057	.670	.269

* Determination lost. † Wine lost.

LIST OF WINE SAMPLES RECEIVED, 1883–85.

No.	Wine.	Vintage.	Name of Contributor.	Locality.
97	German Muskateller	1880	G. Husmann	Talcoa Vineyard.
98	German Muskateller	1881	G. Husmann	Talcoa Vineyard.
99	German Muscatel	1882	G. Husmann	Talcoa Vineyard.
100	Chasselas Rose	1881	G. Husmann	Talcoa Vineyard.
101	Chasselas Rose	1882	G. Husmann	Talcoa Vineyard.
102	Victoria Chasselas	1881	G. Husmann	Talçoa Vineyard.
103	Victoria Chasselas	1882	G. Husmann	Talcoa Vineyard.
104	White Herbemont	1883	G. Husmann	Talcoa Vineyard.
105	Red Herbemont	1883	G. Husmann	Talcoa Vineyard.
106	Semillon	1883	J. H. Drummond	Glen Ellen.
107	Burger	1883	R. Barton	Fresno.
108	Muscat of Alexandria	1883	C. Cnopius	Santa Rosa.
109	Flaming Tokay	1883	C. Cnopius	Santa Rosa.
110	Feher Szagos	1883	C. Cnopius	Santa Rosa.
111	Tokay	1883	N. W. & M. Co.	Natoma.
112	Burger	1883	R. Barton	Fresno.
113	Burger	1884	R. Barton	Fresno.
114	Burger	1884	Stern & Rose	San Gabriel.
115	Seedless Sultana	1884	Stern & Rose	San Gabriel.
116	Blaue Elbling	1884	Stern & Rose	San Gabriel.
117	Chauche Gris (Riesling)	1884	R. Barton	Fresno.
118	Fehr Zagos	1884	R. Barton	Fresno.
119	Catawba	------	Paine	------
120	Scuppernong	------	------	------
121	Mataro	1882	H. W. Crabb	Oakville.
122	Mataro	1883	H. W. Crabb	Oakville.
123	Mataro	1883	W. H. Scheffler	St. Helena.
124	Mataro	1883	Jesuit Fathers	Cupertino.
124 A	Mataro	1883	Capt. Merither	Cupertino.
125	Mataro	1883	J. B. J. Portal	Burgundy Vineyard.
125 A	Mataro	1884	J. B. J. Portal	Burgundy Vineyard.
126	Carignane	1883	J. B. J. Portal	Burgundy Vineyard.
127	Carignane	1883	M. Denicke	Fresno.
128	Carignane	1883	W. H. Scheffler	St. Helena.
128 A	Carignane	1883	H. A. Peller	St. Helena.
129	Carignane	1884	J. B. J. Portal	West San José.
130	Grenache	1880	Ch. Le Franc	Almaden Vineyard.
131	Grenache	1883	J. B. J. Portal	Almaden Vineyard.
132	Grenache	1884	J. B. J. Portal	Almaden Vineyard.
133	Grenache	1884	Robert Barton	Fresno.
134	Black Burgundy	1882	H. W. Crabb	Oakville.
135	Burgundy	1883	George Husmann	Talcoa Vineyard.
136	Burgundy	1883	J. B. J. Portal	West San José.
137	Gamay Teinturier	1882	H. W. Crabb	Oakville.
138	Gamay Teinturier	1883	J. H. Drummond	Glen Ellen.
139	Cabernet Sauvignon	1883	H. W. Crabb	Oakville.
140	Cabernet Sauvignon	1883	J. H. Drummond	Glen Ellen.
141	Cabernet Franc	1884	J. B. J. Portal	Burgundy Vineyard.
142	Ploussard	1884	J. B. J. Portal	Burgundy Vineyard.
143	Tannat	1883	H. W. Crabb	Oakville.
143 A	Tannat	1883	J. H. Drummond	Glen Ellen.
144	Grossblaue	1883	H. W. Crabb	Oakville.
145	Pied de Pedrix	1882	H. W. Crabb	Oakville.
146	Pinot Noir, $\frac{1}{3}$ Pinot de Pernand	1883	J. H. Drummond	Glen Ellen.
147	Petite Sirah	1883	J. H. Drummond	Glen Ellen.
148	Petite Sirah $\frac{1}{3}$, Zinfandel $\frac{2}{3}$	1883	J. H. Drummond	Glen Ellen.
149	Malbeck	1882	H. W. Crabb	Oakville.
150	Malbeck	1883	J. T. Doyle	Cupertino, S. Clara Co.
151	Malbeck	1884	Ch. Le Franc	Almaden Vineyard.
154	Charbono	1882	H. W. Crabb	Oakville.
152	Charbono, No. 1	1883	J. T. Doyle	Cupertino.
153	Charbono, No. 2	1883	J. T. Doyle	Cupertino.
154 A	Charbono	1883	H. W. Crabb	Oakville.
155	Charbono Blend	------	C. O. Butler	Hanford, Tulare Co.
156	Malvoisie, No. 1	1883	J. T. Doyle	Cupertino.
157	Malvoisie, No. 2	1883	J. T. Doyle	Cupertino.
158	Malvoisie	1883	Juan Gallegos	Mission San José.
159	Trousseau	1883	J. T. Doyle	Cupertino.

List of Wine Samples Received, 1883-85—Continued.

No.	Wine.	Vintage.	Name of Contributor.	Locality.
160	Trousseau	1883	M. Denicke	Fresno.
161	Trousseau	1884	C. A. Wetmore	Livermore.
162	Pinot	1883	J. T. Doyle	Cupertino.
163	Black Prince	1883	J. T. Doyle	Cupertino.
164	Lenoir ⅔, Burger ⅓	1883	H. W. Crabb	Oakville.
165	Black Hamburg	1883	C. Cnopius	Santa Rosa.
166	Mission	1883	C. Cnopius	Santa Rosa.
167	Claret	1883	R. Barton	Fresno.
168	Claret	1883	Ch. Richber	Fresno.
169	Red wine	1879	H. J. Leeman	
170	Brandy	1882	H. J. Leeman	
171	Port wine	1883	H. J. Leeman	
172	Sherry	1873	H. J. Leeman	
173	Sherry		Ch. Meinecke	San Francisco.
174	Zinfandel (red hill land)	1880	J. H. Drummond	Glen Ellen.
175	Zinfandel	1881	Juan Gallegos	Mission San José.
176	Zinfandel	1882	Juan Gallegos	Mission San José.
177	Zinfandel	1882	George Husmann	Talcoa Vineyard.
178	Zinfandel	1882	J. H. Drummond	Glen Ellen.
179	Zinfandel	1882	Ch. Krug	St. Helena.
180	Zinfandel	1882	M. Denicke	Fresno.
181	Zinfandel	1882	H. W. Crabb	Oakville.
181 A	Zinfandel	1883	H. W. Crabb	Oakville.
182	Zinfandel (fermented on husks of Cabernet and Tannat)	1883	J. H. Drummond	Glen Ellen.
183	Zinfandel	1883	George Husmann	Talcoa Vineyard.
184	Zinfandel (light-colored)	1883	George Husmann	Talcoa Vineyard.
284	Zinfandel	1883	Ch. Knust	Cloverdale.
185	Zinfandel	1883	J. T. Doyle	Cupertino, S. Clara Co.
186	Zinfandel	1883	Juan Gallegos	Mission San José.
187	Zinfandel	1883	N. W. & M. Co.	Natoma.
188	Zinfandel	1883	Capt. Sherman	El Cajon, San Diego Co.
189	Zinfandel (three-year old vines)	1883	R. Barton	Fresno.
190	Zinfandel	1883	Ch. Richber	Fresno.
285	Zinfandel	1883	Duquesne	Fresno.
191	Zinfandel	1883	William Pfeffer	Gubserville.
192	Zinfandel	1883	J. B. J. Portal	Burgundy Vineyard.
193	Zinfandel	1883	W. H. Scheffler	St. Helena.
194	Zinfandel	1884	J. T. Doyle	Cupertino.
195	Zinfandel	1884	J. B. J. Portal	Burgundy Vineyard.
196	Zinfandel	1884	R. Barton	Fresno.
197	Zinfandel, No. 1	1884	Stern & Rose	San Gabriel.
198	Zinfandel, No. 2	1884	Stern & Rose	San Gabriel.
199	Zinfandel, No. 3	1884	Stern & Rose	San Gabriel.
200	Zinfandel, No. 2	1884	H. Eggers	Fresno.
201	Zinfandel, No. 3	1884	H. Eggers	Fresno.
202	Zinfandel, No. 9	1884	H. Eggers	Fresno.
203	Zinfandel, No. 12	1884	H. Eggers	Fresno.
208	Blend: Mataro, 8.16 per cent. Zinfandel, 16.33 per cent. Malbec, 8.16 per cent. Chauche Noir, 16.33 per cent. Trousseau, 44.89 per cent. West's White Prolific, 16.13 p ct	1884	C. A. Wetmore	Livermore.
209	Blend: Mataro, 8.70 per cent. Zinfandel, 26.10 per cent. Trousseau. Folle Blanche.	1884	C. A. Wetmore	Livermore.
210	"Milksour wine"		Per W. B. Rising	

DESCRIPTIVE LIST OF WINES SENT IN FOR ANALYSIS FOR THE SEASON 1883-4.

A. Reds.

No. 121. *Mataro*, 1882.

From H. W. Crabb, Oakville. A clear, moderately deep ruby-colored wine, of good, claret-like bouquet, with pleasant acid and adequate astringency. Flavor, vinous and agreeable; body, medium. Dilution with fifty per cent water, very good. A wine blend made at the time of tasting, of equal parts Mataro and Zinfandel, was not satisfactory.

No. 122. *Mataro*, 1883.

From H. W. Crabb. Color of wine is not deep, being only light garnet; condition, clear; body, medium to heavy; bouquet, undefined, very immature, but accompanied by a vinous flavor; acid, light, with fair astringency.

No. 123. *Mataro*, 1883.

From J. B. J. Portal, West San José. A moderately deep-tinted wine of medium body, fair acidity and astringency, and clean taste. Too young to show any characteristic bouquet, but promising an excellent development.

No. 124 A. *Mataro*, 1883.

From Captain Merither, Cupertino, per John T. Doyle. (Tasting not on record.)

No. 124. *Mataro Frs.*, 1883.

From vineyard of Jesuit Fathers, Cupertino, per John T. Doyle. (Tasting not on record.)

No. 149. *Malbeck*, 1882.

From H. W. Crabb, Oakville. The sample is a heavy-bodied bright wine of intense purple color, with a strongly vinous and claret-like flavor, but bouquet undeveloped. Acid is decided and agreeable, while the astringency is a little roughish. The result, after adding 50 per cent water to wine, is good; 100 per cent not agreeable.
Wine blend of equal parts Malbeck and Zinfandel, good.

No. 150. *Malbeck*, 1883.

From J. T. Doyle, Cupertino. A very deep-tinted but bright, heavy-bodied wine, of strong, almost rough astringency; too young to show much character, but already distinctly of the Bordeaux Claret type.
At a later tasting (December, 1884), the character of this wine was found to be finely developed, and of the genuine Medoc type; but it is so heavy-bodied that for table use its blend with a lighter wine is desirable.

No. 143. *Tannat*, 1883.

From H. W. Crabb, Oakville. Wine has a very decided astringency, moderately intense, purplish-garnet color; somewhat low acid; undeveloped but promising bouquet, with vinous flavor; condition, bright; body, heavy. With one half its bulk of water the result is very good; with equal bulk, dubious as regards general quality, but good, with reference to color.

No. 143 A. *Tannat*, 1883.

From J. H. Drummond, Glen Ellen. Sample has an agreeable, though undeveloped bouquet, with a vinous flavor well developed for its age. Astringency is very prominent; acid, moderate; body, quite low; condition, almost clear; color, garnet, moderately intense.
Dilution with water holds good up to 75 per cent of its own bulk.

No. 144. *Grossblaue*, 1883.

From H. W. Crabb, Oakville. A wine of intense purple color, so much so that the color holds good after the wine has been diluted with its own bulk of water. Bouquet is undeveloped, but promises well. Flavor, vinous; acid, light; astringency very decided, but agreeable; body, good; condition, bright.
Wine is too astringent for use by itself, but excellent for blending.

No. 144 A. *Grossblaue*, 1883.

From H. A. Pellet, St. Helena. Medium-bodied wine of a very intense bluish purple color, high astringency, and low acid. Bouquet undeveloped, but flavor is agreeable and vinous. The general quality is high; condition, very bright; dilution to 50 per cent, passable; 100 per cent, color good, but wine flattish.

No. 134. *Black Burgundy*, 1882.

From H. W. Crabb, Oakville. A heavy-bodied wine of intense purple color, clear condition, and pronounced astringency; acid decided, a little sharp. Bouquet faint, apparently undeveloped. With 50 per cent water the result is quite good; 100 per cent, not desirable.

No. 135. *Black Burgundy*, 1883.

From George Husmann. A wine of good bouquet, medium body, fair acid and astringency, and vinous flavor. Color, moderately deep.

No. 139. *Cabernet Sauvignon*, 1882.

From H. W. Crabb, Oakville. Wine of moderately dark garnet color, with a vinous flavor, accompanied by a perceptible, light bouquet; fair acid and medium astringency. Body, good; condition, clear. The wine promises very well.

No. 140. *Cabernet Sauvignon*, 1883.

From J. H. Drummond, Glen Ellen. Wine has a bouquet which is faintly developed, but of excellent quality. Acid somewhat sharp; astringency only medium. Body, low; color, moderately intense purple.

No. 137. *Gamay Teinturier*,* 1882.

From H. W. Crabb, Oakville. A wine of heavy body, deep purple color, vinous flavor, and good, claret-like bouquet. Acid moderate, pleasant; astringency agreeable, though somewhat low. After addition of 50 per cent water, the wine is still good; 100 per cent, only passable.

No. 138. *Gamay Teinturier*,* 1883.

From J. H. Drummond, Glen Ellen. A clear, medium-bodied wine, of strong purplish garnet color; decided and pleasant astringency; fair acid, with a fruity and agreeable bouquet, accompanied by a claret-like flavor and somewhat alcoholic odor. Dilution is good to 100 per cent of water.

No. 145. *Pied de Pedrix*, 1882.

From H. W. Crabb, Oakville. The condition of sample, clear and bright, and color very dark purple. The bouquet, though undeveloped, promises very well. Flavor, vinous; astringency fair and acid decided. Body good, though somewhat light. With 50 per cent of water, the result is a fair wine, but acid comes out too prominently. With 100 per cent water it is flattish.

No. 147. *Petite Sirah*, 1883.

From J. H. Drummond, Glen Ellen. Condition of sample, clear, accompanied by a very light garnet color; astringency, low; acid, moderate; pleasant odor claret-like; bouquet undeveloped.

No. 154. *Charbono*, 1882.

From H. W. Crabb, Oakville. Condition of sample is bright with a moderately intense purple color, a rather light body, and a decided fruity bouquet; astringency adequate, and acid a little sharp. The character of the wine somewhat impaired by the easky flavor.

No. 154 A. *Charbono*, 1883.

From H. W. Crabb, Oakville. Sample is clear, medium-bodied, and of intense purple color; astringency, fair; acid, low; bouquet undeveloped; flavor fairly vinous. Dilution with 50 per cent water results in a fair wine; with 100 per cent, only tolerable.

No. 155. *Charbono blend*, 1883.

From C. O. Butler, Hanford. A clear wine of light garnet color, thin body, moderate acid, no bouquet, with an earthy unpleasant flavor, and mawkish aftertaste; astringency hardly perceptible; though sound, evidently grown on alkali soil.

No. 128 A. *Carignane*, 1883.

From H. A. Pellet, St. Helena. A heavy-bodied wine of good astringency and medium acid. Bouquet, decided, and well developed for its age, accompanied by a remarkably vinous flavor and alcoholic odor. Color, purplish, moderately intense; condition, clear but not bright. With fifty per cent water the wine is still good. With its own bulk of water the result is fair, color, acid, and astringency still holding good.

* Doubtless the "Teinturier mâle."

No. 127. *Carignane*, 1883.

From M. Denicke, Fresno. Wine is clear and bright, and of a lightish purple color. There is no alcoholic odor accompanying the wine, and bouquet is undeveloped. Flavor, vinous; acid and astringency only medium; body, fair. With one half its bulk of water the dilution is "only tolerable."

No. 158. *Malvoisie*, 1883.

From J. Gallegos, Mission San José. A clear, medium-bodied wine, of imperceptible bouquet, indefinite flavor, light acid, and very low astringency; color, very light garnet.

No. 165. *Black Hamburg*, 1883.

From Ch. Cnopius. A wine of medium acid and astringency, heavy body, and very light bouquet; color, light red; condition, slightly turbid.

No. 110. *Feher Szagos*, 1883.

From Ch. Cnopius, Santa Rosa. A light straw colored wine, of undeveloped bouquet, vinous, but slightly casky flavor, heavy body and pleasant acid.

No. 118. *Feher Szagos*, 1884.

From R. Barton, Fresno. Bouquet fairly developed; body, heavy; acid, medium; flavor, vinous, nutty; color, pale straw; a very fair, drinkable wine.

No. 108. *Muscat of Alexandria*, 1883.

From Ch. Cnopius, Santa Rosa. A heavy-bodied wine, of topaz color and clear condition. Bouquet, covered by muscat odor; acid, light.

No. 166. *White Mission*, 1883.

From Ch. Cnopius, Santa Rosa. Condition of sample, bright; color, white; faintly reddish; body, light; bouquet, faint; flavor, fairly vinous.

No. 100. *Chasselas Rose, or Violet Chasselas, 1881.*

From George Husmann, Napa. A reddish topaz-colored wine, of clear condition, and decided Chasselas aroma and alcoholic odor. Decided but pleasant acid, perceptible astringency, and vinous flavor. Bouquet, agreeable, light; body, heavy.

No. 101. *Chasselas Rose, 1882.*

From George Husmann, Napa. Condition of wine is clear; color, light topaz; body, medium; flavor, strongly vinous, but bouquet undeveloped. The acid is agreeable, though less than that of the previous vintage.

No. 104. *White Herbemont, 1883.*

From George Husmann, Napa. A bright, medium-bodied wine, of reddish-white color; full, pleasant acid, and well-developed bouquet; flavor, vinous.

No. 102. *Victoria Chasselas, 1881.*

From George Husmann, Napa. Condition of sample, bright; body, heavy; flavor, vinous, nutty, accompanied by a decided, agreeable bouquet; acid, full but pleasant; color, reddish topaz.

No. 103. *Victoria Chasselas, 1882.*

From George Husmann, Napa. A light-bodied wine, of straw color, medium acid, and a slightly casky flavor. Bouquet not well developed; condition, clear.

No. 98. *German Muskateller, 1881.*

From George Husmann, Napa. A bright, straw-colored wine, of heavy body, moderate acid, and good bouquet.

No. 99. *German Muskateller, 1882.*

From George Husmann, Napa. Muscat aroma, decided; bouquet, light; body, heavy; acid, higher than that of same wine of previous year.

No. 106. *Semillon, 1883.*

From J. H. Drummond, Glen Ellen. Condition of sample, bright, with a pale topaz color, medium acid, well-developed vinous flavor, accompanied by a characteristic Sauterne bouquet.

No. 173. *Sherry.*

From Charles Meinecke, San Francisco. Heavy-bodied wine, light brown in color, with a very faint bouquet, but fruity flavor; acid, fair; condition, bright.

TABLE No 3.

Analyses of Wines sent for Examination during the season 1883–84.

Number	Wine.	Wine Grower.	Place of Production.	Vintage.	Body.	Alcohol.		Tannin.	Acid as Tartaric.	Ash.
						By Weight.	By Volume.			
	Red.									
121	Mataro	H. W. Crabb	Oakville	1882	2.24	9.92	12.36	.100	.495	.312
122	Mataro	H. W. Crabb	Oakville	1883	2.69	10.63	13.10	.085	.345	.323
84	*Mataro	J. P. Smith	Livermore	1883	2.13	8.48	10.60	.055	.465	.348
125	Mataro	J. B. J. Portal	Burgundy Vineyard	1883	2.18	9.85	12.30	.100	.375	.266
124 A	Mataro	Capt. Merither	Cupertino, Santa Clara Co.	1883	2.26	7.23	9.00	.080	.533	.246
124	Mataro	Jesuit Fathers	Cupertino, Santa Clara Co.	1883	2.44	7.50	9.37	.073	.315	.346
83	*Mataro	M. Denicke	Fresno	1883	2.69	9.20	11.50	.076	.555	.485
149	Malbeck	H. W. Crabb	Oakville	1882	2.18	10.81	13.27	.088	.375	.255
150	Malbeck	J. T. Doyle	Cupertino, Santa Clara Co.	1883	3.59	11.15	13.63	.240	.345	.355
143	Tannat	H. W. Crabb	Oakville	1883	2.99	10.07	12.54	.197	.397	.280
143 A	Tannat	J. H. Drummond	Glen Ellen	1883	2.05	8.55	10.66	.175	.484	.234
144	Grossblaue	H. W. Crabb	Oakville	1883	3.44	9.92	12.36	.239	.387	.396
144 A	Grossblaue	H. A. Pellet	St. Helena	1883	2.44	10.35	12.85	.250	.398	.311
134	Black Burgundy	H. W. Crabb	Oakville	1882	2.31	9.34	11.65	.145	.596	.388
135	Black Burgundy	George Husmann	Talcoa Vineyard	1883	1.80	9.63	12.00	.124	.630	.300
139	Cabernet Sauvignon	H. W. Crabb	Oakville	1883	2.94	10.44	12.90	.113	.390	.257
140	Cabernet Sauvignon	J. H. Drummond	Glen Ellen	1883	1.85	7.23	9.00	.093	.472	.216
137	Gamay Teinturier	H. W. Crabb	Oakville	1882	2.56	10.81	13.27	.092	.555	.250
138	Gamay Teinturier	J. H. Drummond	Glen Ellen	1883	2.31	8.84	11.00	.147	.495	.285
145	Pied de Pedrix	H. W. Crabb	Oakville	1882	2.56	9.99	12.45	.125	.600	.294
147	Petit Sirah	J. H. Drummond	Glen Ellen	1883	2.05	8.48	10.58	.090	.430	.300
154	Charbono	H. W. Crabb	Oakville	1882	1.92	8.41	10.50	.110	.375	.445
154 A	Charbono	H. W. Crabb	Oakville	1883	2.46	9.78	12.18	.130	.420	.329
155	Charbono blend	C. O Butler	Hanford, Tulare County	1883	2.49	10.81	13.27	very light	.468	.324
128 A	Carignane	H. A. Pellet	St. Helena	1883	2 18	9.63	12.00	.162	.525	.233
88	*Carignane	J. P. Smith	Livermore	1883	2.05	8.48	10.60	.063	.666	.357
127	Carignane	M. Denicke	Fresno	1883	3.04	9.92	12.36	.100	.475	.370
87	*Carignane	M. Denicke	Fresno	1883	1.93	8.84	11.00	.073	.581	.403
158	Malvoisie	J. Gallegos	Mission San José	1883	2.43	9.27	11.54	deficient	.467	.220
165	Black Hamburg	Ch. Cnopius	Santa Rosa	1883	1.69	8.48	10.58	.070	.561	.300

* Wines made at the Viticultural Laboratory.

TABLE No. 3—Continued.

Analyses of Wines sent for Examination during the season 1883-84.

Number.	Wine.	Wine Grower.	Place of Production.	Vintage.	Body.	Alcohol.		Tannin.	Acid as Tartaric.	Ash.
						By Weight.	By Volume.			
	White.									
100	Chasselas Rose	George Husmann	Talcoa Vineyard	1881	2.11	10.07	12.50		.610	.278
101	Chasselas Rose	George Husmann	Talcoa Vineyard	1882	1.67	9.20	11.45		.480	.230
111	Tokay	Natoma Co.	Natoma	1883	2.18	9.78	12.20		.667	.268
104	White Herbemont	George Husmann	Talcoa Vineyard	1883	1.52	9.20	11.45		.411	.163
105	Red Herbemont	George Husmann	Talcoa Vineyard	1883	1.80	7.99	10.00	.039	.293	.200
102	Victoria Chasselas	George Husmann	Talcoa Vineyard	1881	1.80	10.54	13.00		.540	.250
103	Victoria Chasselas	George Husmann	Talcoa Vineyard	1882	1.80	8.84	11.00		.555	.226
98	German Muskateller	George Husmann	Talcoa Vineyard	1881	1.80	10.81	13.27		.531	.133
99	German Muskateller	George Husmann	Talcoa Vineyard	1882	1.80	9.63	12.00		.546	.162
106	Semillon	J. H. Drummond	Glen Ellen	1883	1.52	8.48	10.58		.381	.217
110	Fehr Szagos	Ch. Cnopius	Santa Rosa	1883	2.56	10.63	13.09		.435	.271
118	Fehr Szagos	R. Barton	Fresno	1884	1.52	9.05	11.27		.546	.328
108	Muscat of Alexandria	Ch. Cnopius	Santa Rosa	1883	2.05	8.84	11.00		.531	.215
166	White Mission	Ch. Cnopius	Santa Rosa	1883	1.80	7.99	10.00		.615	.152
117	Chauche Gris ("Riesling")	R. Barton	Fresno	1883	2.05	9.20	11.45		.660	.260
173	Sherry	Ch. Meinecke	San Francisco		4.22	14.00	17.30		.431	

COMPOSITION OF ZINFANDEL WINES.

In Bulletin No. 9, dated April 2, and subsequently in Bulletin No. 12, of May 30, 1884, were given discussions of the analyses of Zinfandel wines made up to that time, twenty-four in number. The table below gives twenty-one additional ones, or forty-five in all. The large measure of attention given to this grape variety is justified by the fact alone, that in 1884 it was estimated as constituting two fifths of all the vines then planted in the State. The cause of this preference, as is well known, is the rapid growth, hardiness, and high production of the Zinfandel vine, together with its adaptation (at least so far as quantity is concerned) to a great variety of soils; while the red wines yielded by it, though not rising to the highest quality, form thus far the bulk of "California clarets," and when sound, are pleasant table wines, endowed, however, with a flavor peculiar to the grape, not easily mistaken, and too pronounced for the taste of many who are accustomed to the Bordeaux type of table clarets. From the fact that this flavor is found in nearly all the red shipping wines of the State, the impression has gone abroad that it is inherent in California wines as such, and that the true Bordeaux type cannot be reproduced on this coast. Those who have tasted the clarets exhibited at the viticultural conventions of the past two years, are well aware how utterly unfounded is this impression, it having been abundantly seen that with the proper grape varieties, and rational treatment in accordance with the requirements of this climate, the true Bordeaux claret type can in many localities at least be reproduced without difficulty. But this fact, however acceptable to those who are now planting vineyards, does not relieve those who have the large Zinfandel plantations on their hands, from the difficulty of finding a sufficiently extensive market for the bulk of their product.

The devising of proper blends for the Zinfandel wines, in which their too prominent character shall be in a measure disguised or made harmonious with other flavors, is certainly one of the most important problems now before us, not only with respect to the vineyards already existing, but also in respect to the maintenance of the culture of so desirable and fruitful a stock. Hence the analysis of Zinfandel wines was early taken in hand, in order that a clew might be obtained for the modification of at least those characters of which chemical analysis, and not the palate alone, can take cognizance. Moreover, from the widely extended culture of this variety it was comparatively easy to ascertain, by comparison of the several points of composition, the influence of locality and soil in modifying its product, and thus to lead up to a forecasting of corresponding influences to be looked for in the case of other grape varieties. The importance of such forecasting cannot easily be overestimated, as is shown by the constantly repeated question, on the part of those about to engage in the vineyard enterprises: "What shall I plant?" It is of no mean importance to replace the more or less blind guessing on the part of even the older vineyardists, by something more palpable and definite, if possible.

In the work of the Viticultural Laboratory of the University, both of the above points have been kept constantly in view, and every opportunity promising progress in that direction has been embraced. It is very obvious that this cannot be the work of a few years, so far as the State at large is concerned; and even as regards particular localities or regions, the need of corroboration by time and repeated experience, as in all agricultural experiments, must not be forgotten. Still, a reasonably numerous representation of wines from one and the same region during several consecutive vintages

affords very strong presumptions and convenient working hypotheses; and as the number of data is increased, such presumptions soon acquire such consistency as to serve, in any case, as a far better basis for practice than the wild guesses of beginners, or of those who have only their own local experience to offer as a guide for far-away locations.

However imperfect, then, may be the cogency of the conclusions thus far reached by our work, they afford at least good presumptions, to be strengthened by daily accretion of facts if correct, or quickly contradicted by experience if incorrect.

The general conclusions reached at the time when Bulletin No. 12 was published, have thus far only been corroborated by the additional work done; and this being the case, it is but fair that its substance should be literally reproduced here:

BULLETIN No. 12.

EXAMINATION OF ZINFANDEL WINES.

In a previous bulletin (No. 9, April 2, 1884), were given the analyses of thirteen red (main crop) Zinfandel wines from different localities in the State, with five others referring to second crop and white wines from the same grape variety. The great predilection towards this grape, and the great breadth of vineyards now established in which it forms the leading ingredient, renders a full understanding of its general, as well as local peculiarities, a matter of considerable importance to the viticultural interests of the State.

Hence, the conclusions apparently foreshadowed by the analyses heretofore published, have called forth widespread interest; and contributions of samples from localities and locations not before represented, have since so far supplemented the data of the former bulletin, as to render it desirable to publish them in connection and juxtaposition with those before reported.

In the table below are given eleven additional analyses (or twenty-four in all), the additional *localities* represented being Cloverdale, Glen Ellen, in the Sonoma Valley, and the neighborhood of San José and Mountain View, Santa Clara County.

(The additional localities represented in the enlarged table now given are in the Sierra foothills, viz., Natoma, Sacramento County, and Penryn, Placer County. But several of the localities previously occupied are represented by additional vintages.)

In comparing the data of this table with those given in Bulletin No. 9, it becomes necessary to take into account difference in the location of the several vineyards of the same locality. Thus, the conclusion that the Zinfandels of Napa Valley are deficient in tannin appears here to be contradicted, yet only apparently; for the Napa wines showing a good to high tannin percentage in the present table are not from valley lands proper, but from hill lands adjacent; thus showing very important differences to arise from what are commonly considered slight variations in location. Considering first the point of

"SOLID CONTENTS,"

Or "body," we find in the northern localities of Santa Rosa and Cloverdale two vintages (Nos. 37 and 284), showing a heavy body, somewhat over three per cent, while in three vintages of Glen Ellen (Nos. 174, 178, and 182), the average body is quite light, like that of the valley wines of Napa (Nos. 5 and 181). Alongside of the two latter appear two others (Nos. 179 and 181A) from higher lands of the same localities, viz., Krug's and Crabb's vineyards, both alike showing a markedly heavier body, as also does No. 40, from the hills of Talcoa Vineyard. Whether No. 177 grew on low land in the same locality is not on record, but seems probable.

No. 193, from Mr. Scheffler's vineyard near St. Helena, shows an abnormally heavy body for the latitude, though in other respects it does not differ markedly from other wines of the same region. The anomaly may be traceable to some peculiarity in its treatment or location.

Passing southward we find a remarkable agreement in the figures for the Zinfandels of the Santa Clara Valley, Nos. 175, 176, 185, and 192, those from Mission San José, West San José, and Cupertino Creek, alike coming within a trifle of three per cent of solid contents. As none of these wines contain any unfermented sugar, the indication that in this region the Zinfandel yields too heavy a body for clarets proper, seems quite definite; and it is not a little remarkable that a region so near the coast should, in this respect, stand next to Fresno, an interior region of steady high Summer temperature.

As regards the latter, Richber's wine (No. 190), adds to the list of extraordinarily heavy-bodied wines from that region, while Denicke's 1882 (No. 180), stands between these and

Eisen's (No. 91), in which the percentage is only 2.69. It will probably be found that both the latter are from low ground, while the rest are from higher land.

ALCOHOLIC STRENGTH.

Since the alcohol percentage can, to a certain extent, be governed at will by the producer in the degree to which he allows the grapes to ripen, the data of the table are largely, no doubt, affected by individual practice; yet heretofore it has been usual to give the wines, as nearly as possible, the maximum strength, in accordance with the curiously irrational demand of the wine merchants. On the whole the alcohol percentage runs nearly parallel with that of the "body," being highest, closely approaching the possible maximum, at Fresno, next highest in the Santa Clara Valley, and at Stockton; a lower average in the Napa and Sonoma Valleys, rising somewhat at Santa Rosa and Cloverdale. The great variation in the three Glen Ellen vintages (Nos. 174, 178, and 182) is quite remarkable, and so far as that of 1883 (No. 182) is concerned, is probably in part due to the unfavorable season that so generally affected the crop in the northern part of the State.

TANNIN.

The analyses given in the previous bulletin (No. 9) led to the conclusion that the Zinfandels of Napa Valley were remarkably deficient in tannin, as exemplified in Nos. 5 and 181. The more ample data of the present table show, however, that the outcome is quite different in the hill lands adjoining; for Krug's 1882 (No. 179) from such lands shows, in strong contrast to No. 5, next to the highest tannin percentage of the whole table (29 *pro mille*), requiring to be blended in order to subdue the harshness. Crabb's 1883 (No. 181A), also from higher land, gives over 7 *pro mille*, and Scheffler's (No. 93), likewise from slope land, 15 *pro mille*. Of Drummond's Glen Ellen wines, from red slope lands, one shows 14 *pro mille*, the other two respectively 7 and 8.6. It thus appears that while in but few cases the tannin rises quite as high as the average of French clarets (20 *pro mille*), yet a respectable amount is obtained in the hill lands of Napa and Sonoma; so that there can be little difficulty in obtaining all that is desirable by blends with grapes naturally richer in tannin than the Zinfandels.

Denicke's 1882 (No. 180) shows again the tendency of Fresno wines to high tannin, as already previously shown. But the climax is reached in Richber's 1883 (No. 190), which shows the astonishing amount of 33.8 *pro mille;* making, with its high body, high alcohol, and low acid, a product of exaggerated Fresno peculiarities hardly pleasant to drink as it is, but exceedingly useful for blending purposes. It will be highly interesting to ascertain in what precise locality and under what circumstances Mr. Richber's wine was produced, as it will give important indications as to the relations between soil and grape product in that region.

In the matter of

ACID,

It is interesting to find that in the vintages of 1883 the acid is, in Napa and Sonoma, almost throughout, lower than in 1882, or than the average of previous vintages on record in the Santa Clara Valley. However, Doyle's and Portal's 1883 show an average near to that of Gallegos' 1882, indicating that the causes that depressed this factor to northward were less active here. Similarly, Duquense's and Denicke's wines of 1883, Fresno, show a good acid percentage, the latter being almost throughout a remarkably well proportioned and palatable wine of its age, almost identical with that of the Cajon Valley, No. 188.

The showing made by the above table, in respect to the wide differences caused by locality and climate in the composition of Zinfandel wines, is sufficiently eloquent of the need of detailed and close observation, in each region, of the prominent peculiarities, in order to adapt to them the proper blends. If a certain proportion of Mataro and Trousseau makes the most acceptable blend in the Santa Clara and Livermore Valleys, it does not prove that the same will be best in Napa and Fresno; the more, as the other grape varieties are undoubtedly similarly modified in the several localities. It has been thought best to push through, at once, a full series of examinations of one of the most widely diffused grape varieties, in order to show the importance of the results that may be thus obtained, since the material on hand does not allow of such extensive comparisons in the case of any other grape. Several smaller, but, nevertheless, very important series of samples are in progress of examination, and their analyses will be published as fast as their completion may render it profitable. The occurrence of the University vacation of ten weeks from date, will, for the time being, interrupt the work; but it is hoped that those able to contribute samples of authentic origin from single grape varieties will, in the meantime, add as much as possible to the collection, and that during the coming vintage many will prepare samples for the express purpose of obtaining, through such examination, an insight into the peculiarities of their wines and grapes. Thus far the foothills of the Sierra are almost entirely unrepresented; and yet, the future importance of that region in grape growing can hardly be a matter of doubt.

BERKELEY, May 30, 1884.

A review of the table below, with its twenty-one additional analyses, will show that the above conclusions have only been strengthened throughout

by the additional data, so far as the same localities are concerned. The slope lands of the Santa Clara Valley and the products of Fresno still show the high body and tannin previously foreshadowed; but the late and cold season of 1884 gave, in the Fresno region, as everywhere else in that year, unusually high acid and relatively low alcohol. In the vintage of 1885, so far as it has come under observation, high alcohol percentages are almost universal, and tannin, as well as in most cases acid, is considerably increased. But the difference in favor of tannin in the hill lands, as against the plain, is strikingly exemplified in the case of the Mission San José Zinfandels, where Gallegos wine shows about 50 per cent more tannin than in three previous seasons; but that amount is nearly doubled in the wine grown on the hill land at the same place, viz.: McIvor's. This is precisely what previous analyses had shown to be the rule for the Napa Valley and elsewhere.

The representation of Zinfandels from the foothills is unfortunately too small to be convincing, the more as two of the Natoma wines represent second crop. In view of the varied nature of the foothill lands—part valley, part slope and hills, and underlaid by varying rocks, such as slate, granite, gravel, and igneous rocks—it will be very difficult to come to any general conclusions without a very wide range of data, accurate not only as to location, but also in respect to the lay of the land and nature of soil.

Second Crop and White Zinfandel Wines.—Several of these are given in the table, but in order to present summarily the points noted in respect to them, I introduce here a portion of Bulletin No. 9, relating to this subject, the table for second crop being increased by the introduction of the 1885 wines of Gallegos:

For comparison with the above series, it is interesting to note the composition of "second crop" wines, that is, made of grapes only just ripe, but not "full-ripe." The subjoined table gives the composition of two (three) such wines:

SECOND CROP ZINFANDEL WINES.

CONTRIBUTOR.	Locality.	Vintage.	Solid Contents by Spindle.	ALCOHOL.		Tannin.	Acid calculated as Tartaric.
				By Weight.	By Volume.		
Natoma Company	Folsom	1883	2.060	8.48	10.60	.035	8.10
J. Gallegos	Mission San José	1883	2.440	8.13	10.20	.025	.700
J. Gallegos	Mission San José	1885	2.069	8.54	11.00	.120	8.73

Comparing these wines with the general "run" of the main crop Zinfandels in the first table, the differences are sufficiently apparent, especially where, as in the sample from Mission San José, a direct comparison can be made. As it may fairly be presumed that the Folsom wine would, on the whole, resemble the wines from Stockton and Talcoa Vineyard, the outcome might be thus stated: light body, light alcoholic strength, little tannin, much acid—a material fit, in general, for blending only, as it does not seem to develop much bouquet. The great and frequent utility of the second crop Zinfandel in carrying other wines through their fermentation, when for any cause it has been checked, is not to be forgotten.

It thus appears that, as our best wine experts have long contended, no one locality thus far represented will yield a true claret from Zinfandels alone. Of all, the Cajon Valley wine comes nearest to such a composition; but until that product shall have acquired some age, its merits cannot be definitely determined. The great bulk of all Zinfandels in the State will need to be blended, and the blends must vary considerably with the locality. In fact, it is plain that the Zinfandel is not a true claret grape; but there can be no doubt that it will lend itself to the preparation of exceedingly acceptable red wines, under whatever name. Perhaps its adaptation to white wines deserves more serious attention than

has heretofore been bestowed upon it. The subjoined table shows the differences between red and white wines prepared from the same lots of grapes in the Viticultural Laboratory:

COMPARISON BETWEEN RED AND WHITE ZINFANDEL WINES.

CONTRIBUTOR.	Locality.	Vintage.	Solid Contents by Spindle.	ALCOHOL. By Weight.	ALCOHOL. By Volume.	Tannin.	Acid calculated as Tartaric.
Natoma Co.; 2d crop..... R.	Folsom	1883	2.060	8.48	10.60	.035	.810
W.		1883	1.880	8.98	11.25	.....	.548
George West ..... R.	Stockton ..	1881	2.575	11.57	14.20	.063	.437
W.		1881	2.060	11.41	14.10	.....	.420
Charles Krug..... R.	St. Helena .	1880	2.000	9.20	11.46	.....	.390
W.		1880	1.800	9.34	11.54	.....	.600

It will be noted that there is no material difference in the alcohol percentages of the red and white wines; but the latter have less body, of course less tannin, and in general less acid than the red. To the latter rule there is a conspicuous and unexplained exception in the case of Mr. Krug's wine. The white Zinfandel wines often develop a very agreeable bouquet, and in any case form an excellent material for blending with lighter wines.

BERKELEY, April 2, 1884.

In order to present a complete view of the subject, the descriptive list below contains all the Zinfandels thus far analyzed up to 1885. The table includes, also, those published in the report of 1882:

DESCRIPTIVE LIST OF ZINFANDELS, 1880–1884.

No. 174. *Zinfandel*, 1880.

From J. H. Drummond, Glen Ellen. From red hill land. Color of sample not very deep; condition, bright; acid and astringency, both light; body, medium; bouquet not strong, but flavor vinous and claret-like. The color, after the wine has been diluted with one half its bulk of water, remains quite stable, and the general quality is good.

No. 175. *Zinfandel*, 1881.

From J. Gallegos, Mission San José. Sample is full-bodied, of deep garnet color, and clear condition, with moderate acid and a well developed vinous flavor. Bouquet, claret-like, but not as alcoholic as Gallegos' Zinfandel of 1882. The wine dilutes well.

No. 176. *Zinfandel*, 1882.

From J. Gallegos, Mission San José. A bright wine of garnet color, with pleasant acid and fair astringency. Bouquet light, with alcoholic odor very faint after dilution; flavor vinous and well developed; body, medium. With 100 per cent water the wine is good as regards acid and astringency.

No. 178. *Zinfandel*, 1882.

From J. H. Drummond, Glen Ellen. Red hill land. A heavy-bodied wine of agreeable acid and astringency, with a pleasant, light bouquet and vinous flavor. Condition, clear; color, light garnet. Dilution with 50 per cent water is very good; 100 per cent, only fair.

No. 177. *Zinfandel*, 1882.

From George Husmann, Napa. A wine of light garnet color, with a good body, low astringency, and somewhat excessive acid. Bouquet, claret-like, somewhat alcoholic; flavor, vinous and agreeable; condition, clear, but not bright.

No. 181. *Zinfandel*, 1882.

From H. W. Crabb, Oakville. The sample is clear, not bright, with an intense purple color. Bouquet, claret-like, rather faint; flavor, vinous and slighty fruity; acid, decided; astringency, fair; body, medium. With 50 per cent water only a fair result is obtained.

No. 179. *Zinfandel*, 1882.

From Charles Krug, St. Helena. A deep purple-colored wine, bright, with moderate and agreeable acid, and high astringency, both being well proportioned. Bouquet, well developed and claret-like; flavor, vinous; body, good.

No. 180. *Zinfandel*, 1882.

From M. Denicke, Fresno. Bouquet of sample is light and agreeable; odor vinous, not alcoholic; acid and astringency, both good; body, heavy; condition, clear; color, deep garnet. Dilution to 50 per cent water, very good; 100 per cent, fair.

No. 182. *Zinfandel*, 1883.

From J. H. Drummond, Glen Ellen. (Fermented on pressed pomace of Tannat and Cabernet.) A clear, light garnet wine, of moderate body, light acid, and decided astringency, with an undeveloped but claret-like bouquet.

No. 181 A. *Zinfandel*, 1883.

From H. W. Crabb, Oakville. A deep purple colored wine, of heavy body, vinous flavor, but undeveloped bouquet; acid and astringency not at all high; condition is clear but not bright. Wine diluted with one half of its bulk of water is good; with equal bulks, only fairly so.

No. 193. *Zinfandel*, 1883.

From W. Scheffler, St. Helena. A clear, heavy-bodied wine, of very intense purple color, with a claret-like bouquet, which promises well; acid full and astringency good; flavor vinous, with a trace of sweetness. With 50 per cent of water the result is good, and acid strongly characterized; 100 per cent, fair.

No. 186. *Zinfandel*, 1883.

From J. Gallegos, Mission San José. The body is lighter than the same wine of the two preceding years; astringency lower but acid somewhat higher. Bouquet, not developed; color, light garnet; condition, bright.

No. 185. *Zinfandel*, 1883.

From J. T. Doyle, Cupertino. A bright wine of good body, medium and pleasant acid, and decided astringency. Bouquet, undeveloped; flavor, vinous; color, dark purple. With 50 per cent water the result is good; 100 per cent, quite passable.

No. 192. *Zinfandel*, 1883.

From J. B. J. Portal, West San José. A wine of moderate and agreeable acid and good astringency. Bouquet, undeveloped; flavor, alcoholic, fruity, and vinous. The sample is bright with an intense purplish red color and heavy body. With 50 per cent water result very good; 100 per cent, quite fair.

No. 284. *Zinfandel*, 1883.

From Chas. Knust, Cloverdale. Condition of sample, clear not bright. Wine is too young to judge of its bouquet, likewise as regards the flavor. Body, above medium; acid, moderate; astringency, low; color, deep purple.

No. 187. *Zinfandel*, 1883.

From N. W. & M. Company, Natoma. No data regarding this sample are on record.

No. 189. *Zinfandel*, 1883.

Three-year old wines from R. Barton, Fresno. A wine of immature bouquet with alcoholic odor; acid somewhat low but astringency quite decided. Body, heavy; condition, clear; color, dark purple. Wine will not bear dilution, the acid disappearing.

No. 190. *Zinfandel*, 1883.

From C. Richber, Fresno. A heavy-bodied wine of no perceptible bouquet; low acid, but very high astringency; color, intense purple; condition, clear.

No. 285. *Zinfandel*, 1883.

Duquesne Cellar, Fresno. Acid and astringency of sample, medium; bouquet, undeveloped; body, heavy. Wine is moderately deep purple in color, and in bright condition.

No. 188. *Zinfandel*, 1883.

Capt. Sherman, El Cajon, San Diego County. The wine has a decided claret-like bouquet, accompanied by a vinous flavor; condition, clear; body, somewhat light; acid and astringency decided and agreeable; color, intense purplish red.

No. 195. *Zinfandel*, 1884.

From J. B. J. Portal. Bouquet characteristic and well developed; flavor, vinous, clean; astringency, good; condition, bright; color, intense purplish red.

No. 194. *Zinfandel*, 1884.

From John T. Doyle, Cupertino. A heavy-bodied wine, of deep color and somewhat pronounced acid, and good, clear Zinfandel flavor; promising, but too young to develop much bouquet; astringency, not high.

No. 197. *Zinfandel*, 1884.

From Stern & Rose. A medium-bodied wine, of moderate acid; good astringency; color, moderately deep red; condition, bright; bouquet, not very well developed.

No. 200. *Zinfandel, No. 2*, 1884.

From Eggers' Vineyard, Fresno. Condition of sample, clear, with deep purple color; heavy body; high acid and astringency; vinous flavor and strong Zinfandel bouquet; dilution with 50 per cent water, very good, 100 per cent, very fair; 150 per cent, passable; color, acid, and astringency well kept.

No. 202. *Zinfandel, No. 9*, 1884.

From Eggers' Vineyard, Fresno. (Pure press wine.) A heavy-bodied wine, of intense purple color; decided astringency and acid; flavor, vinous; very promising; bouquet, covered by a slight taint of sulphur. The wine dilutes well, but is somewhat harsh.

No. 201. *Zinfandel, No. 3*, 1884.

From Eggers' Vineyard. A dark purple-colored wine of clear condition; heavy body; medium, agreeable acid; high astringency, and pleasant, vinous flavor; dilution with 50 per cent water, very good; 100 per cent, fair; and with 150 per cent, still passable.

No. 203. *Zinfandel, No. 12.*

From Eggers' Vineyard. Condition, clear; color, intense red; body, heavy; acid and astringency, high; bouquet, fairly developed, strong Zinfandel. The wine dilutes well.

Zinfandel, 1884.

From R. Barton, Fresno. Condition of sample, clear; color, light garnet. Bouquet is undeveloped, carbonic acid predominating. Acid low, and somewhat covered by astringency, which is very good; flavor, vinous, agreeable, and fruity; body, heavy. Wine, after addition of 50 per cent water, is good; with 100 per cent, medium.

No. 4. Table of Analyses

Of Zinfandel Wines, 1879 to 1885.

No.	Vine Grower.	Place of Production.	Vintage.	Body.	Alcohol,		Tannin.	Acid as Tartaric.	Ash.	Remarks.
					By Weight.	By Volume.				
36	I. De Turk	Santa Rosa	1879	1.46	10.83	13.40		.650	.265	
49	I. De Turk	Santa Rosa	1880	2.38	10.26	12.70		.690	.346	
174	J. H. Drummond	Glen Ellen	1880	2.31	9.41	11.80	.086	.588	.252	
5	Ch. Krug	St. Helena	1880	1.35	10.18	12.60		.600	.186	White.
6	Ch. Krug	St. Helena	1880	1.71	10.42	12.90		.390	.292	Red.
37	I. De Turk	Santa Rosa	1881	3.00	10.67	13.20		.675	.239	
40	George Husman	Napa	1881	2.71	10.67	13.20		.478	.272	
23	George West	Stockton	1881	2.58	11.57	14.30	.063	.437	.266	Red.
22	George West	Stockton	1881	2.08	11.41	14.10		.420	.156	White.
175	Juan Gallegos	Mission San José	1881	3.19	11.69	14.30	.040	.730	.260	
176	Juan Gallegos	Mission San José	1882	2.94	10.81	13.29	.079	.590	.280	
178	J. H. Drummond	Glen Ellen	1882	2.34	11.00	13.42	.140	.570	.249	Red hill land.
177	George Husman	Napa	1882	2.11	8.62	10.70	.067	.660	.274	
179	Ch. Krug	St. Helena	1882	2.69	10.81	13.27	.290	.498	.280	Hill land.
181	H. W. Crabb	Oakville	1882	2.31	9.92	12.36	.100	.570	.290	
180	M. Benicke	Fresno	1882	2.76	9.92	12.36	.175	.600	.350	
182	J. H. Drummond	Glen Ellen	1883	2.18	7.92	9.90	.140	.468	.261	Fermented on husks of Tannat and Cabernet.
181 A	H. W. Crabb	Oakville	1883	2.69	10.07	12.55	.074	.432	.301	
193	W. Scheffler	St. Helena	1883	3.81	10.35	12.72	.150	.498	.349	
284	Ch. Knust	Cloverdale	1883	3.06	9.92	12.36	.068	.468	.384	
187	Natoma Co.	Natoma	1883	3.32	8.35	10.40		.776	.372	
89	*Natoma Co.	Natoma	1883	1.88	8.98	11.25		.550	.210	White, second crop.
90	*Natoma Co.	Natoma	1883	2.05	8.48	10.60	.035	.810	.266	Red, second crop.
185	J. T. Doyle	Cupertino	1883	3.06	11.62	14.20	.128	.543	.276	
192	J. B. J. Portal	Burgundy Vineyard	1883	3.00	11.08	13.54	.168	.690	.266	
186	Juan Gallegos	Mission San José	1883	2.44	8.13	10.20	.025	.700	.154	Second crop.
189	R. Barton	Fresno	1883	3.46	9.92	12.36	.129	.438	.422	
190	C. Richber	Fresno	1883	3.59	12.23	15.00	.337	.337	.546	
285	Duquesne	Fresno	1883	4.11	12.39	10.20	.102	.558	.462	
91	*G. Eisen	Fresno	1883	2.69	11.20	13.70	.050	.435	.296	
188	Captain Sherman	El Cajon, San Diego County	1883	2.71	10.07	12.50	.154	.615	.323	
227	*P. W. Butler	Penryn	1884	1.93	7.43	9.25	.080	.633	.200	

226	*J. L. Black	Livermore	1884	2.36	7.85	9.75	.036	.450	.425	
194	J. T. Doyle	Cupertino	1884	3.44	10.54	13.00	.077	.592	.344	
195	J. B. J. Portal	Burgundy Vineyard	1884	2.69	8.27	10.33	.180	.540	.300	
196	R. Barton	Fresno	1884	3.34	9.34	11.64	.121	.395	.400	
200	H. Eggers, No. 2	Fresno	1884	3.00	9.56	11.90	.344	.607	.271	
201	H. Eggers, No. 3	Fresno	1884	3.47	9.34	11.64	.239	.637	.296	
202	H. Eggers, No. 9	Fresno	1884	3.00	10.03	12.55	.256	.558	.338	Pure press wine.
203	H. Eggers, No. 12	Fresno	1884	3.21	9.56	11.90	.260	.675	.273	
197	Stern & Rose	San Gabriel	1884	3.56	10.54	13.00	.127	.450	.287	
204	Juan Gallegos	Mission San José	1885	3.83	11.77	14.60	.120	.753	.370	
205	Juan Gallegos	Mission San José	1885	2.69	8.84	11.00	.120	.873	.234	Second crop.
206	L. D. Combe	Los Gatos	1885	2.89	10.63	12.91	.174	.609	.370	
207	—. McIvor	Mission San José	1885	8.64	12.23	15.00	.212	.534		Zinfandel Port from hill land.

*Wines made at Viticultural Laboratory.

COMPARISON OF DIFFERENT WINES FROM THE SAME LOCALITY.

Bulletin No. 13, reproduced below, gives an example of the utility of being enabled to compare the composition of wines from different grape varieties grown in the same locality, in the same soil, and made into wine by the same hands and processes. The established reputation of Mr. Crabb as a wine-maker imparts especial interest to this series; and for the ascertainment of the relative character of important varieties, it is very desirable that parallel series from other localities should become available. Within a year this will be the case as regards the Cupertino locality, in which, by the liberality of Mr. John T. Doyle, the University experimental vineyard is located in a manner quite analogous to that of Mr. Crabb:

BULLETIN NO. 13.

EXAMINATIONS OF RED OR CLARET WINES FROM MR. H. W. CRABB, OAKVILLE, NAPA COUNTY.

In previous bulletins giving the results of the examination of wines (Nos. 6, 9, and 12), stress has mainly been laid upon the differences shown in the composition of *one and the same kind* of grape and wine grown in different localities, the object being to show that differences so serious may occur between the products of such as differ materially in climate or soil, or in both, as to render the blends most successfully made in *one* case totally inappropriate in others. In the present issue the object is to show the differences in the composition of wines made from *different* grape varieties grown in the same locality and on the same soil, and treated precisely alike by a skilled wine-maker. It will thus appear what are the characteristic points of each variety, so far as chemical analysis can show them, thus indicating the direction in which proper blends may be sought with the best promise of success. It should be fully understood and remembered, that while defects shown by analysis are perfectly definite indications as to the conditions that must be fulfilled in a successful blend, yet analysis cannot as yet take cognizance of the delicate and almost intangible flavors or "bouquets," which must likewise be made to harmonize, in order to satisfy a cultivated palate. To that extent the determination of the proper blends must always remain with the expert wine taster; but the work of the latter is immensely facilitated by being informed, through the analysis, of the prominent chemical peculiarities, which in any case must be taken into consideration, and which ordinarily are left to laborious and more or less blind guessing and experimenting.

The wines of which the analyses are given below, were made by Mr. H. W. Crabb, of Oakville, Napa County, from grapes grown by himself, on a soil of remarkable uniformity over a considerable portion of the Upper Napa Valley. It is a gray, moderately retentive loam, easily tilled, although intermixed with a sometimes very considerable proportion of fragments of a shaly rock that forms the main body of the adjacent hills on the west side of the valley. The soil is of considerable depth, sometimes several feet without obvious change, and being then underlaid by a bed of gravel, may be considered naturally well drained. It is in this respect unlike the somewhat heavier soil, free from stones, that forms considerable tracts at other points in the region, but has a subsoil of a stiff clay, and is materially benefited by under-drainage. In chemical composition, the two kinds of soil are probably not widely different. Mr. Crabb's soil has not been analyzed. A sample of the other variety from the land of Mr. Wheeler, near Rutherford, shows a very high supply of potash, a moderate one of lime and of phosphoric acid, and an abundant one of humus; forming, altogether, a soil of high quality for almost any purpose, but especially adapted to the vine by its high percentage of potash. The extraordinary crops (of twelve to thirteen tons per acre) sometimes obtained north of St. Helena, grow on a somewhat lighter soil, of great depth, but remarkably well drained by underlying gravel.

All the grapes here mentioned were fully ripe, and were fermented on the skins until the first active fermentation was over; say from five days to a week, or sometimes more.

ANALYSES OF CLARET WINES FROM H. W. CRABB, OAKVILLE.

NAME OF GRAPE.	Vintage	Solid Contents by Spindle	Alcohol. By Weight	Alcohol. By Volume	Tannin	Acid calculated as Tartaric
Zinfandel	1882	2.310	9.92	12.36	.099	.570
Zinfandel	1883	2.690	10.07	12.55	.074	.432
Mataro*	1882	2.242	9.92	12.36	.100	.495
Mataro*	1883	2.690	10.63	13.10	.085	.345
Charbono	1882	1.916	8.41	10.50	.110	.375
Charbono	1883	2.463	9.78	12.18	.130	.420
Malbeck	1882	2.181	10.81	13.27	.088	.375
Crabb's Black Burgundy	1882	2.310	9.34	11.65	.145	.596
Gamay Teinturier	1882	2.56	10.81	13.27	.092	.555
Pied de Perdrix	1882	2.56	9.99	12.45	.125	.600
Grossblaue	1883	3.44	9.92	12.36	.239	.387
Cabernet Sauvignon of Medoc	1883	2.94	10.44	12.90	.113	.390
Tannat	1883	2.99	10.07	12.54	.197	.397

* It may be as well, before an incorrect pronunciation of this name becomes firmly established, to note that it should be pronounced with the accent on the last syllable, Mataró, from the town of that name in Catalonia, Spain.

In order to correlate somewhat this interesting series of data heretofore published, it should be remembered that Crabb's Zinfandels of 1882 and 1883 showed, in comparison with those from other localities, a medium body higher than in those from Krug's, a medium alcoholic strength (average 10.0 by weight); rather low tannin, though more than Krug's valley wine; and a medium average of acid. In the same connection, it should be kept in mind that in French table clarets (the type mostly desired) the average body is about 2 per cent, alcoholic strength 8 to 9 per cent, tannin 18 to 20 pro mille, acid 5 to 6 pro mille.

BODY.

The determination of the solid contents of wine gives the nearest approach to the numerical representation of what is designated as "body" by wine tasters; yet the sensation is materially influenced by the presence of other matters, notably by that of glycerine, which, other things being equal, is usually most abundant in wines having undergone a rapid and high fermentation.

The table shows the lightest body of all (1.916) for the Charbono of 1882, and the next lowest (2.181) for Malbeck of that year. The Mataro comes next with 2.242, and then Crabb's Black Burgundy and with 2.310 in the same year. Apart from the Charbono, whose coarseness will exclude it from all choice blends, these are sample varieties, which may be expected to form the main body of claret wines in California, as two of them already do in France. From these there is a sudden ascent to the high-bodied Gamay Teinturier and Pied de Perdrix; varieties which in more respects than this can be considered only as materials for blending.

Passing to the vintage of 1883, we find, so far as the comparison reaches, a higher body throughout; the increase being 16.5 per cent for Zinfandel, 10 for Mataro, and over 25 for Charbono. Taking this into consideration, in our estimate of the comparative percentages, the Grossblaue still stands far above the Teinturier and Pied de Perdrix as a body-giving wine; while the Cabernet and Tannat would stand about on a level with those just named, and would be classed chiefly as blending material.

ALCOHOLIC STRENGTH.

A cursory glance shows that in this respect, also, the Charbono is the lowest of all (8.41), while Malbeck and Gamay stand highest (10.81). As regards the Malbeck, this result is somewhat unexpected. Mataro comes next with 10.63, and Cabernet close to the same. The rest differ but slightly from the general average of ten per cent by weight, except that Crabb's Burgundy, contrary to expectation, is considerably below, being 9.34 in 1882, which would place it about 9.50 in 1883.

TANNIN.

On this essential point the table gives most important and gratifying information. Of the list, the Zinfandel and the Mataro of 1883, and the Malbeck and Gamay of 1882, alone range materially below 10 pro mille; while of those ranging above, the Grossblaue stands highest, with nearly 24 pro mille; the Tanat next with 19.7; Crabb's Burgundy next with 14.5; the Charbono and Pied de Perdrix nearly together, 13 and 12.5.

ACID.

In regard to acid, it is evident that on the whole, that of the wine of 1882 was high; the Charbono forming an exception. Comparing the wines of that year, we find in descending

order, four, viz.: Pied de Perdrix, Black Burgundy, Gamay, and Zinfandel, ranging between 5.55 and 6.00 pro mille, with Mataro close up to 5.00. The rest range mostly between 3.45 and 4.00. It is noticeable that in a year of high acid, Malbeck was so low that it fails to dilute well, while Crabb's Burgundy and Zinfandel, as well as the Perdrix, had nearly the typical 6.00. Gamay has, in the same year, 5.55, and Mataro nearly 5.00. In 1883, a year evidently of low acid, all the French varieties represented, except the Charbono, fall near, but somewhat below, 4.00 pro mille. It is evident that making allowance for the difference in vintages, the Burgundy, Gamay, and Pied de Perdrix would, with the Zinfandel, have remained above 4.00 pro mille in that year, and furnished a fair supply of acid.

In drawing the practical conclusions from the above data, it is painfully apparent how much the absence of the comparison of at least two vintages *throughout* the series, impairs its value. Some of the omissions may still be filled through the courtesy of Mr. Crabb; but even as the table stands, some very important points may be derived from it.

The most obvious one is, that so far as chemical analysis can determine the matter, Crabb's Black Burgundy stands nearer to the composition of French clarets than the wines made from the typical French grapes—Malbeck and Mataro—when grown in the climate of Napa. Something may be due to the youth of the vines from which the last named varieties were derived; but according to the usual assumption, the difference from that cause should be the other way.

Next in importance is, doubtless, the remarkable quality of the Grossblaue, as a wine for blending, imparting both body and tannin in a remarkable degree. Adding to this its low acid, and the fact that the color of this grape is very intense, and of a very desirable shade, it cannot fail to become of considerable importance for blending purposes. Chemically it would seem to be the very thing for correcting the high acid, low tannin, and low color Zinfandel wines of the valleys.

A more detailed consideration of other points would render this bulletin too lengthy, and is reserved for the future; the more as some other series, now in hand, will throw additional light upon the peculiarities of some of the grape varieties concerned.

BERKELEY, August 8, 1884.

The subjoined bulletin presents some additional facts in relation to the influence of locality upon the composition of wines from various grape varieties:

BULLETIN No. 21.

EXAMINATION OF RED WINES FROM SONOMA AND NAPA COUNTIES.

We owe to the courtesy of Messrs. J. H. Drummond, of Glen Ellen, and H. A. Pellet, of St. Helena, the opportunity of comparing with each other, as well as with similar ones heretofore examined (see Bulletin No. 13), the wines of some of the more important and promising claret grapes of late introduction. Some of these wines were made in small quantities only, from the crop of 1883, and may, therefore, not represent in every respect the probable outcome of large scale production hereafter; yet, as to the main points, they are doubtless representative, in so far as a single vintage can be. It should be kept in mind that in Sonoma, as well as elsewhere in the country north of the bay, the grape crop of 1883 was seriously affected by the hot June winds, not only shortening the total product, but also affecting, more or less, its general quality, especially as regards color, which was deficient throughout as compared with good years.

In the table below, data previously obtained and reported are placed alongside of those now communicated. The wines were all sound and in good condition when received:

CONTRIBUTOR.	Locality.	Grape Variety.	Vintage	Residue by Spindle	ALCOHOL. By Weight	ALCOHOL. By Volume	Tannin	Acid calculated as Tartaric
J. H. Drummond	Glen Ellen	Tannat	1883	2.054	8.55	10.66	.175	.484
W. H. Crabb	Oakville	Tannat	1883	2.99	10.07	12.54	.197	.397
J. H. Drummond	Glen Ellen	Cabernet Sauvignon	1883	1.85	7.23	9.00	.093	.472
W. H. Crabb	Oakville	Cabernet Sauvignon of Medoc	1883	2.94	10.44	12.90	.113	.390
J. H. Drummond	Glen Ellen	Gamay Teinturier	1883	2.308	8.84	11.00	.147	.495
W. H. Crabb	Oakville	Gamay Teinturier	1882	2.56	10.81	13.27	.092	.555
J. H. Drummond	Glen Ellen	Petite Sirah	1883	2.60	8.48	10.58	.090	.430
W. H. Crabb	Oakville	Grossblaue	1883	3.44	9.92	12.36	.239	.387
H. A. Pellet	St. Helena	Grossblaue	1883	2.436	10.35	12.85	.250	.398
H. A. Pellet	St. Helena	Carignane	1883	2.181	9.63	12.00	.162	.525
J. P. Smith	Livermore Valley	Carignane	1883	.....	8.48	10.60	.063	.677
Mr. Denicke	Fresno	Carignane	1883	.....	8.84	11.00	.073	.678

Of the varieties given in the table, the two first—*Tannat* and *Cabernet Sauvignon*—are especially noted as producing wines of high quality, the former being the grape entering mainly into the wines of Madiran and other localities of the Pyrenean region; while the Cabernet Sauvignon gives its high qualities to the Chateau Lafitte and related wines. It is curious to note the constant difference caused in both wines here analyzed by the repective localities, all the figures except those for acid being higher for Oakville than for Glen Ellen. This recalls the difference in the respective soils, that of Mr. Crabb's vineyard being (as heretofore noted) valley land with a gray loam soil largely intermixed with slaty rock fragments; while Mr. Drummond's vineyard lies on rolling or undulating land, immediately adjacent to the red hills at outlet of Nun's cañon. The soil itself is of a reddish tinge, and rather heavier than the Oakville soil. Mr. Pellet's soil seems practically identical with Mr. Crabb's. As regards the figures for Carignane, it must be remembered that while Mr. Pellet's vines are of considerable age, those from which the Livermore and Fresno wines were made were only in their third year, and were therefore liable to differ materially from the older grapes, while agreeing closely among themselves. Considering first the matter of

"BODY,"

Or solid contents, we find in the Cabernet and Tannat a difference approaching to fifty per cent in the excess in the Oakville wine over that from Glen Ellen, the latter approaching more nearly to the figures for "clarets," the former to the Burgundies. In the Teinturier the difference is materially less, which is the more remarkable, as there is a difference of about two per cent in the alcoholic contents, the valley wine again being the stronger. They are, however, of different vintages. The Sirah, from Glen Ellen, also shows a lighter body than is commonly supposed to belong to that grape. The Grossblaue, from Oakville, shows a remarkable excess of body over that from Pellet's, although in other respects the two wines agree closely, and neither offers a suspicion of imperfect fermentation. "Heavy body" would, therefore, seem to be a prominent characteristic of Mr. Crabb's location. Pellet's Carignane also has a rather light body.

ALCOHOLIC CONTENTS.

Crabb's wines have throughout a higher alcohol percentage than either Drummond's or Pellet's. Some of this may be due to personal practice in respect to the ripeness of the grapes when picked. Yet it is presumable that in 1883, a year of more or less defective vintage, all allowed their grapes to acquire all the sugar they could. Probably the youth of Drummond's vines as compared with Crabb's, has here also exerted its influence. Still, it cannot but be noticed that all the noble grapes on this list (counting out the Teinturier and Grossblaue) have given rather a low average of alcohol. This is a pregnant fact in reference to the prevailing lamentable practice of wine merchants, in gauging the price of wines purchased sensibly in proportion to their alcoholic strength. So long as this is tolerated by producers, and strengthened by the addition of sugar to must having less than the arbitrarily prescribed minimum of 22 of sugar, we shall vainly strive to improve the quality and reputation of California wines by the introduction and culture of the best grape varieties. The wines grown at the rate of ten or twelve tons per acre in the hot valleys will carry the day, so long as this vicious practice is adhered to.

In the matter of

TANNIN,

The table is very instructive. The high value of the Tannat and Grossblaue as furnishers of tannin, is strikingly shown in the closely concordant results of the two pairs of analyses, the average of the Tannat being nearly 1.80 pro mille, that of the Grossblaue nearly 2.45; the Tannat is followed closely, however, by Pellet's Carignane (1.62), showing one good reason why the Carignane blends so well with the Zinfandels of Napa, and the comparison of Pellet's products of older vines with those from three-year old vines of both Fresno and Livermore, shows very well one of the defects of these firstlings of our young vineyards, which should be kept well in mind by those blending for the market.

ACID.

In regard to acid, the Tannat and Cabernet Sauvignon show a striking and concordant difference for the two localities, Oakville showing in each case nearly one pro mille less than Glen Ellen, and the latter approaching more nearly to the accepted average for clarets, and rather remarkably nearly alike for the four wines—Tannat, Cabernet, Teinturier, and Sirah.

The acid percentage for the Grossblaue is almost identical for Crabb and Pellet, and is rather low, pointing, as heretofore remarked, to its adaptation to blends with the rather acid Zinfandels with low tannin.

The Carignane shows a rather high acid, and with its high tannin and low body, stands quite near the Tannat, as grown by Crabb. The marked differences in flavor between the two wines determine, of course, a difference of adaptation as to blends; but of the two the Carignane seems to come nearer to "standing on its own feet" as a claret grape acceptable to the general market.

Altogether, Glen Ellen appears in these comparisons, as a locality adapted to the lighter and more acid (and, therefore, possibly high bouquet) clarets, while the two valley-slope localities of Napa yield heavier bodied and also more alcoholic and astringent wines. In

the latter respect, the slaty soils of the Oakville region seem to differ quite materially from the properly alluvial soils of St. Helena, and approach those of the hills in the latter locality.

The discussion of the wines of the Santa Clara Valley, given below, forms Bulletin 43, to which, however, have been added the analyses of a number of wines made since its publication:

BULLETIN No. 43.

ANALYSES OF SANTA CLARA VALLEY RED WINES.

As it is of great interest to viticulturists to know what is likely to be the prevalent character of the wines of each region or locality, so as to adapt their blends to the production of definite qualities, I give below a table of the analyses of wines from the Santa Clara Valley made thus far; excluding therefrom some cases in which the wines were either not sound or manifestly not what they claimed to be, in kind. Some of these analyses have, of course, been given in previous bulletins and reports, but they are here placed alongside of later results which complement them, without, however, being as yet sufficiently numerous to be finally conclusive.

It is hardly necessary to repeat here, as regards the claims of chemical analysis in showing the character of wines for purposes of blending, that analysis can only determine certain conditions which *must* be fulfilled in a successful blend; but cannot speak of the flavors, which must likewise be harmonized in order to render a wine palatable. The taster must of necessity be the ultimate arbiter in the premises.

As regards, first (see table below), the Zinfandels, the conclusion previously reached (see Bulletin No. 12, Zinfandel discussion), that those of the Santa Clara region are of exceptionally heavy *body*, as compared with those of the Napa and Sonoma *valley* lands, is confirmed, viz.: a little over 3 per cent, against an average of 2.3 in the latter. The difference is so great that it strikes the taste at once; and parallel with it runs the always intense *color* of the Santa Clara Zinfandels, which seems to exceed, in general, that of any other region in the State, even where, as in the hill Zinfandels of Napa, Santa Rosa, and Cloverdale, the body reaches nearly the average of 3 per cent. The *alcoholic strength* also reaches an exceptionally high average, that of 13.6 per cent, against 11.3 for all Zinfandels of Napa and Sonoma, and 13.2 for the hill Zinfandels alone of the latter counties. As regards *tannin*, there seems to be a difference between the wines from the deep gravelly loam lands of the western border of the valley, and those from the dark adobes of the eastern; the former showing in two cases quite a high proportion of tannin, while the Mission San José wines range rather low. In *acid*, the average of the five Santa Clara Zinfandels runs nearly 1 *pro mille* above the average of eleven from Napa and Sonoma (.630 against .537).

If this comparison be taken as representing approximately the relations of the two regions to each other as to the product of the Zinfandel vine, it would appear that notwithstanding its location so near the coast, and more or less under the influence of the Summer fogs, the Santa Clara Valley represents in most of the above points regions having a much hotter climate; for its Zinfandels run with those of Stockton and Fresno, and are more of a Burgundy than of a claret type, save in one particular, viz.: that of acid. The average of seven Zinfandel wines from the great valley (Stockton and Fresno) is .488 of acid, against the above, .630, from the Santa Clara Valley.

While tastes may differ as to which of the two is the preferable average, it is well established that wines of very heavy body and alcoholic strength acquire a special zest from the presence of a large proportion of acid, which in lighter wines would be considered excessive.

The question naturally arises whether what is true of the Zinfandel holds good also with other grape varieties; whether, in other words, there is in the Santa Clara Valley a *general* tendency to the above characteristics, that should be taken into account in proportioning the grape varieties intended to produce, *e. g.*, a moderately light table claret, such as is usually desired by those accustomed to its use.

The data thus far at hand are too scanty to determine this question definitely; but in reviewing such as we have, there appears to be reason for the belief that what is true of the Zinfandel holds also, more or less, as regards other wine grapes now grown in the Santa Clara Valley.

Taking first the Mataro, we unfortunately have no adequate data of comparing its wines with those from other localities. But it will be noted that not only in general, but for corresponding vintages and localities, the Mataro has a notably lighter body, as well as lower alcoholic contents and lower acid than the Zinfandels. It is, therefore, in these respects, a very proper blend for the heavy Zinfandels, with a view to modifying them for table use; and, as the two wines are perfectly harmonious in taste, this will doubtless be one of the prominent blends in the future. But it must be remembered that the Mataro carries no larger proportion of tannin than the average Zinfandel, so that where the latter is deficient a third tannin-bearing grape should enter into the combination. A glance at the tannin column above shows that of the varieties represented, the Malbeck and the Charbono (from Lefranc and Doyle, West Side) are the ones preëminently adapted to this use,

their tannin contents ranging from 17.2 ten thousandths to 24.0. The innate and invincible coarseness of the Charbono excludes it from use in the better class of blends; but the Malbeck is eminently the third ingredient needed, both for tannin and for the modification of the Zinfandel peculiarities; its character being decided and harmonious, and its acid low and mild. In the future the Grossblaue, Tannat, and perhaps Crabb's Burgundy will take their place in the combination to suit the various tastes of consumers. It should be noted that of all wines in the table the Malbeck shows, from both localities, the heaviest body (3.61 per cent); it has also a very intense color. In last year's vintage from Folsom, Malbeck showed only 2.68 of body and 10 ten thousandths of tannin.

It is instructive to note that Portal's and Pfeffer's Cabernet, which has been claimed as simply a variety of the Malbeck or Cot, differs remarkably in composition from the true Malbecks of the valley; having a much lower body and tannin, so that, however high their general quality, they cannot take the place of the Malbeck in blends, and in fact themselves need the latter or some equivalent, to eke out the tannin. I doubt that their profitable use will be found to lie in the direction of blends with the Zinfandel, which is too pronounced in character not to overshadow the delicate qualities of the Cabernets, whose natural combinations would be rather with the Malbeck, Ploussard, and Merlot for high quality wines, and with Verdot for the commoner sorts.

The low body, and relatively low alcoholic contents of Grenache and Carignane wines, seem to justify their use for Zinfandel blends alongside of Mataro, as has been customary; the more as their defects of color will not make any difference in the intensely-tinted Zinfandels of the Santa Clara Valley. But both are high in acid, and thus do not modify to the desirable extent the sharp acidity of the Zinfandel; nor does the latter, to many persons' taste, blend agreeably with the burnt-sugar flavor of the Grenache.

The Trousseau and Malvoisie wines of the valley do not appear to differ materially from those of other regions, save that, as noted in a former bulletin, the Trousseau seems to be remarkably low in tannin here, as the Malvoisie is everywhere. The latter is hardly to be taken into consideration as a material for dry wines in this region. The Trousseau must evidently, when so used, be blended with other grapes having an adequate astringency; while in the great valley it seems to be provided with tannin almost as fully as the Zinfandels.

BERKELEY, September 10, 1885.

ANALYSES OF SANTA CLARA VALLEY RED WINES.

No.	VARIETY.	Grower.	Locality.	Vintage.	Body.	ALCOHOL.		Tannin.	Acid as Tartaric.	Ash.
						By Weight.	By Volume.			
175	Zinfandel	J. Gallegos	Mission San José	1881	3.19	11.69	14.30	.040	.730	.260
176	Zinfandel	J. Gallegos	Mission San José	1882	2.94	10.81	13.27	.079	.590	.280
186	Zinfandel	J. Gallegos	Mission San José	1883	2.44	8.13	10.20	.030	.700	.154
185	Zinfandel (second crop)	J. T. Doyle	Cupertino	1883	3.07	11.62	14.20	.128	.543	.276
192	Zinfandel	J. B. J. Portal	Burgundy Vineyard	1883	3.07	11.08	13.54	.168	.690	.266
195	Zinfandel	J. B. J. Portal	Burgundy Vineyard	1884	2.69	8.27	10.33	.180	.510	.300
194	Zinfandel	J. T. Doyle	Cupertino	1884	3.44	10.54	13.00	.077	.592	.344
204	Zinfandel	J. Gallegos	Mission San José	1885	3.83	11.77	14.60	.120	.753	.370
205	Zinfandel (second crop)	J. Gallegos	Mission San José	1885	2.69	8.84	11.00	.080	.873	.234
207	Zinfandel *Port*	McIvor	Mission San José	1885	8.64	12.23	15.00	.212	.534	-----
206	Zinfandel	L. D. Combe	Los Gatos	1885	2.89	10.63	12.91	.174	.609	.370
124 A	Mataro	Capt. Merither	San José	1883	2.26	7.23	9.00	.080	.533	.246
124	Mataro	Jesuit Fathers	Santa Clara	1883	2.44	7.50	9.37	.073	.315	.346
125	Mataro	J. B. J. Portal	Burgundy Vineyard	1883	2.18	9.85	12.30	.100	.375	.266
125 A	Mataro	J. B. J. Portal	Burgundy Vineyard	1884	2.90	9.92	12.36	.138	.600	.20
289	Mataro	L. D. Combe	Los Gatos	1885	2.56	8.98	11.18	.110	.590	.390
52	Grenache	Ch. Le Franc	Almaden Vineyard	1876	2.49	9.36	11.60	not det.	.792	.360
131	Grenache	J. B. J. Portal	Burgundy Vineyard	1883	2.17	9.78	12.17	.093	.543	.219
241	*Grenache	William Pfeffer	Gubserville	1884	1.93	7.43	9.27	.065	.532	.277
290	Grenache	L. D. Combe	Los Gatos	1885	2.69	9.85	12.20	.127	.400	.235
9	Charbono	H. M. Naglee	San José	1880	1.53	5.21	6.50	not det.	.442	.319
152	Charbono, No. 1	J. T. Doyle	Cupertino	1884	2.84	8.34	10.40	.175	.506	.453
153	Charbono, No. 2	J. T. Doyle	Cupertino	1884	2.84	7.99	10.00	.200	.507	.409
291	Charbono	L. D. Combe	Los Gatos	1885	2.69	7.99	10.00	.190	.672	.266
150	Malbeck	J. T. Doyle	Cupertino	1883	3.59	11.15	13.63	.240	.345	.355
151	Malbeck	Ch. Le Franc	West San José	1884	3.62	9.99	12.45	.172	.461	.446
141	Cabernet Franc	J. B. J. Portal	Burgundy Vineyard	1884	3.02	9.78	12.18	.110	.480	.270
213	*Cabernet Franc	William Pfeffer	Gubserville	1884	2.13	8.48	10.58	.070	.607	.293
292	*Cabernet Franc	William Pfeffer	Gubserville	1885	-----	-----	-----	.179	.726	.354
293	Cabernet Franc	R. C. Stiller	Gubserville	1885	3.36	13.08	16.10	.168	.608	.350
294	*Cabernet Franc	L. D. Combe	Los Gatos	1885	2.99	8.84	11.00	.123	.850	.270
295	Cabernet Sauvignon	Father Cichi	Santa Clara	1885	3.24	9.85	12.27	.167	.495	.430
136	Burgundy	J. B. J. Portal	Burgundy Vineyard	1883	2.45	9.70	12.10	.073	.750	.277
296	Burgundy	L. D. Combe	Los Gatos	1885	3.07	10.07	12.50	.200	.761	.306

297	Burgundy	Father Cichi	Santa Clara	1885	2.49			.145	.45	.350
298	Petit Pineau	Father Cichi	Santa Clara	1885	2.80			.143	.604	.400
126	Carignane	J. B. J. Portal	Burgundy Vineyard	1883	2.06	9.27	11.54	.055	.627	.227
142	Ploussard	J. B. J. Portal	Burgundy Vineyard	1884	2.77	10.69	13.12	.091	.543	.273
156	Malvoisie	J. Gallegos	Mission San José	1883	2.43	9.27	11.54	slight.	.467	.220
286	Malvoisie	J. T. Doyle	Cupertino	1884	2.05	7.64	9.54	.050	.590	.250
287	Malvoisie	J. Gallegos	Mission San José	1884	2.10	7.99	10.00	.040	.456	.300
288	Malvoisie	J. Gallegos	Mission San José	1885	3.07	9.41	11.80	.104	.521	.287
159	Trousseau	J. T. Doyle	Cupertino	1883	2.69	11.15	13.50	.040	.600	.447
231	*Trousseau	William Pfeffer	Gubserville	1884	2.28	9.92	11.64	.050	.474	.349
------	Trousseau	Father Cichi	Santa Clara	1885	3.06	9.20	11.45	.108	.657	.337

* Wines made at the Viticultural Laboratory.

PART III.

RECORD OF WORK IN THE VITICULTURAL LABORATORY FOR THE SEASON 1884-5.

GENERAL REMARKS ON THE VINTAGE WORK OF 1884.

The volume, and, in a measure, the importance of the work of the season 1884, largely exceeded that of 1883. This was in the main due to the offer of the Natoma Water and Mining Company, of Natoma, Sacramento County, to forward to the viticultural laboratory for experimental wine-making, sample lots of each of about forty varieties of grapes, which had been imported from Europe two years before, and, having been grafted on vigorous Mission stocks, and trained long on stakes, were expected to yield a sufficient crop for a fair wine-making test. Some of these would be fruited in the State for the first time. As the limited means of the viticultural laboratory would not have allowed the purchase of the necessary caskage, the company offered to furnish this also, besides paying, as usual, the transportation charges. It was agreed that the results of these tests should be published for the benefit of the public, whenever available.

The plantation is in rather low ground, and the product may, from this cause, as well as from the youth of the vines, be accounted as not representing the best result to be expected from each variety.

The grapes were usually (after stemming) crushed as soon as received, *i. e.*, in from two to three, rarely four days after shipment from the vineyard. The quantities being small, it was necessary to keep the temperature of the fermenting room higher than would have been admissible for large packages—usually between 67° and 70° F. Under these circumstances the fermentations were almost always completed within from seven to nine days after crushing, as is the case on the large scale. The red wines were fermented in tubs of appropriate sizes, with floating, unperforated covers, leaving about an inch or less of space all around for the escape of gas, without exposing the pomace to acetification; and twice each day the whole was thoroughly stirred. The pomace was in all cases pressed, and the press must or wine united with the first run; and here, again, the wines do not represent the best possible result, as is well understood. The presses used were the "Keystone" and the "Americus," and, as the same persons always did the pressing, it is presumable that the percentages of pomace given below represent actual differences in the grapes themselves. The must was in most cases analyzed immediately after pressing, but sometimes the pressure of work prevented this, and it was omitted.

The after-fermentation of all the red wines at least took place in kegs of proper size, of from one to ten gallons, in a room kept at all times at from 58° to 60° F.

It would have been impossible to carry out this work successfully with the aid of the single assistant (Mr. M. E. Jaffa) then employed; but this difficulty was measurably removed by the offer of Mr. F. Pohndorff, of St. Helena, the well known and highly esteemed wine expert, to lend his aid in the way of advice and occasional direct help, and also to send his son,

Mr. F. Pohndorff, Jr., to serve as a volunteer and special student during the vintage season. Even with this generous help, the pressure became too great toward the end, and, upon my suggestion, the State Viticultural Commission agreed to defray, for one month, the salary of a special assistant, who was secured in the person of Mr. George E. Colby (since appointed permanently to the position of second assistant in the viticultural laboratory.) It thus became possible not only to handle successfully the large number of wines from single varieties, and blends made under the advice of Mr. Pohndorff, but also to analyze the more important ones in time for the meeting of the State Viticultural Convention, which occurred during the first week of December. On that occasion a set of ninety-six wine samples of the same year's vintage was exhibited on behalf of the viticultural laboratory, and the showing thus made was the direct cause of the recommendation made by that Convention for a material increase in the facilities for work at the University, that was embodied in the report of a committee appointed for the purpose of examining the arrangements then existing. That report, as well as a documentary history of the appropriation made in pursuance thereof by the Legislature, is appended to this publication.

With such inadequate space and appliances, it was not easy to maintain perfect order and the best conditions for all the numerous fermentations, some of which would have required a higher, others a lower temperature than that which was maintained as adapted to the majority, viz., from sixty-five to seventy degrees. The result was that a few of the wines "went wrong," but the great majority were successfully made, and now, a year from the making, they exhibit very strikingly and favorably the qualities to be expected of the several grape varieties represented.

The following table shows in summary form the amount and kind of the work done this season, and the contributions received from various sources:

Contributor.	Red Grapes.	White Grapes.
Natoma Water and Mining Company, Natoma	22	22
C. W. Howard, Lower Lake	1	
H. A. Pellet, St. Helena	2	
William Scheffler, St. Helena	1	
J. L. Black, Livermore	1	1
P. W. Butler, Penryn	1	1
E. B. Smith, Martinez	1	
J. T. Doyle, Mountain View	1	
H. Mel, Glenwood	1	
H. Hagen, Napa	1	
Stern & Rose, San Gabriel	1	1
H. Langenberger, Anaheim	1	
George West, Stockton	1	
L. P. Berger, Lakeport	1	
William Pfeffer, Gubserville	3	
H. W. Crabb, Oakville	2	
R. Barton, Fresno		1

The wines made were:

Of Claret and Burgundy types	36
Dry White, Sauterne, etc.	19
Ports	5
Sherries	7
Total wines of single varieties	67

Grape blends, etc.:

Red, Claret, and Burgundy types	15
Dry White, Sauterne	2
Ports	2
Total grape blends	19
Total wines made	86
Wine blends made	10
Total samples	96

Most of these samples were tasted by the wine committee of the Viticultural Convention, and the results were published in the report of its proceedings.

The wines in the University Laboratory storage room were, of course, duly attended to in the way of racking and filling up, and were repeatedly tasted, partly by Mr. Pohndorff, and partly by myself, as opportunity occurred. Toward the Spring of 1885 it became apparent that some of them were suffering as though from excessive access of air, although carefully closed at the bungs, and kept full; and it was found that this arose from the excessive thinness of the keg staves, which did not average half an inch. No better kegs being procurable at the time, it was determined to give to all a thick coat of pure paraffine, so as to cut off both excessive evaporation and access of air. This was done, with some difficulty, by the repeated use of well-heated paraffine, applied with a large, coarse brush. The application was, however, quite successful in its object. The ullage was at once greatly reduced in amount, and no further increase of the abnormal condition, viz., increase of improper acids, and other signs of oxidation, have since appeared. It was, however, determined that for all future vintages kegs of double thickness should alone be used, in preference, also, to glass vessels, in which the access of air is too limited, thus placing the wines under conditions materially different from those obtaining on the large scale, and also liable to cause frequent loss of the experiment from bursting, consequent upon, sometimes entirely unexpected, after-fermentation in closely stoppered demijohns.

In the racking of quantities ranging in most cases from one to five gallons, considerable trouble arises from the difficulty of finding vessels—whether kegs or glass—which shall exactly contain the quantity of wine diminished by the removal of "turbids." Thus, a five-gallon keg of must will, at the first racking, come down to about four and a half gallons; then at each succeeding racking a progressively diminishing portion will be left as "turbids," and it becomes impossible to avoid placing a surplusage over *even* gallons in bottles, half bottles, or vials, as the case may be. Such bottled samples are ordinarily afterwards used in filling up; but in many cases the portions bottled at the early stages are found to be so widely different in character from the wines kept in wood, as to render it inexpedient to mix them. It being inadmissible in these experimental fermentations to use other wines for filling up, it then becomes necessary to devise something else that shall fill the space left vacant by evaporation. For this purpose broken quartz is sometimes used; but finding it difficult to procure that substance entirely free from admixtures that might possibly influence the wine, it was decided to use fragments of Folsom granite instead, which contains no minerals at all affected by the acids of wines. This proves quite satisfactory, provided the utmost precaution is used in keeping the broken rock free, not only from dust, but from all contact with odors or

laboratory fumes. It is, therefore, kept in close vessels after purification, first, by treatment with strong acid, then thorough washing, and a final boiling with clean water, until no trace of odor or other impurity can remain. The only effect upon the wines is that from strongly colored ones, or those losing their color readily, a little color is taken up and remains fixed. It is therefore necessary to reserve separate portions for use in red and white wines, in order to avoid coloration of the latter by absorption from reddened granite.

Of nearly all the wines, samples have also been kept in bottles and vials, for comparison of the effects of the package on the development of the wines; and of many, samples were exposed in bottles only partially full, in order to test their keeping qualities under such circumstances. Nearly all have been tasted at three successive periods by Mr. Pohndorff as well as by myself. In the notes given below, the dates as well as the tasters are mentioned, and they include, of course, such portions of the report of the wine committee of the late Viticultural Convention as refer to the same wines.

In order to render the results more generally useful in guiding the choice for planting, I place at the beginning of each statement an abstract of the main points of interest in connection with the culture of the several grapes, largely from the (French) work on the vines of France, by Mas & Pulliat; also the notes furnished by the Natoma Company concerning the habit of the vine, as observed at Folsom, with such remarks as were suggested by the comparison with the figures and descriptions of the French types.

LIST OF GRAPES RECEIVED AT THE VITICULTURAL LABORATORY, 1884.

No.	Variety.	Grower.	Place of Production.
	Red Wine.		
211	Malbeck	Natoma Company	Natoma.
212	Cabernet Franc	Natoma Company	Natoma.
213	Cabernet Franc	Wm. Pfeffer	Gubserville.
214	Cabernet Sauvignon	Natoma Company	Natoma.
215	Merlot	Natoma Company	Natoma.
216	Verdot	Natoma Company	Natoma.
217	Tannat	H. W. Crabb	Oakville.
218	Beclan	Natoma Company	Natoma.
219	Carignane	Natoma Company	Natoma.
220	Grossblaue	H. A. Pellet	St. Helena.
221	Black Burgundy	H. W. Crabb	Oakville.
222	Black Pinot	L. P. Berger	Lakeport.
223	Meunier	Wm. Scheffler	St. Helena.
224	Meunier	H. Mel	Glenwood.
225	Zinfandel	Ch. Webb Howard	Lower Lake.
226	Zinfandel	J. L. Black	Livermore.
227	Zinfandel	P. W. Butler	Penryn.
228	Zinfandel	E. B. Smith	Martinez.
229	Zinfandel	Natoma Company	Natoma.
230	Trousseau	Geo. West	Stockton.
231	Troüsseau	Wm. Pfeffer	Gubserville.
232	Petite Sirah	Natoma Company	Natoma.
233	Petite Sirah	Natoma Company	Natoma.
234	Serine	Natoma Company	Natoma.
235	Mondeuse	Natoma Company	Natoma.
236	Mondeuse	Natoma Company	Natoma.
237	Cinsaut	Natoma Company	Natoma.
238	Aramon	Natoma Company	Natoma.
239	Mourastel	Natoma Company	Natoma.
240	Grenache	Natoma Company	Natoma.
241	Grenache	Wm. Pfeffer	Gubserville.
242	Petit Bouschet	Natoma Company	Natoma.
243	Petit Bouschet	Natoma Company	Natoma.
244	Clairette Rouge	Natoma Company	Natoma.

List of Grapes Received, Etc.—Continued.

No.	Variety.	Grower.	Place of Production.
245	Barbera	J. T. Doyle	Cupertino.
246	Lenoir	H. Hagen	Napa.
247	Lenoir	H. Langenberger	Anaheim.
248	Blau-Elbling	Stern & Rose	San Gabriel.
249	Mission	Gov. Stanford	Vina.
250	Black Prince	P. W. Butler	Penryn.
	Dry White Wine.		
251	Semillon	Natoma Company	Natoma.
252	Semillon	Natoma Company	Natoma.
253	Sauvignon, bl.	Natoma Company	Natoma.
254	Sauvignon, bl.	Natoma Company	Natoma.
255	Sauvignon, bl.	Natoma Company	Natoma.
256	Muscadelle du Bordelais (loose bunches)	Natoma Company	Natoma.
257	Muscadelle du Bordelais (compact bunches)	Natoma Company	Natoma.
258	Folle Blanche, "Tannat"	Natoma Company	Natoma.
259	Folle Blanche	J. L. Black	Livermore.
260	Burger	Stern & Rose	San Gabriel.
261	Burger	R. Barton	Fresno.
262	Rousanne	Natoma Company	Natoma.
263	Marsanne	Natoma Company	Natoma.
264	Clairette Blanche	Natoma Company	Natoma.
265	"Pecoui Touar" (?)	Natoma Company	Natoma.
	Sherry and Madeira.		
266	Pedro Jimenes	Natoma Company	Natoma.
267	Palomino	Natoma Company	Natoma.
268	Peruno	Natoma Company	Natoma.
269	Mantuo de Pilas	Natoma Company	Natoma.
270	Mourisco blanco	Natoma Company	Natoma.
271	Beba	Natoma Company	Natoma.
272	Verdelho	Natoma Company	Natoma.
273	Boal Madeira	Natoma Company	Natoma.
274	Ugni blanc	Natoma Company	Natoma.
275	Malmsey	Natoma Company	Natoma.
276	Malaga	P. W. Butler	Penryn.
	Port Wine.		
277	Tinta Cao	Natoma Company	Natoma.
278	Tinta Madeira	Natoma Company	Natoma.
279	Mourisco Preto	Natoma Company	Natoma.
280	Tinta Amarella (not fully ripe)	Natoma Company	Natoma.
281	Tinta Amarella (fully ripe)	Natoma Company	Natoma.
282	Moretto	Natoma Company	Natoma.
283	Bastardo	Natoma Company	Natoma.

DESCRIPTIVE LIST OF GRAPES RECEIVED AND WINES MADE, WITH ANALYSES OF MUSTS AND WINES.

A.—RED WINES.

NOTE.—The classification of grapes and wines here given is made for convenience of reference, in accordance with the most usual or most prominent characters; but of course is not absolute, since one and the same grape may, according to climate, location, and treatment, be made to yield a great variety of wines.

1. BORDEAUX OR CLARET TYPE.

No. 211. Malbeck.

The general character and uses of the Malbeck are sufficiently well understood in California to render any elaborate recapitulation unnecessary. It is one of the most widely cultivated grape varieties of France, where it forms more especially the basis of a large proportion of the wines of the Bordeaux type. Its best qualities seem to be developed in the western departments, within reach of the tempering influence of the Atlantic Ocean. Considering the importance attached to the Malbeck in France, it is rather remarkable that its culture should have received so little attention thus far in California, where it has nevertheless been the especial desire to emulate the Medoc wines. This is doubtless largely due to the fact that this variety is but a very light bearer under the short-pruning system, which, for many reasons, has thus far been almost universally prevalent. But now that a large number of other indispensable long-pruners is being introduced, the Malbeck, with the Cabernets, must take its place here, as in France, among the most important claret varieties; furnishing, apart from its characteristic and well known "Bordeaux" flavor, abundance of color, tannin, and body. In its use for blending, the fact that it seems to ripen proportionately somewhat earlier than in France, must be considered.

The largest area of Malbeck in the State, thus far, is probably to be found at the New Almaden vineyard of Mr. Charles Lefranc.

From Natoma it is reported to be a light bearer of good vigor; bunches small and loose; ripens during the first week of September. The grapes arrived in good condition on September sixth, and were worked up the following day. The amount of sugar was 21.33 per cent. Fermentation of 84.9 pounds crushed began on the morning of September tenth, at a temperature of 71.6° F. It reached its maximum temperature of 81.5° F. (temperature of the room, 71° F.) on the morning of September eleventh, then very gradually fell to the cellar temperature (68° F.) on September sixteenth, when the murk was drawn off ten days from the crushing, the yield from the above amount being 6.7 gallons, or at the rate of 158 gallons per ton; pomace 14.57 per cent.

The wine was racked from the lees the first time on October twenty-second; again racked November thirteenth; again racked February twenty-seventh.

RECORD OF TASTING.

[Report of Viticultural Convention Committee, December, 1884.]

Malbeck having matured at the Natoma Vineyards on the seventh of September, while Cabernet Franc, Merlot, and Verdot grapes were ripe on the twentieth, and Cabernet Sauvignon on the twenty-ninth of September, the utilization in blends, on the programme at the University, of different Medoc varieties for closer composition according to the

Bordeaux methods was out of the question, and thus a more determinate trial in that style was not made. But all doubts as to the success, in regard to the quality, from these grapes in California vineyards are overcome. While at Natoma the bearing power of all is so far only very moderate.

Mr. Drummond states that at Glen Ellen Malbeck is pretty prolific. Possibly better success as to quantity may be attained in different regions of the State with these varieties, which will be very important ones for our vineyards.

Samples not present at the Convention, but known to two members of the committee, of Malbeck of 1883, of J. T. Doyle, and another of 1882, of Crabb, the latter kept in a bottle half full for six months at the University, had preserved their color in all its beauty, and remained fully sound and in perfect state of preservation, the older one well developed.

The same was the case with a half full bottle of Tannat of 1883, grown by Mr. Crabb, in which the color was deep ruby, not in the least weakened. These proofs of the keeping qualities of these varieties it may be opportune to state. It may be well to state here, also, that samples not exhibited at the Convention, but subsequent to that occasion, came before one of the committee. Malbeck of 1881, of Lefranc, and another of the same, of a vintage twelve years back of wine of that grape, as well as another of three years of another Santa Clara County Malbeck, prove irrefragably the excellent keeping power of the color of that wine, and a beautifully rounded mellowness in their taste. But the examination of those samples equally confirmed that, far from being up to the mark as to agreeableness for a direct drinking wine, its great qualities for addition to and characterizing other Medoc variety wines, are manifest; and that, in fact, an intelligent proportioning of such addition is an indispensable requirement.

Malbeck Nos. 172, 139 (this number is deficient in astringency), U. 211, of the 1881 vintage No. 133, and of 1882 No. 134, represented this variety direct. The qualities desired and expected were best expressed in No. 172 from Mountain View, while the other two numbers were found of nice quality, proving the success that grape will have in our vineyards.

U. 309. Four parts Malbeck with one part of Petite Sirah, is a combination which seems it will have to be discarded, proving that Malbeck needs no addition, but is a welcome and highly useful addition in that grape.

ANALYSES.

	Natoma Company, Natoma.	Ch. Lefranc, New Almaden Vineyard.
Must.		
Sugar by spindle	20.94	
Acid	.61	
Wine.		
Alcohol: Volume	10.42	12.45
Alcohol: Weight	8.34	9.99
Body	2.68	3.62
Tannin	.10	.05
Acid	.45	.59
Ash	.39	.25

CABERNET FRANC.

The Cabernet Franc occupies a prominent place as one of the standard wine grapes of the Bordeaux region. It is a vigorous and hardy vine, which, wherever it is grown in a suitable soil, yields wines of high and delicate bouquet and of excellent keeping qualities. This characteristic bouquet is due to a peculiar flavor of the grape, which is maintained under the most diverse conditions of growth; while the grape-stems, highly charged with tannin, yield abundance of the latter substance, so as sometimes to render it desirable to exclude them from the vat. The berries resist rains and moisture remarkably well, so that they can be fully matured without fear of injury. Such full maturity, necessary for the production of the "great wines," can only be attained in climates at least as warm as that of Bordeaux, it being a grape of the second epoch of ripening.

The Cabernet succeeds especially in dry and stony soils, in which varieties of less vigorous habits could not prosper. In deep and rich soils it

runs to wood, and its berries lose largely their quality. It is a shy bearer, and must always be pruned long.

At Natoma, the Cabernet Franc showed fair vigor, and although a light bearer it was somewhat more prolific than Cabernet Sauvignon, and ripened a few days earlier. The grapes were gathered, fairly ripe, on September eighteenth, and again, more fully matured, on September twenty-third. The last invoice was mainly used for blends, the first being made into wine by itself. The grapes were quite acid to the taste, and not very juicy, with a peculiar, faintly "foxy" aroma, and no very prominent astringency; the must showed only 19.9 per cent of sugar.

The fermentation of 121.2 pounds, crushed on September twentieth, began on September twenty-second, and reached its maximum next morning at a temperature of 82.4° F.; then gradually fell to the cellar temperature on September twenty-seventh, when the murk was drawn off, seven days from the crushing; showing a remarkably good and regular fermentation. The yield was 9.5 gallons, or at the rate of 156.5 gallons per ton; pomace, 10.3 per cent. The young wine was racked from the lees on November fourteenth, showing a clear, almost bright condition.

RECORD OF TASTING.

November 14. (Pohndorff.) Color, medium deep; taste showing a superabundance of vinous acids, proving that the grape should be combined with other varieties, but character excellent, with a pronounced, peculiar aroma.

First week of December, 1884. Report of Viticultural Convention Committee:

Cabernet Franc, U. 212, gives evidence of the well known meritorious qualities of its grapes. Its combination (U. 310), with one third Grossblaue, has a certain degree of harshness which indicates a too heavy proportion of the latter grape, while U. 60, having with 15 per cent of Grossblaue and 10 per cent of Black Prince and 15 per cent of Folle Blanche to 60 per cent of Cabernet Franc, proves to be quite distinct and advantageously combined.

This blend, however, showed the defect of taste, and smell of sulphur, which was caused by this latter substance having been too freely put on the Cabernet Franc grapes in the vineyard, and notwithstanding the repeated washing of these grapes at the University laboratory, to free them from the adhering sulphur, the smell and taste had entered into the wine. This instance may teach that a very scrupulous handling of the delicate Medoc variety vines is indispensable.

U. No. 311, having to 64 per cent of Cabernet Franc, 9 per cent of Grossblaue, 9 of Folle Blanche, and 18 of Carignane (the latter grapes having imparted a slightly mouldy taste to the blend, impaired thereby in its frank impression), seemed also measurably harmonious, showing that it is desirable to study the proper combination of these varieties in different proportions.

U. blend, No. 312, not noted in the catalogue, consisting of $\frac{1}{3}$ Petit Sirah and $\frac{2}{3}$ of Cabernet Franc, is a successful combination.

February 9, 1885. (Pohndorff.) Cabernet Franc in a four-gallon keg is well advanced in its development, and shows the characteristic grand perfume of its variety; has depurated itself particularly well, but has felt the adverse circumstances due to the thinness of the staves. Comparing the hardiness of the Cabernet Franc wine with that from the Cab. Sauvignon, the Natoma samples prove the latter to be the more stable one. A sample of Cab. Franc in bottle on some lees, has developed beautifully, its taste being frank and expressive, body good, and color well preserved.

April 29. (E. W. H.) The condition of the wine is bright, color fine, although only moderately intense; bouquet developing slowly, but the peculiar flavor of the grape well pronounced, together with a markedly smooth, agreeable, vinous taste. A sample preserved in a bottle since February is more harsh in taste, but bouquet better developed.

It should be noted that the Cab. Franc has thus shown here all the qualities attributed to it in France, including that of the hardiness of the grape itself, which remained sound for several weeks, stored on shelves in the basement.

ANALYSES.

	No. 212. 1884. Natoma Co.	No. 213. 1884. W. Pfeffer.	No. 292. 1885. W. Pfeffer.	No. 294. 1885. L. D. Combe.
Must.				
Sugar by spindle	20.62	22.43	22.15	21.49
Acid	.62	.77	.82	1.04
Wine.				
Alcohol: Volume	12.00	10.58	.....	11.00
Alcohol: Weight	9.63	8.48	.....	8.86
Body	2.84	2.13	.....	2.99
Tannin	.04	.07	.18	.12
Acid	.48	.61	.73	.85
Ash	.43	.29	.35	.27

No. 213. *Cabernet Franc.* (Wm. Pfeffer.) Bunches were somewhat bruised when received. The grapes were worked on October 21, 1884, showing 21.39 per cent of sugar.

Fermentation of 13.2 pounds crushed began during the morning of October 22, 1884, reached its maximum the next morning at a temperature of 72.5° F. (temperature of cellar, 67° F.), where it stood for about forty-eight hours, then slowly fell to the temperature of the cellar (65.3° F.), on October 28, 1884, when the murk was drawn off, seven days from the crushing. The yield from the above amount being .978 gallons, or at the rate of 148.10 gallons per ton; pomace, 11.25 per cent.

On November 7, 1884, the wine was racked from the lees; again racked November 25, 1884; again racked February 20, 1885, and lastly in August following, and analysis was made April 3, 1885.

RECORD OF TASTING.

Report of Viticultural Commission Committee, December, 1884. A sample of Cabernet Franc of Wm. Pfeffer, Santa Clara County, shows excellent qualities, and is of a velvety pleasant taste.

CABERNET SAUVIGNON.

The Cabernet Sauvignon is closely related to the Cabernet Franc, and greatly resembles it in most respects; it ripens a few days earlier, and is quite as good a keeper; its wine has a peculiar body and a great deal of bouquet and perfume; its color is somewhat deeper than that of the Cabernet Franc. The wine is fully as good a keeper as the latter, and matures a little more slowly, generally requiring one year more in the cask before bottling.

The Cabernet Sauvignon enters in a very large proportion of the wines of Lafitte, Mouton, Latour, Leoville, and most of the "Grands Crus." A soil of gravel mingled with clayey sand is that in which this vine prospers most; in marly soils it produces but little. It bears chiefly on the upper ends of the canes, hence requires long pruning; and in order to counteract the tendency to fruiting on the ends only, the canes are bent in training on trellises. The berries, which are rather small, are quite thick skinned, and have the peculiar flavor of all Cabernet varieties. They ripen somewhat late in the second epoch.

From Natoma the Cabernet Sauvignon is reported to be of fair vigor, and a light bearer. The grapes were gathered on September twenty-fourth, fully ripe; they were received in good condition at the University, and corresponded accurately to the description, also as regards the differences

from the Cabernet Franc, the latter having looser bunches and smaller berries, and a more decided flavor.

The fermentation of 84.5 pounds, crushed September twenty-fifth, and showing 23.14 per cent of sugar, began on the morning of the twenty-seventh at 66.2° F.; reached its maximum of 73.4° F. on September twenty-ninth, the temperature of the room being 70° F. at the time, then fell slowly to the cellar temperature on October fourth, when the murk was drawn off, nine days from the crushing. Yield from the above amount, 6.5 gallons, corresponding to 153 gallons per ton: pomace, 17.2 per cent, being the largest of all the red grapes worked. It will be noted that the fermentation started very promptly, but progressed slowly, though steadily, the temperature rising but a few degrees above that of the cellar. The young wine was racked from the lees on November fourteenth, and again on March second.

RECORD OF TASTING.

November 14, 1884. (Pohndorff.) Excellent; of deep ruby color, and clean taste, though slightly affected by the sulphuring of the grapes.

First week of December. Report of Viticultural Convention Committee. (No record regarding the above pure sample.)

A sample of Cabernet Sauvignon, U. No. 214, of Pfeffer, Santa Clara County, shows excellent qualities, and is of a velvety pleasant taste.

Blend U. 314, Cabernet Sauvignon with Grossblaue, is inferior to No. 14, while blend U. 313, Cabernet Sauvignon with Mourastel and Carignane, although the latter grape has imparted to it a taste of mould, showed distinctly the adaptability of this combination, which it would be well to continue trying in different proportions of the ingredients.

February 9, 1885. (Pohndorff.) Wine in a four-gallon keg is well preserved; notwithstanding the thin staves, it is unimpared in quality, and confirms the fine keeping qualities of the wine, or at least its easy handling in its first youth. Development very good, but compared with that in the vial (see below) is backward.

Sample in one-gallon keg is equally well preserved, and unaffected by the still greater thinness of the keg staves, allowing too easy evaporation and oxidation.

A *bottle* of the same, which on November fourteenth had thrown out the cork, was kept without filling up. Taste still sound, flavor characteristic, and color good.

A *small remnant in a vial*, only about one fifth full, since November fourteenth, has stood this heavy test of its stability remarkably well; color, good; taste, frank and very pleasant; flavor, very expressive.

April twenty-ninth. (E. W. H.) Condition, bright; color, more intense than that of the Cabernet Franc, but bouquet less developed, and wine altogether less smooth to the taste.

The table below gives results of the chemical analyses of the above and two other wines, which were made at the end of November, after the first racking:

No.	Variety.	Date of Receiving Grapes.	Must.			Wine.				
			Solid Contents by Spindle.	Acid as Tartaric, of Must.	Acid as Tartaric, of Murk.	Body.	Alcohol by Weight.	Alcohol by Volume.	Tannin.	Acid as Tartaric.
216	Verdot	Sept. 20	23.040	.656	.517	2.765	9.780	11.820	.071	.438
215	Merlot	Sept. 20	20.660	.472	.498	2.435	9.200	11.420	.065	.467
212	Cabernet Franc	Sept. 20	20.620	.619	.384	2.840	9.630	12.000	.035	.480
214	Cabernet Sauvignon	Sept. 26	22.670	.462	.495	3.190	9.920	12.360	.079	.540

It will be noted that the differences here shown between the two Cabernets fall in the direction usually caused by difference in ripeness; one having been gathered three days before the other and crushed six days before. Probably the high acid and low tannin and sugar of the first are partly, at least, due to this cause.

Being light bearers of fruit, with a low yield of must, but producing delicate wines of high quality, the two varieties will naturally be chosen chiefly by those who make a specialty of high grade wines.

Of the two other varieties, the Verdot ranges closely with the Cabernets in all respects, while the Merlot shows its lighter character both in body and alcoholic strength; entirely in accord with its reputation in France. Its uneven maturing as above noted may account for its inferiority to the Verdot in the kind and amount of bouquet.

MERLOT.

Like the Verdot, the Merlot is altogether a grape of the Bordeaux region, and is planted as well as blended more or less with the better qualities of wines, especially the Cabernets. It matures earlier than the latter, and is, therefore, planted on northern exposures in order to retard maturity. The very dark-tinted grape is very sweet and agreeable, but very delicate, and must be gathered as soon as ripe; the wine, also, is delicate, lighter than those of the Cabernets, and matures more quickly but does not attain as high quality. It is pruned more or less long according to the vigor of the vine, which is quite productive.

From Natoma the Merlot is reported to be a light bearer, of fair vigor, medium ripening. The grapes were in good condition when received, September twentieth, and corresponded accurately to the type figure, but were unevenly ripened, rather insipid, thick-skinned, and not very juicy.

Fermentation of the 50.6 pounds received September twentieth, and crushed the same day, began on the evening of September twenty-second, at the temperature of 69.8° F., and reached its maximum temperature of 75.2° F. the next morning, remaining thus for about twenty-four hours, then gradually fell to the cellar temperature of 68° F., on September twenty-seventh, when the murk was drawn off, seven days from the crushing, showing a quick and energetic fermentation. The yield from the above amount was 4.03 gallons, or at the rate of 159.3 gallons per ton; pomace, 14.35 per cent.

The young wine was racked from the lees on November twenty-fifth, but there is no record of its having been tasted at the time.

For *Viticultural Convention Committee* report on the same, see below under Verdot.

RECORD OF TASTING.

February 9, 1885. (Pohndorff.) Sample in three-gallon keg: color, somewhat faded; taste, characteristic; development, tardy; no injury from thin staves.

Sample in vial: good color and proper development; good clean taste.

April 10, 1885. (E. W. H.) Condition, bright; color, light red, apparently still more faded; faint, but agreeable bouquet; acid and astringency moderate, but well proportioned. Good, but decidedly inferior to Verdot. Like the latter, it does not dilute well.

In judging of the relative merits of Verdot and Merlot from Folsom, it should not be forgotten that, while the former found there its habitual location in low ground, the latter, adapted to the hilly lands, was somewhat out of its place.

For analysis, see table under Cabernet Sauvignon.

VERDOT.

The Verdot belongs exclusively to the vineyards of the Bordeaux region, and is there cultivated in the low grounds, in whose strong, clayey soils this grape yields better products than any other. It is the latest ripening grape of the region, and is, on that account, always gathered and treated by itself. It is only moderately productive, and is therefore mostly pruned long, although it does not resent short pruning. In its propagation the strongest wood should be carefully selected. The Verdot wine is a good keeper, and is especially esteemed for export.

From Natoma the Verdot is reported to be of medium vigor and a light

bearer. Its bunches were considerably more compact than in the figure given in French works. This was found to be very generally the case in the varieties sent from Natoma and is probably attributable to the youth of the vines. In other respects the grape tallied well with the description. Its maturity, however, was much earlier than reported from France, as it was gathered September eighteenth, about the middle of the vintage of last year, and was at the time fully ripe. It was thus earlier than the Beclan, Cinsaut, Cabernet Sauvignon, and others that in France precede it, and simultaneous with Cabernet Franc, Sirah, and Petit Bouschet. This is the more remarkable as it was grafted on the stock of a late variety, the Mission. Quite a number of parallel cases may be noted in the series of Natoma grapes; and others are known to occur among our more common varieties. It is thus obvious that many grape blends not practicable in France may be perfectly feasible with us, especially when the differences in the time of ripening that may result from grafting upon the various resistant stocks (referred to in Bulletin No. 34) are duly utilized.

The grapes received on September twentieth were crushed the same day, and fermentation began on the evening of September twenty-second; reached its maximum temperature of 78.8° F. on the morning of September twenty-third, then fell very gradually to the cellar temperature of 68° F. on the twenty-seventh, eight days from the crushing, when the murk was drawn off, the yield from the above amount being seven and a half gallons, or at the rate of 158.5 gallons per ton; pomace, 12.0 per cent.

The young wine was racked from the lees on November fifteenth. Its condition at the time was clear; color, intense purple.

RECORD OF TASTING.

November 13, 1884. (Pohndorff.) Good in color and taste, slight contamination of sulphur from grapes.

November 18. (E. W. H.) Heavy body; astringency rather light; a fruity flavor, promising high quality; acid, agreeable.

Report of Viticultural Convention Committee, December 17. Verdot, U. 216, shows successfully the fine qualities of the variety, which will necessarily form part of the plantations where the other Medoc varieties are to be grown. The same is true of Merlot, U. 215.

February 9, 1885. (Pohndorff.) Fine color, not very deep; taste much superior to that of Merlot, but has suffered slightly from the thinness of the keg staves.

April 9, 1885. (E. W. H.) The condition of the wine is bright, the color unchanged in quality and intensity. The bouquet has developed decidedly, promising a high quality claret with an agreeable fruitiness. It does not dilute well; with 50 per cent of water its quality is almost lost.

Sample from a vial which has stood half full since February twenty-fifth: The bouquet has developed decidedly by oxidation, and the astringency appears increased through the acquisition of slight bitterish taste; the acid also has increased somewhat, but there is no perceptible acetification. The wine has thus resisted the six weeks' exposure very well confirming the keeping qualities attributed to it in France.

Personally, the writer is a good deal impressed with the qualities of the Verdot wine as resulting from its culture at Folsom; but the light production of the vine and the low percentage of juice must not be forgotten.

For an analysis see table under Cabernet Sauvignon.

TANNAT.

The Tannat, properly so called, belongs to a very restricted area in the French Pyrenees, it being the most noted vine of the Madiran region, where it is associated with the Mansene and Bouchy in the production of the high grade red wines. It is a vigorous and productive vine, and is always pruned long, whether on high stakes or trellises. The conico-cylindrical, strongly-shouldered bunches are rather large and close; the berries round, medium-sized; they assume a fine black tint, when ripe, and are very rich in coloring matter and tannin; very sweet, but somewhat astringent.

There is no doubt of the authenticity of the Tannat grape grown by Mr. Crabb, of Oakville, and Mr. Drummond, of Glen Ellen. Wines of the vintage of 1883 were received from both; and in 1884 a small lot of grapes was sent by the former, and made into wine at the University Laboratory. All were deeply tinted, and markedly but pleasantly astringent, with less of the roughness noted in other wines of similar tannin contents.

TANNAT WINES.

Contributor.	Locality.	Vintage.	Residue by Spindle.	Alcohol.		Tannin.	Acid calculated as Tartaric.
				By Weight.	By Volume.		
J. H. Drummond	Glen Ellen	1883	2.05	8.55	10.66	.175	.484
H. W. Crabb	Oakville	1883	2.99	10.07	12.54	.197	.397
H. W. Crabb	Oakville	1884	2.69	7.46	8.92	.171	.633

The prominent fact indicated by the above analyses is the large proportion of tannin shown by these wines, in the wet and cool season of 1884, when alcoholic contents were unusually low, as well as in the preceding dry season, when Crabb's wine rose to 12.5 per cent, while Drummond's still remained a light wine, in accordance with the original mountain character of the grape. Even apart from differences in quality, the uses of the Tannat thus differ markedly from those of the Lenoir, which, with an equally intense color, yielded in 1884 only from about one third as much tannin as the Tannat.

It must be presumed that the best locations of the Tannat for high quality will be the higher foothills, and the northern part of the State generally. But the composition of Crabb's valley wine indicates plainly that it will be extremely useful elsewhere also.

No. 82. *Tannat.* From H. W. Crabb, Oakville. Grapes were nearly all damaged; it was with the greatest difficulty that 7.92 pounds were picked out. All the grapes were carefully washed, still the *wine* tasted mouldy. The grapes were worked on October 21, 1884, and showed 21.15 per cent of sugar. Fermentation of the 7.92 pounds crushed began on the morning of October twenty-second and at a temperature of 66.2° F., and reached its maximum of 68° F. the next morning (temperature of cellar, 64.4° F.), where it remained during the next forty-eight hours, and then gradually fell to the temperature of the cellar, 65° F., on October twenty-seventh, when the murk was drawn off, six days from the crushing. The yield from the above amount was half a gallon. On November 3, 1884, the young wine was racked from the lees; again racked on November twentieth, perfectly bright, and analyzed November twenty-second; again racked April twentieth; again racked in the Fall.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. Tannat. No. 7 of Glen Ellen, 196 of Oakville, No. 194 ditto of 1883. U. 315 of Oakville grapes. Unhesitatingly this variety deserves the greatest attention on the part of California growers, since the product, from the small amount of vines thus far planted, shows excellent success. It is one of the wines of deepest color, combined with a harmonious astringency, and unexceptionable taste. It is useful and character-giving in blends, both with inferior and higher class varieties.

It is our opinion that this valuable variety, in locations where it can be successfully grown, should be propagated in proper proportions, as it has proved thus far to be both prolific and productive of a high quality wine in California.

BECLAN.

The Beclan occupies rather a restricted area, chiefly in some of the vineyards of the Jura, where, however, it does not seem to be greatly appreciated. It succeeds admirably and yields excellent results in the granitic soils of the Beaujolais, northward of Lyon, and is highly recommended as yielding a deeply colored wine of high quality, agreeable, and keeping well. The vine is fairly vigorous, and resists diseases well, but should have a deep and strong soil. Though adapted to short pruning, it yields a larger product when long-pruned. The grape, which is rather small and somewhat thick-skinned, matures toward the beginning of the third epoch; is not easily affected by moisture.

We have no report from Natoma as to the vigor and productiveness of this vine. The grapes were gathered on the twenty-fifth of September, and when received were in good condition and fully ripe; taste agreeable, subacid, and very sweet. The bunches correspond well in form with the French type, but the berries were rather smaller and more closely packed.

The fermentation of 80.1 pounds crushed on September twenty-sixth began on the morning of the twenty-eighth, reached its maximum of 76.1° F. on the evening of the twenty-ninth, then gradually fell to the cellar temperature on October third, when the murk was drawn off, eight days from the crushing; the yield being 6.5 gallons from the above amount, or at the rate of 161.7 gallons per ton; pomace, 12.3 per cent.

The young wine, which seemed to clear itself very rapidly, was racked from the first lees on October seventeenth, then again on November twelfth, when taking a sample for the Viticultural Convention.

RECORD OF TASTING.

November 11, 1884. (Pohndorff.) Color somewhat faded, but good; expression, fine; fruity.

Report of Viticultural Convention Committee, first week of December:

Beclan. U. No. 218. The color of this wine is of fine ruby hue and great density; its astringency considerable and well proportioned; its mild, light, oily, fully vinous expression placing it on a level in regard to quality with Cinsaut. The Beclan partakes of a character midway between Burgundy and Medoc types, and may be useful in blends, as it is desirable for direct drinking.

February 9, 1885. (Pohndorff.) Sample in four-gallon keg; color, deep ruby; development, backward; taste, too fresh, but indicative of good expression.

Blend of one third Beclan and two thirds Petit Bouschet, in full bottle, had cleared itself very well; its taste frank and good; an excellent type of a table wine. It should be noted that this was a sample of "turbids," left at the end of November last with an excessive proportion of lees in it; yet, the latter had not in the least affected the clean taste and flavor of the wine, showing this type to be very easy to handle in the cellar.

April 9, 1885. (E. W. H.) The condition of the wine is bright, the color being of an intense purplish red. The bouquet is faint as yet, but very agreeable; the flavor vinous; the acid and astringency fair in amount, and agreeable. The wine dilutes remarkably well, both as to color and taste.

April 27. (Pohndorff.) An excellent wine of great promise.

ANALYSIS.

Must.

Sugar by spindle	20.92
Acid	.44

Wine.

Alcohol:	Volume	11.00
	Weight	8.84
Body		2.64
Tannin		.05
Acid		.38
Ash		.26

CARIGNANE.

The Carignane has found considerable acceptance in this State, especially as a useful blend for Zinfandel. It has been found very satisfactorily productive under the short-pruning system, and seems to adapt itself well to a great variety of soils. Its reputation in France, of producing not a very high quality, but an abundant quantity of good medium quality wine, seems to be sustained in California thus far.

From Natoma it is reported to be a large bearer with good vigor, having large and compact bunches. Time of ripening is the first week in October.

This variety was received in good condition, and was worked on October fourth, showing 19.03 per cent of sugar. Fermentation of 36.3 pounds crushed began on the morning of October 6, 1884, at a temperature of 69.8° F. and reached its maximum during the next morning at a temperature of 74.3° F. (temperature of the cellar, 67° F.), then slowly fell to the temperature of the cellar (67°) on October thirteenth, when the murk was drawn off, nine days from the crushing, the yield from the above amount being 3.01 gallons, or at the rate of 161.3 gallons per ton: pomace, 12.8 per cent.

The wine was racked from the lees on October 22, 1884; again racked November seventh; again on November twenty-fourth; again racked April twenty-second, and lastly in August, 1885.

Wine was analyzed February 6, 1885.

RECORD OF TASTING.

February 6, 1885. (E. W. H.) The condition of the sample is clear, but color is very poor; bouquet present, though impaired greatly by the mouldy odor; body and astringency, medium.

ANALYSIS.

	Natoma Co., Natoma.
Must.	
Sugar by spindle	19.56
Acid	.59
Wine.	
Alcohol: Volume	9.90
Alcohol: Weight	7.92
Body	2.18
Tannin	.06
Acid	.53
Ash	.29

GROSSBLAUE.

The Grossblaue, more commonly known as Kölner, is cultivated chiefly in southeastern Europe, in Styria, Croatia, and Hungary. It imparts its character more especially to the wines of the former two countries, where it is used for the table as well. Its handsome large bunches and berries render it acceptable in the latter respect. It is a hardy vine, even as regards damage from frost during bloom; is mostly pruned long, and even allowed to run over trees and hedges, and is a prolific bearer. Curiously enough, it is reported as yielding a wine lacking color and body, while in California, at least in the Napa Valley, the deep tint of its wine and heavy body are among its recommendations; next to the unusual percentage of

tannin—which in 1883 ranged from 2.4 to 2.5 *pro mille*—being higher than any other similarly fermented in that valley. This remarkable difference would almost lead to the suspicion that there is some error in the determination of the variety. At any rate, the grape, as grown by Crabb and Pellet, is eminently adapted to blends needing color and tannin, while it cannot be considered of high quality in other respects, being somewhat coarse in flavor, yet very much preferable to the Charbono, being less pronounced in character. The vine is always pruned rather long, and Mr. Crabb states that it is necessary to do so in order to obtain a sufficient production.

The grapes sent by Mr. Pellet were on their arrival quite badly bruised, but otherwise were in good condition, and were worked on October 9, 1884, showing 20.61 per cent of sugar.

The fermentation of 32.34 pounds crushed commenced on the morning of October 10, 1884, at a temperature of 65.3° F., and reached its maximum at a temperature of 74.3° F. (temperature of room, 66° F.) on the evening of October twelfth; then gradually fell to the cellar temperature of 67° F., on October 17, 1884, when the murk was drawn off, eight days from the crushing. The yield was 2.35 gallons from the above amount, corresponding to 145.40 gallons per ton; pomace, 10.70 per cent.

On November 13, 1884, the young wine was racked from the lees; again racked March 10, 1885. Wine was analyzed November 18, 1884.

RECORD OF TASTING.

November, 1884. (Pohndorff.) Color, good, very good, but not up to expectations; frank, clean taste. The type is fit to go in any blend; by itself, also, of good taste for direct consumption

Report of Viticultural Convention Committee, December, 1884. Grossblaue. No. 11, of Glen Ellen, No. 203 and U. No. 220 of grapes from St. Helena. These samples met with favor, and the variety is sure to be one of the important ones for our vineyards.

The excellent properties of color and tannin in proper proportions, and neutral frank taste, of the Grossblaue grape were manifest in blend U. No. 316 in a successful manner, although the vintage of 1884 proves exceptionally poor in tannin.

U. No. 322, blend of equal parts of Grossblaue and Mondeuse with blend U. 317, equal parts of Aramon and Zinfandel, shows a well covered wine as to color, of mellow taste, with fine full astringency and an expression which is somewhat too loud, but shows the way whereon to reach satisfactory results by continuation of studies.

ANALYSIS.

Must.

Sugar by spindle	21.31
Acid	.56

Wine.

Alcohol: Volume	11.42
Alcohol: Weight	9.20
Body	2.10
Tannin	.07
Acid	.57
Ash	.25

2. Burgundy Type.

BLACK BURGUNDY.

(Locally known as "*Crabb's Black Burgundy.*") This variety is now generally supposed to be the "Petit Pinot" of Burgundy—one of the many varieties of the Pinot group. Its heavy bearing even under short pruning, and the deep tint, heavy body, good astringency, and general high quality of its wine, have recommended it for extensive culture in California. Its

cuttings root with some difficulty in the open ground, and are best rooted in the nursery and transplanted.

No. 221. The grapes, from Mr. Crabb's own vineyard, arrived in apparently good condition, and were crushed and worked on October 21, 1884, showing 22.76 per cent of sugar.

Fermentation of 19.8 pounds crushed began on the morning of October twenty-second, at a temperature of 65.3° F., and reached its maximum of 68.9° F. on the next morning (temperature of the cellar, 64.4° F.) where it remained during forty-eight hours, then gradually fell to the cellar temperature (64.4° F.) on November first, when the murk was drawn off, eleven days from the crushing. The yield from the above amount was 1.32 gallons, or at the rate of 133.42 gallons per ton; pomace, 13.89 per cent.

The wine was racked from the lees on November 23, 1884; again racked April 22, 1885.

Wine was analyzed November 25, 1884.

RECORD OF TASTING.

November, 1884. (Pohndorff.) Wine made from mouldy grapes; color as deep as from the best coloring grapes. Taste quite full.

November 25, 1884. (E. W. H.) A heavy-bodied wine of intense purple color, with adequate and pleasant acid and decided astringency. With 50 per cent water, the dilution is excellent; with 100 per cent, the acid and color are good, but tannin disappears.

ANALYSES.

	H. W. Crabb, Oakville.	J. B. J. Portal,* Burgundy Vineyard.
Must.		
Sugar by spindle	22.95	
Acid	.89	
Wine.		
Alcohol: Volume	11.64	12.10
Alcohol: Weight	9.34	9.70
Body	2.77	2.45
Tannin	.19	.07
Acid	.77	.75
Ash	.28	.28

* 1883 wine.

No. 222. *Black Pinot.* This grape, evidently a Pinot, but without any special variety designation, was furnished by Mr. L. P. Berger, of Lower Lake, Lake County. The grapes were from young vines, bearing for the first time.

Grapes were worked on October 18, 1884. Of the 6.44 pounds crushed, the fermentation began at a temperature of 68.9° F. on the morning of October 19, 1884, and reached its maximum the next morning at a temperature of 71.6° F. (temperature of cellar, 68° F.); then very slowly fell to the cellar temperature of 68° F. on October 24, 1884, when the murk was drawn off, six days from the crushing. The yield from the above amount was .32 gallons, or at the rate of 98.5 gallons per ton; pomace, 9.23 per cent.

The wine was racked from the lees on November 15, 1884; again racked December 12, 1884; again in March following. Wine was analyzed on April 8, 1885.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. U. No. 222. Black Pinot from Lakeport grapes. Owing to mould having generated in these, could not be determined as to merits.

February 9, 1885. (Pohmdorff.) Grapes having been mouldy, its quality is that of a wine unfit for any purpose; color, very deep indeed.

ANALYSIS.

Must.

Sugar by spindle	19.58
Acid	.63

Wine.

Alcohol:	Volume	8.00
	Weight	6.42
Body		2.11
Tannin		.13
Acid		.75
Ash		.31

MEUNIER.

The Meunier (Miller, so called from the conspicuously white furze on its leaves) is closely related to the Pinot or Burgundy group in most of its characters. It is extensively cultivated in central and northern France, and in Germany, as specially adapted to the less favorable locations and soils in which the other varieties would fail to yield and ripen fruit well. It seems to enjoy a higher estimation in France than in Germany, where its wine is held to be considerably below the quality of the Pinots proper, and as best utilized in blends. It is there reported to yield deep-tinted wines of a roughish character and of inferior bouquet.

So far as the Meunier wines have come under my observation in California, they mostly justify the German rather than the French estimate of their quality, being at first, at least, rather flat and lacking character, and sometimes, contrary to European experience, color. It has, perhaps, not found its proper soils as yet. Being hardy, productive, and early ripening, it will doubtless succeed in the northern part of the State (where the best Meunier wines have thus far been grown), and on soils on which vines of higher quality would fail to bring remunerative returns. It may be pruned long or short, according to the strength of the soil.

No. 223. *Meunier.* From W. Scheffler, St. Helena. This variety arrived and was worked on September 19, 1884, the grapes being in good condition. Fermentation of 83.6 pounds crushed, commenced on the morning of September twenty-first, at a temperature of 71.8° F., and reached its maximum the following morning at a temperature of 82.4° F. (temperature of cellar, 70° F.), remaining at that point for the day, then gradually fell to the temperature of the cellar, 68° F., on September twenty-seventh, when the murk was drawn off, eight days from the crushing. The yield from the above amount was 4.88 gallons, or at the rate of 116.93 gallons per ton; pomace, 14.79 per cent.

The wine was racked from the lees on November 25, 1884, and again on February 25, 1885; was analyzed on April seventh, and November 17, 1885.

No. 224. *Meunier.* From H. Mel, Glenwood, Santa Cruz County. Grapes were received in bad condition, nearly all being more or less decayed, and were crushed on October 8, 1884. Solid contents by spindle, 19.35 per cent.

Fermentation of 10.35 pounds crushed, began on the morning of October 10, 1884, at a temperature of 66.2° F.; reached its maximum on the evening of October twelfth, at a temperature of 68.9° F. (temperature of the

room, 66° F.), then slowly fell to the cellar temperature of 67° F., on October 17, 1884, when the murk was drawn off, eight days from the crushing. The yield from the above amount was .62 gallons, or at the rate of 120.10 gallons per ton; pomace, 12.30 per cent.

The wine was racked from the lees on November 24, 1884, and again on April 22, 1885.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. February 11, 1885. (Pohndorff.) No color, and quality impaired in keg. Meunier Nos. 2 and 78, of Glen Ellen, 223 of St. Helena, and U. 224 of Glenwood grapes, gave no high idea of the quality of this grape. Blend U. 318, in which Meunier is added to Zinfandel and Mataro, is a happy union and apparently the application in a similar manner may be useful.

April 20, 1885. (E. W. H.) A light-bodied and very light-tinted wine, which has developed no bouquet thus far; acid, moderate, agreeable.

November 19, 1885. (E. W. H.) The wine from Scheffler's, of bright condition; color, quite light; bouquet, very well developed and agreeable, with vinous flavor; acid, rather high, apparently in consequence of the thin staves of the keg; a considerable proportion of the acids being volatile.

The wine from Mel's grapes, having on account of its small quantity been kept in glass bottles, is but slightly developed as yet, though showing a considerable increase in acidity. The wine is somewhat lighter tinted than Scheffler's, and not as clear, but no rigorous comparison of the two can be made.

The undoubted and striking development of a desirable bouquet in Scheffler's wine is a good indication of quality, and correspondingly modifies the opinions given in the committee report above.

ANALYSES.

	W. Scheffler. St. Helena.	H. Mell. Glenwood.
Must.		
Sugar by spindle	22.73	19.35
Acid	.48	.60
Wine.		
Alcohol: Volume	12.55	8.64
Alcohol: Weight	10.07	6.95
Body	2.55	2.44
Tannin	.03	.06
Acid	.53	.62
Ash	.42	.29

ZINFANDEL.

The Zinfandel is too well known in California to require any remarks on its general character, beyond the statement that since about two fifths of the vineyards of the State were in 1884 reported to be planted with this vine the importance of adapting its product to the taste of the world's market cannot easily be overestimated. Hence in the work of the season 1884, the opportunity afforded by the numerous grape varieties sent to the laboratory was extensively utilized in the trial of blends with the Zinfandel. The results of these experiments will be found under the head of "Blends," page 119.

(The record regarding Zinfandel wines sent for analysis in 1884 is given in connection with the general discussion of Zinfandel wines in the report for 1883–4 above.)

No. 225. *Zinfandel.* From vineyard of Charles W. Howard, Lower Lake, Lake County. Grapes from two-year old vines arrived on September tenth in good condition, and were crushed on the following day. They were rather short of full ripeness.

Fermentation of 73.48 pounds crushed began on the morning of Septem-

ber twelfth, at a temperature of 71.6° F., and reached its maximum on the morning of September thirteenth, temperature 78.8° F.; temperature of the cellar, 66° F.; then fell slowly to the temperature of the cellar (69.8° F.) on September eighteenth, when the murk was drawn off, nine days from the crushing, the yield being 5.18 gallons from the above amount, or at the rate of 140.9 gallons per ton; pomace, 14.67 per cent.

This wine was racked from the lees on October second, and then blended with some of that from the Grenache, Petit Bouschet, and Bastardo.

RECORD OF TASTING.

September 29, 1884. (Pohndorff.) Color purplish, rather than ruby; tastes of unripe grapes, but clean, fruity, and fresh, with good expression.

November, 1884. (Pohndorff.) Excellent color and astringency, but acids not harmonious; flavor very fruity for so young a vine.

Report of Viticultural Convention Committee, December, 1884. U. No. 225 Zinfandel, from grapes of C. W. Howard, Lower Lake, which had attained only an imperfect maturity, and were the first fruit from a new plantation, showed a high degree of bouquet, and was of light good taste.

No. 226. *Zinfandel.* From vineyard of J. L. Black, Livermore. This variety was worked on October fourth; grapes in good condition, and showing 18.81 per cent solid contents by spindle.

Fermentation of 11.22 pounds crushed, began on the evening of October fifth, at a temperature of 69.8° F., and reached its maximum on October seventh, at a temperature of 75.2° F. (temperature of the room, 67° F.), then slowly fell to the cellar temperature of 68° on October eleventh, when the murk was drawn off, seven days from the crushing, the yield from the above amount being 1.06 gallons, or at the rate of 188.47 gallons per ton; pomace, 10.79 per cent.

The wine was racked from the lees on November 17, 1884; again racked February twenty-fifth; again in August following. Wine was analyzed April 9, 1885.

RECORD OF TASTING.

November, 1884. (Pohndorff.) Wine is of good Zinfandel type, but as the grapes were mouldy, it could not be properly judged.

April 9, 1885. (E. W. H.) A bright, heavy-bodied wine with light astringency and medium acid; color, not very intense garnet.

No. 227. *Zinfandel.* From vineyard of P. W. Butler, Penryn. Grapes were in a very bad condition—soft and decayed. They were also very "green," notwithstanding their color being reddish. The lot was crushed on October 4, 1884, and showed 16.05 per cent solid contents by spindle.

Fermentation of 18.26 pounds crushed, began on the morning of October sixth, at a temperature of 70.7° F., and reached its height on the evening of the same day, at a temperature of 72.5° F. (temperature of the cellar, 67° F.), then very slowly fell to the temperature of the cellar (68° F.), on October thirteenth, when the murk was drawn off nine days from the crushing; yield from the above amount being 1.25 gallons, or at the rate of 136.3 gallons per ton; pomace not determined.

The wine was racked from the lees on October 17, 1884; racked again on October twenty-second; again on November twenty-fifth; again in March, and also in August, 1885. An analysis was made on February 7, 1885.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. U. No. 227, Penryn Zinfandel, was of ordinary quality.

ANALYSES.

	No. 227. P. W. Butler.	No. 226. J. L. Black.
Must.		
Sugar by spindle	16.05	18.81
Acid	.59	.55
Wine.		
Alcohol: { Volume	9.25	9.75
Alcohol: { Weight	7.43	7.85
Body	1.92	2.36
Tannin	.08	.05
Acid	.63	.45
Ash	.20	.44

No. 228. *Zinfandel.* From vineyard of E. B. Smith, Martinez. Grapes arrived in quite a green condition and were worked on October 4, 1884. Solid contents by spindle, 18.50 per cent.

Fermentation of 37.18 pounds crushed, began on the evening of October sixth, at a temperature of 68.9° F., reaching its maximum during the next evening at a temperature of 73.4° F. (temperature of room, 68° F.), then slowly fell to the cellar temperature, 67° F., on October 11, 1884, when the murk was drawn off, seven days from the crushing; the yield being 2.5 gallons from the above amount, or at the rate of 134.5 gallons per ton; pomace, 16.27 per cent.

The wine was used for blending, with the exception of a sample which was sent to the Viticultural Convention, their report being as follows:

U. No. 228 in an acceptable wine indicative of good quality from that locality, but no delicacy of its flavor was observable in the sample.

3. Southern French and Italian Type.

TROUSSEAU.

Among the grape varieties best adapted for the purpose of overcoming the too pronounced characters of the Zinfandel, the Trousseau has been prominently mentioned. There is no question that in several cases this blend has been remarkably successful; perhaps more decidedly so than any except the Grossblaue. But in others, it has been unsatisfactory; and it is of considerable interest to determine the cause of this difference, since the Trousseau when properly pruned is a good bearer, and its wine imparts to blends a desirable delicacy. Below are given the results of the analyses of several authentic Trousseau wines, that throw some light on the question:

Grower.	Locality.	Vintage.	Body.	Alcohol.		Tannin.	Ash.	Acid as Tartaric.	Must.	
				By Weight.	By Volume.				Sugar by Spindle.	Acid.
M. Denicke	Fresno	1883	3.07	10.63	13.10	.172	.534	.645	.....	.....
J. T. Doyle	Cupertino	1883	2.69	11.15	13.50	.040	.447	.600	.....	.....
C. A. Wetmore	Livermore	1884	3.04	9.78	12.18	.041	.328	.435	.....	.....
Wm. Pfeffer	Santa Cruz Mount'ns.	1884	2.28	9.92	11.64	.050	.349	.474	22.87	.518
Geo. West	Stockton	1884	2.66	11.23	13.73	.075	.379	.485	23.94	.330

It will be noted, that except in the case of Denicke's 1883, from Fresno, tannin percentages of these wines are very small, and far below those required for standard clarets. The same is true, as has heretofore been shown, of the Zinfandels grown in the coast range valley lands; while those from the hill lands, and seemingly also those from the San Joaquin Valley, have a larger supply of tannin. It is in a great measure the lack of tannin that leaves the somewhat sharp acid of the Zinfandels so unpleasantly prominent; and when this is remedied, as in the hill Zinfandels it is naturally, or as it is in blends with Grossblaue, Crabb's Burgundy, or other tannin-bearing grapes, that sharpness vanishes, although the peculiar flavor of the Zinfandel still comes out. The Trousseau overcomes the latter to a remarkable extent, but the blend can be satisfactory only on condition that the tannin deficiency is remedied at the same time.

The practical inference is obvious that, in blending Trousseau with Zinfandels, care should be taken not to join two products having the same deficiency. Thus, a hill Zinfandel would probably make a satisfactory blend with a Trousseau like Denicke's, without any third ingredient. But such as those from Livermore, Cupertino, or Santa Cruz Mountains, would evidently need some third, heavily tannin-bearing wine, in order to make an acceptable blend; the more as the Trousseau carries, as will be seen, a pretty full supply of acid, though not of as sharp a quality as is that of the Zinfandel.

Another practical inference is, that in order to give to the Trousseau at least as much tannin as the grape can supply, it should be allowed to remain on the skins as long as is compatible with other considerations: such as exposure to acetification, to contamination from unsound grapes, etc.

On the other hand, it is clear that the Trousseaus poor in tannin would blend particularly well with the highly tannin-bearing Zinfandels of Fresno, whose relative lack of acid in ordinary years would also thereby be compensated.

In regard to body and alcoholic strength, the Trousseau wines agree very nearly with the Zinfandels from the same localities.

As regards the adaptation of the Trousseau grape to the manufacture of ports, its claim cannot rest on its chemical composition, but solely upon the peculiar port or sherry flavor acquired by its wines when somewhat aged—an important qualification, but not available unless supplemented by blending with other wines possessing the requisite body and tannin, if high grade ports are to be produced. Since the successful introduction of the true port wine grapes—the Mourisco Preto, Tinta Cao, Tinta Amarella, and others—the importance of the Trousseau for this purpose will probably be second to these, unless better adaptation to climate or higher productiveness should still secure it a preference.

The following extracts from the report of the Wine Committee of the Convention of 1884 illustrates these points:

Nos. 70 and 71. Ports from the Trousseau grape from Cresta Blanca, Livermore, are expressive of the fruit taste of the grape, which yields certainly a good type of sweet red. No. 56 is a wine of which a small proportion might be admitted in port-like wine from better adapted grapes. Nos. 111 and 112, Fresno ports of 1883 and 1884, resent the poor fortifying mediums used in their preparation. No. 160, Stockton Trousseau port, is clean tasting and of good sweetness, but would be better qualified had it more astringency.

No. 149. Trousseau port of 1880, of the same grower, has a fine bouquet, proving the adaptedness of the grape to port character wines; its sweetness is rich and pleasant, but the tannic proportion is too deficient to render it perfect.

In the matter of sweet reds, of California production, there is certainly success from varieties like the Trousseau and to a degree also from Malvasia from the southern counties, after the wines have obtained some age and oxidation has brought out a lively etherization, which pleasantly influences the taste; the only objection to them is, that the astringency generally does not keep pace with the sweetness, which is too free to allow our ports to find favor with all tastes.

We may therefore be allowed to urge wine-makers, for the security of success, to experiment seriously in future vintages with different high class varieties and, chief among them, with the Oporto ones, for the sake of bringing our port wines up to a creditable standard.

Mention should have been made of a white Trousseau wine, not analyzed, sent by Gen. H. M. Naglee, of San José. This sample was ten years old, and had become a dry Sherry of surprising quality. Perhaps the Trousseau will find good use in this connection yet.

No. 230. *Trousseau*, from G. West, Stockton. Grapes arrived in fair condition, and were worked on October 18, 1884, showing 23.94 per cent solid contents by spindle. Fermentation of 62.92 pounds crushed began on the morning of October 19, 1884, at a temperature of 66.2° F., reached its height on the morning of October twenty-second, at a temperature of 72.5° F. (temperature of cellar, 67° F.), then gradually fell to the temperature of the cellar, 66.2° F., on October 27, 1884, when the wine was drawn off, nine days from the crushing. The yield from the above amount was 5.02 gallons, or at the rate of 159.55 gallons per ton; pomace, 11.54 per cent. The wine was racked from the lees on November 5, 1884, then again on February twentieth. It was slow in clearing, and even on April tenth, when tasted, was not clear in the bottle.

No. 79. *Trousseau*, from William Pfeffer, Gubserville. Grapes arrived in fair condition, with some mouldy grapes in the bunches; were carefully picked over and worked on October 21, 1884, showing a sugar percentage of 22.85. Fermentation of 11.5 pounds crushed commenced on the morning of October 22, 1884, at a temperature of 64.4° F., and reached its maximum on the morning of October 24, 1884, at a temperature of 68.9° F. (temperature of the cellar, 64.4° F.), then slowly fell to the temperature of the cellar, 64.4° F., on October twenty-eighth, when the murk was drawn off, seven days from the crushing. The yield from the above amount being .79 gallons, or at the rate of 138.56 gallons per ton; percentage of pomace, 9.62. The young wine was racked from the lees on November 23, 1884, and again on April 22, 1885; at the last racking its condition was bright.

RECORD OF TASTING.

Report of Viticultural Convention Committee. U. 230 and U. 231 do not give a clear idea of the type, the grapes having become mouldy. This variety is a very recommendable one, and, in congenial locations, very thrifty. No. 76 (West's) has only a trace of mould, while Pfeffer's grapes were badly affected, and the wine can only be judged as to color, acid, and alcoholic contents, as ascertained by analysis.

Of the *tasting of No. 76 on April 10, 1885*, the record is as follows (E. W. H.):

Condition, somewhat turbid; color, light red; acid and astringency very light, so that a little dilution spoils it; very little bouquet developed as yet, but flavor vinous.

The analyses of both were made November 25, 1884; hence, the determination of the body is somewhat too high.

SIRAH—PETITE SIRAH, SYRAC, ETC.

The Sirah, like the Mondeuse, is most largely cultivated in southeastern France, from the region of Lyon southward beyond Valence; but it is also grown more or less on the Côte d'Or and in the Bordelais. It forms, in blends with white grapes like the Marsanne, Roussanne, Viognier, etc., a large ingredient of the high-grade red wines of Hermitage, Côte Rôtie, and other localities. It is a vigorous vine, of good productiveness; is mostly pruned long, or half long, but is sometimes nearly as productive as the Mondeuse even when short-pruned.

From Natoma, the Sirah is reported to be (long-pruned) a very fair bearer, and medium ripening, a little later than the Mondeuse. This is the reverse of what is stated in this regard from France, where the Mondeuse ripens between the second and third epoch, while the Sirah is of the second. The character of the Sirah from Natoma was very exactly that described and figured by French authors, only the bunches were more closely packed. They arrived in good condition, although the skin is more tender than that of the Mondeuse; and, on the whole, the Sirah would not bear transportation or keep as well as the former. The berries are very juicy and deeply colored.

Two lots were received—one, No. 232, on September thirteenth, showing 21.6 sugar by spindle; the other, No. 233, September thirtieth, with (according to the alcoholic contents of the wine) about 23.0 of sugar. The first lot was in good condition; the second considerably damaged by handling, and in part by mould; but it was carefully picked over before crushing.

Of the first lot, 104.7 pounds was crushed on September thirteenth, and began fermentation on the morning of the fifteenth, at a temperature of 68.9° F. It reached its maximum temperature of 77.8 F. on September sixteenth, remaining at that temperature for one day, while that of the cellar was 70° F.: then gradually fell to the cellar temperature of 69° F., on September twentieth, when the murk was drawn off, seven days from the crushing, the yield being 8.9 gallons from the above amount, or at the rate of 170.1 gallons per ton; pomace, 11.3 per cent. The young wine was racked from the lees on November twenty-seventh.

The fermentation of the second lot of 86.9 pounds, crushed on September thirtieth, began on the evening of October second, at a temperature of 66.2 F., and reached its maximum of 76° F. on October fourth, the temperature of the cellar being at the time 67° F. Next morning the temperature had fallen to 71.6° F., and then gradually fell to the cellar temperature of 68.9° F. on October eighth, when the murk was drawn off, nine days from the crushing, the yield being 7 gallons from the above amount, or at the rate of only 161.1 gallons per ton. This wine was racked from the lees on November eleventh. The color of both samples was very intense.

RECORD OF TASTING.

November 11, 1884. (Pohndorff.) No. 232, good color and clean taste.

No. 233, deeper color than No. 232, clean taste.

Viticultural Convention Committee Report. Petit Sirah U. 232 and 202, from Oakville, confirmed the conviction gained from previous samples from Mr. Drummond, of Glen Ellen, of a very useful wine of splendid color, fine fragrance, and frank, clean, vinous taste. The latter gentleman presented his 1884 in a blend with one fifth of Marsanne, the white grape of Hermitage, and this blend was a very good one.

U. No. 319, one fifth Sirah to four fifths of Malbec, although having apparently too small an addition of the former to modify the nature and taste of the latter, seems to be a homogeneous mixture, while U. blend No. 312, not noted in the catalogue, consisting of one third of Petite Sirah and two thirds of Cabernet Franc, is a successful combination. So is blend No. 90, which in the catalogue is incorrectly noted, and consists of half Petite Sirah

and half Cinsaut; the result being a wine of perfumed flavor. The use of the same in equal proportions, making up 60 parts of Sirah, to 40 parts of Zinfandel, is beautifully shown in U. No. 320.

It will be noted that the pure Sirah sample, No. 232, mentioned above, is the earlier one.

February 9, 1885. (Pohmdorff.) Sample in five-gallon keg (No. 232), is of full flavor, good, deep color, and rich, expressive taste, mild, and agreeable.

Sample in one-gallon demijohn: deep color, well kept, and development corresponding to the clean taste and characteristic expression.

Sample in bottle: deep color, bright, clean taste, characteristic expression, advanced development, owing to three rackings received since it finished its fermentation.

Sample in small keg from the grapes arrived September thirtieth: deep color; although still sound, the wine has suffered and its taste is affected by too easy access of air and evaporation through the thin staves.

April 1, 1885. (E. W. H.) The condition of both samples, 232 and 233, is clear. The color of the first is sensibly less deep than that of the latter sample, which is of an intense purple tint; its body, also, is heavier to the taste than that of No. 232. The bouquet has developed decidedly since last tasting, and has a suggestion of that of dried prunes. The acidity of the sample No. 235 (the earlier), is quite decided to the taste though pleasant; that of 232 a much less so, although this is the sample noted as having suffered from the thinness of the staves. Neither dilutes well; the bouquet is lost at once, though in No. 235 the acid and astringency still hold out, while 236 becomes flat at once.

For analysis, see table following Cinsaut.

No. 234. *Serine.* The Serine is held by Pulliat to be a mere variety of the Sirah, and the characters of the grapes received from Natoma entirely confirm this view. The amount received was very small, and the fermentation was not quite successful, but so far as the facts go, the wine also showed a substantial identity with that of the Sirah.

Grapes arrived in good condition, and were worked on September 13, 1884. Of 15.62 pounds crushed, the fermentation commenced on the morning of September fourteenth, at a temperature of 67.1° F. It reached its maximum of 72.5° F. (temperature of cellar, 66° F.) on September sixteenth, then gradually fell to the temperature of the cellar, 69.8° F., on September twenty-third, when the murk was drawn off, ten days from the crushing, the yield being .978 gallons from the above amount, or at the rate of 125.16 gallons per ton; pomace, 14.08 per cent. The young wine was racked from the lees on November fourteenth, and again February twenty-fourth. Sample for analysis was taken on April ninth.

RECORD OF TASTING.

April 9, 1885. (E. W. H.) The condition of the sample is bright, and the color an intense purple red; body, heavy; bouquet, well developed and excellent; acid, excessive, on account of acetification; astringency, high.

ANALYSIS.

Must.

Sugar by spindle	21.43
Acid	.59

Wine.

Alcohol:	Volume	10.58
	Weight	8.48
Body		2.49
Tannin		.06
Acid		.51
Ash		.40

MONDEUSE.

Cultivated chiefly in southeastern France, in the more northern departments bordering on the Rhone, and in Savoy, where it forms a large proportion of the vineyards and yields excellent red wines, provided it is planted on upland slopes with good exposure, as it needs considerable heat to acquire its best qualities; in valley lands, or on unfavorable slopes, it

rapidly loses quality. The wines are heavy-bodied and deeply colored, but somewhat rough at first and rather slow to mature. It is a vigorous and very productive vine, even with short pruning, and remarkably long-lived. From the Natoma Vineyard it is reported as being not quite so productive as the Sirah, but more vigorous—the bunches from that locality were, on the whole, remarkably long and rather more loose than in the figure, even sparse; berries of medium size with a thin but firm skin, much less tender than those of the Sirah, and deeply colored.

Two lots were received, one on September 10, 1884, with 20.2 per cent sugar, and a second one on October 1, 1884, showing 22.6 per cent of sugar. Both were crushed for their own wine on the days of receipt, and were in good condition throughout. Fermentation of the first lot (No. 236) began on the night of September eleventh, at 68.9° F., and reached its maximum temperature of 82.4° F. on the night from September thirteenth to fourteenth, then fell to the temperature of the cellar (70° F.) on September seventeenth, the seventh day from the crushing, when the murk was drawn off, the yield being 12 gallons from 148.06 pounds, or at the rate of 167.2 gallons per ton; pomace, 13.4 per cent. Fermentation of the second lot (No. 235) began on the morning of October second, at 66° F., and reached its maximum temperature of 71.6° F. on October fourth, then fell to the temperature of the cellar on October eighth; when the murk was drawn off, eight days from the crushing, the yield from the 56.3 pounds employed not being measured in this case; pomace, 12.6 per cent.

The fermentation was regular and satisfactory throughout, and the young wine cleared very rapidly; racked from lees November twenty-sixth.

RECORD OF TASTING.

November 11. (Pohndorff.) Sample No. 235, crushed September tenth. Excellent color and taste.

Same date, No. 236, of October first, better than the preceding, and of very marked quality.

First week of December; Convention Committee report. Equal usefulness and quality (as in the Petite Sirah) is shown in samples No. 73 of Mrs. C. A. Wetmore and U. No. 236 of Mondeuse, or Grosse Sirah. The color, as grand, ruby-tinted, and of great intensity in this wine, as in the small Sirah, and astringency and general taste and flavor of equal beauty, will render the two varieties some of the future favorite plants in California vineyards. U. No. 321, a blend of two fifths Mondeuse with three-fourths Zinfandel, is an eloquent test of a happy improvement and good use of Zinfandel for a delicious superior wine. It is fortunate that, according to experience at the Natoma Vineyard, the Petite Sirah shows itself a very fair bearer, and Mondeuse to be a vine of good vigor; both ripen early.

February 9, 1885. (Pohndorff.) Sample in ten-gallon keg: color deep ruby, taste clean, mild, light, and showing good development, but taste slightly impaired by the thinness of the staves, and consequent excessive access of air. Bouquet expressive, but likewise influenced by the circumstance just referred to. Had the care of keeping an even temperature in the cellar been relaxed, this wine would probably have gone wrong.

Sample in full bottle filtered from lees November twenty-sixth: kept and developed well; taste frank, color unimpaired.

Sample in bottle three fourths full, closely corked, same date as above: perfectly sound, color kept remarkably well. Taste astringent; oxidation produced only a slight bitterness.

Small remnant of same in eight-ounce vial, with cork loosely put in since November twenty-sixth, kept its color perfectly, taste clean and only slightly affected by the air that half filled the vial.

The Mondeuse proves therefore to be a sturdy keeper, a circumstance of great value for the hot regions of the State.

April 1, 1885. (E. W. H.) The condition of the earlier sample, No. 235, is bright; its color is sensibly less intense than that of No. 236, which is clear and of an intense purplish-red color. The character of both is strongly developed, showing a peculiar, fruity bouquet, most agreeable in the later sample. The body is heavy; the vinous flavor is well developed; both are decidedly roughish to the taste at this time, both acid and astringency being quite prominent; the wine dilutes remarkably well. It will evidently take some time to tone down the asperity. In all respects, therefore, the samples agree with the French types.

For analysis see table following Cinsaut.

CINSAUT, OR BOUDALÈS.

The Cinsaut is widely distributed in the south of France, from the Alps to the Pyrenees. It yields a heavy-bodied but delicate and highly-flavored wine, and for that reason is largely used in blends, to which it imparts its fine aroma, which is best developed at the age of about four years. It is, moreover, a most excellent table grape. The grape develops its best qualities on the warmest slopes of dry stony hills. On light soils its life is not long, unless well sustained by fertilizers and with very short pruning; requires a good deal of heat; ripens early in second period.

From Natoma it is reported to be a fair bearer, not very vigorous, and medium ripening. The grapes were received September twenty-fifth, in excellent condition, and corresponded very accurately to the description of the typical grape. Bunches and berries large, fine, and very attractive-looking; berry rather firm, very sweet, but with sufficient acid to render it very palatable. It was noted that the stems were already partly dry, while at the same time some of the berries were not fully ripe, showing that the unusually cool season had not supplied a fully adequate amount of heat for uniform maturity.

The fermentation of the 121.7 pounds, crushed on September twenty-sixth, began on the morning of September twenty-seventh, at a temperature of 68° F., and reached its maximum on September twenty-eighth, at a temperature of 78.8° F., at which it remained for two days, the cellar temperature being 70° F. It then gradually fell to the temperature of 68.9° F., that of the cellar on October third, when the murk was drawn off, on the ninth day from the crushing, showing a remarkably uniform and vigorous fermentation. The yield was 10.7 gallons from the above amount, or at the rate of 176.5 gallons per ton; pomace, 11.6 per cent; color of murk, quite full at that time.

RECORD OF TASTING.

November 16, 1884. (Pohndorff.) Color failed considerably since the pressing, but expression is splendid.

Of the sample presented to the *Convention Committee*, December 3, 1884, the record is as follows:

Cinsaut. U. 237. This sample illustrates the fact that even a grape with as great an amount of coloring matter as the Cinsaut possesses, ought to be blended with other varieties, in order to hold the color. Soon after fermentation the deep color was lost, and, as the sample stands, only a poor pinkish tint is preserved in it. On the other hand, the quality of the wine is grand, its flavor and corresponding taste of a high expression, indicative of all that can be desired from a first-class red wine grape. The color in U. 323, half Cinsaut, half Petite Sirah, is deep ruby, proper to the latter, and in no way more feeble than the Petite Sirah wine alone, while the quality of this blend is vastly superior to Sirah straight. It may be risky to deduce from the only instance of the Cinsaut wine U. 237, that the grapes of this vine will generally be constituted similarly as to the precipitation of their coloring matter, and this should, therefore, not deter from adopting the variety which is a high grade one; in fact, its aromatic ethers may be classed as of the most acceptable ones for a very superior wine.

February 9, 1885. (Pohndorff.) Samples in five and three-gallon kegs: color slightly faded; taste and bouquet of a pleasant wine of some quality; very easily developed.

Sample in a full eight-ounce vial: in an excellent state of development, brilliant and good color; taste clear and expressive.

Sample in half-full bottle, not tightly closed since November twenty-sixth: color less intense than that of the sample in the full vial; development that of wine of one year; taste, perfect. The making of wine from the Cinsaut grape seems thus to be very easy.

April 1, 1885. (E. W. H.) Condition not quite clear; color, pale pinkish, unsatisfactory; bouquet high, excellent, and characteristic, fruity; body, medium; acid, decided, a little pungent, perhaps from the effect of the thin staves. The astringency is somewhat low, and hence the wine does not dilute well; but as a whole is, perhaps, the most striking of all for high quality acquired in a short time.

It may be here noted, that the Cinsaut, similar to the Grenache, on account of their liability of not holding their color, can probably be utilized for characteristic white wines by running off the juice before the skins can communicate color to the same.

For analysis see subjoined table.

ANALYSES OF MONDEUSES, IRAH, CINSAUT, AND BECLAN MUSTS AND WINES.

No.	Variety.	Date of Receiving Grapes.	Must.			Wine.				
			Solid Contents by Spindle.	Acid as Tartaric.	Acid of Must.	Body.	Alcohol.		Tannin.	Acid as Tartaric.
							By Weight.	By Volume.		
235	Mondeuse	Sept. 10	20.160	.510	.413	2.635	9.56	11.89	.173	.498
236	Mondeuse	Oct. 1	22.600	.....	.533	2.842	9.92	12.27	.141	.405
232	Sirah	Sept. 13	21.600	.663	.450	2.650	10.07	12.54	.092	.401
233	Sirah	Sept. 30	.....	.....	.375	2.790	10.81	13.27	.108	.393
237	Cinsaut	Sept. 25	23.940	.528	.381	2.600	10.44	12.90	.070	.490
218	Beclan	Sept. 26	20.920	.435	.387	2.640	8.84	11.00	.053	.381

It will be noticed that the Mondeuse is altogether the heaviest bearer of tannin, ranking in this respect with the Malbeck, Tannat, and Charbono; the earlier sample, singularly enough, showing the higher figure. The Sirah averages only two thirds as much, while the Cinsaut runs in this respect with the Zinfandels.

Considering the cool season of 1884, the alcoholic contents run high in all, as might be expected of grapes of their climatic location in France. The body, though heavy, is not as high as might have been expected; but as it distinctly increases with maturity, it would probably reach three per cent in our ordinary seasons. Similarly the acid, which reaches a respectable figure in all (the Beclan being lowest), would ordinarily be somewhat lower, probably, than in 1884. The Mondeuse comes nearest to a true claret type; but it is probable that for commercial purposes the wines from these grapes would generally be blended with others, as is done in France: and for such purpose they will certainly be of the highest value in modifying and imparting quality to our more common types.

It will be seen from the above table that the Cinsaut had in a season of low sugar and alcohol percentages attained a very respectable figure, exceeded only by the Sirah and some sherry varieties. The Petit Bouschet, gathered a day later but not crushed until five days after the Cinsaut, remains considerably behind the latter, as do also the Bordeaux varieties. In the matter of tannin, the Cinsaut, Verdot, and Merlot run near together and rather low.

ARAMON.

The Aramon is one of the long-cultivated varieties of southern France, where it now occupies a large area, on account of its great productiveness on fertile soils, this vine having the peculiarity that its product is proportioned to the condition of the soil, both in quality and quantity. On dry, stony hill soils it will yield a moderate amount of excellent wine of good keeping qualities; in rich valleys, a very large quantity of low quality, of very light tint, and best adapted to rapid local consumption; hence it is not esteemed a good blending wine. The color of its wines is never deep, but of a lively red shade. The vine is always pruned short, and the fruit ripens late. It is subject to damage from late frosts, also to sunburn and decay. From Natoma the Aramon is reported to be a good bearer, of medium vigor, with large and loose bunches and large berries. The grapes were picked October second, and arrived at Berkeley in good condition. They corresponded accurately to the description of the variety.

No. 239. *Aramon.* Grapes were in good condition, and were worked on October fourth, showing 18.29 per cent of sugar.

Fermentation of 46.86 pounds crushed commenced on the morning of October sixth, at a temperature of 69.8° F., reaching its maximum on October eighth at a temperature of 74.3° F. (temperature of cellar, 67° F.), then slowly fell to the temperature of the cellar (66.2° F.) on October 11, 1884, when the murk was drawn off, seven days from the crushing; the yield from the above amount being 3.50 gallons, or at the rate of 149.5 gallons per ton; pomace, 7.75 per cent.

The wine was racked from the lees on November 7, 1884; again racked November 23, 1884; also in March and August, 1885. An analysis was made November 26, 1884.

RECORD OF TASTING.

November 14, 1884. (Pohndorff.) Wine in bottles thoroughly sound. Color very light indeed. Taste neutral.

Report of Viticultural Convention Committee, December, 1884. Aramon. U. 238. This sample confirms the expectations from a quantity grape, which, according to Natoma Vineyard observations, this variety proves also to be. With a frank taste, very feeble color, low acids, and moderate astringency, this fruit may be extremely useful for mitigating heavy wines, and play an important part for the production of cheap, good, light red wines for general consumption. Nothing objectionable is apparent in the sample U. 324. The test in blend U. No. 317, half Aramon with half Zinfandel, resulted in too coarse a unity, the proportions being seemingly improper.

The blend of 15 per cent of Black Burgundy, with 15 of Carignane, 28 of Aramon, and 42 of Zinfandel, in U. No. 93, was harmonious.

February 9, 1885. (Pohndorff.) Aramon has splendidly developed and intensified its not very deep color, is a hardy wine, easy to handle in the cellar, as it is completely unaffected by air influences in thin walled kegs.

ANALYSIS.

Must.

Sugar by spindle	18.72
Acid	.66

Wine.

Alcohol:	Volume	10.73
	Weight	9.05
Body		2.32
Tannin		.07
Acid		.50
Ash		.36

MOURASTEL.

The Mourastel is extensively cultivated in southwestern France, into the Pyrenees. In its erect habit of growth, in its leaves and fruit, it resembles the Mataro, but is in general a smaller bearer than the latter, while yielding wines of deep color and high quality, which are in demand for blending, notably with the Aramon and Grenache. The Mourastel succeeds only on light and well drained soils, especially hillside lands. In heavy and fertile soils it runs to wood, and in ill-drained ones it soon dies. It is always pruned short.

From Natoma the vine is reported to be a good bearer, of good vigor, rather late in ripening. The grapes were received and crushed, fully ripe, on October fourth. They corresponded closely to the description, but it was noted that the bunches varied from very compact to quite loose.

No. 239. *Mourastel.* This variety arrived in good condition, and was worked on October fourth, showing 18.30 per cent of sugar.

Fermentation of 34.54 pounds crushed began on the morning of October sixth, at a temperature of 72.5° F., and was very violent until the morning of October ninth, the highest temperature reached being 75.4° F. (temper-

ature of cellar, 68° F.), then gradually fell to the temperature of the room, 68° F., on October 14, 1884, when the murk was drawn off, nine days from the crushing, the yield being 1.75 gallons from the above amount, or at the rate of 101.07 gallons per ton; pomace, 10.83 per cent.

The young wine was racked from the lees on November 15, 1884; racked again February 20, 1885, and finally in August, same year. Wine was analyzed November 25, 1884.

RECORD OF TASTING.

November, 1884. (Pohndorff.) Sample in vial sound, and possessing a rich flavor and expression. In keg there is still too much carbonic acid present to distinguish its beauty, but it is there, and the grape will prove very useful.

Report of Viticultural Convention Committee, December, 1884. U. No. 239, from Natoma, is a wine of splendid color and early developed, rich, vinous flavor, good astringency, and decided acids, stamping it thereby as a blender, or needing a softening element as a direct wine. Its taste is mellow, full, and quite in correspondence with its flavor. This variety is very desirable for propagation in California, the more so as to its good qualities for wine.

February 9, 1885. (Pohndorff.) Wine has very rapidly advanced in its development. Taste full and rich; color, deep. It is a valuable variety.

ANALYSIS.

Must.

Sugar by spindle	18.79
Acid	.63

Wine.

Alcohol: Volume	9.88
Alcohol: Weight	7.92
Body	2.60
Tannin	.05
Acid	.55
Ash	.29

GRENACHE.

The Grenache is pretty well known in this State, as it has been for some time quite extensivly cultivated in the Santa Clara Valley, and to some extent in that of Napa. It is a variety belonging to northern Spain and southern France, and noted there for its vigorous growth and productiveness, under the short pruning system, but requires rich soils; in these it comes into bearing remarkably early. Its wines are rather heavy-bodied and rich in alcohol, of a moderately deep-red color, which tends to become brownish or yellowish with advancing maturity. This tendency to lose its color has been prominently noted in California, as also the strongly pronounced "caramel" taste of its more mature wines. That, while much liked by some, is objectionable to others. On account of this pronounced flavor, it cannot, evidently, serve for blending with wines of delicate bouquets.

No. 240. *Grenache.* From Natoma it is reported to be a fair bearer, with small vigor; bunches both loose and compact; ripening in the early part of September.

Grapes were not fully ripe, but were in good condition; were received on September sixth; worked up the following day, and showed 21.80 per cent sugar. Fermentation of 43.6 pounds crushed, began on the morning of September tenth, at a temperature of 71.6° F., and reached its maximum on the evening of the same day, at a temperature of 75.2° F. (temperature of room, 70° F.), then very gradually fell to cellar temperature of 68° F., on September sixteenth, when the murk was drawn off, nine days from the crushing. The yield being three gallons from the above amount, or at the rate of 139.5 gallons per ton; pomace, 13.53 per cent.

The young wine was racked from the lees on October 22, 1884; again racked November fifteenth; again racked March tenth, and lastly, in September.

RECORD OF TASTING.

September 23, 1884. No color, and wine bitter to the taste. (Pohndorff.)
April 6, 1885. (E. W. H.) Heavy-bodied wine, with very light color; fair astringency and high acid, owing to acetification from thin staves. Analysis was made on above date.

No. 241. *Grenache.* From vineyard of Wm. Pfeffer, Gubserville, Santa Clara County. Grapes arrived and were worked on October twenty-first; condition medium with a few mouldy. Solid contents by spindle, 18.12 per cent.

Fermentation of the 14.96 pounds crushed started on the morning of October twenty-second, at a temperature of 66.2° F., reaching its maximum during the next morning at a temperature of 73.4° F. (temperature of cellar 62.6° F.), then gradually fell to the cellar temperature, 64.4° F., on October 28, 1884, when the murk was drawn off, seven days from the crushing. The yield from the above amount being 1.12 gallons, corresponding to 150.11 gallons per ton; pomace, 9.60 per cent.

The young wine was racked from the lees on November 15, 1884; again racked April 23, 1885; also, in August; analyzed November 22, 1884.

RECORD OF TASTING.

November, 1884. Mouldy grapes have impaired the flavor.
Report of Viticultural Convention Committee, December, 1884. Grenache 115, of Fresno—lacks color, 174 of J. T. Doyle middling color, U. 241, from grapes of Santa Clara County, no color, poor body—137 and 138 of Lefranc, 1881 and 1880. None of these represent a satisfactory type, nor is any similarity to the Banyuls and Colliure types approximated. Still, the grape is of value, but in connection with Mataro and Carignane none of the wines seem to give satisfaction. Doubtless the splendid growth of the Grenache vine, and its abundant bearing in good position, recommend it, and, if raised by addition of appropriate grapes from other varieties, the quality of its wine may be brought up to the mark. Until this is ascertained its propagation on a moderate scale only might be advisable. In France the quality of the aged Grenache wines is praised, but their color turns into a yellowish tint. The same is the case in northern Spain, where the turning into what is called rancio for certain markets is desirable, sweetness being preserved, and a soft mellow wine the consequence; but this is just the opposite type to straight, frank tasting, deep tinted, dry table wines, the merit of which lies in perfection through a thorough fermentation.

The tendency of the Grenache wine being to an oxidation of its rich ethers, the utilization of this grape for port—character, sweet red—might be suggested. In any case, it should not go alone for this purpose, but another or several of the Oporto varieties be added; and, next, care should be taken to choose varieties the coloring matter of which should be intense, but in its nature and weight not such as to aid in precipitating that of the Grenache grape. This suggestion is based, of course, only on a hypothesis, but it may be followed up in the coming years, for study, as the Grenache vine has been copiously planted in some regions and is in favor, and all experience and studies for finding the best utilization of the same will be desirable.

ANALYSES.

	No. 240. Natoma Co.	No. 241. Pfeffer.
Must.		
Sugar by spindle	21.80	18.12
Acid	.62	.41
Wine.		
Alcohol: (Volume	10.58	9.27
Alcohol: (Weight	8.48	7.43
Body	1.67	1.93
Tannin	.11	.07
Acid	.48	.53
Ash	.28	.28

PETIT BOUSCHET.

This grape is of especial interest as being the direct result of the careful hybridization of the Aramon, a quantity grape of medium quality and yielding but little color, with the intensely colored Teinturier. Like the latter, it has not only color in the skin, but also in juice itself, and is, therefore, largely used in making up for deficiency of color in blends, while it is not, by itself, a grape of high quality. It is a heavy bearer, even when short pruned; it is cultivated chiefly in the south of France; ripens early.

From Natoma the Petit Bouschet is reported to be a medium bearer, of good vigor, and medium ripening time. Lots were shipped from Natoma on the nineteenth, and again on the twenty-fourth of September. The latter was altogether overripe, and somewhat damaged thereby when received; the first was fully ripe, and in part showed a disposition to dry into raisins. Evidently the grapes could have been harvested some time before, say the fifteenth. They had been heavily sulphured, and had to be carefully washed to avoid tainting the wine. The samples agreed well with the description, only the bunches were rather longer and looser than in the figure.

The first lot (No. 242) of 86¼ pounds, received and crushed September twenty-second, began fermentation on the morning of the twenty-fourth, reaching its maximum temperature of 76.1° F. on the morning of the twenty-fifth, then fell to 75.2° F. in the evening, and so remained for twenty-four hours, then gradually fell to the cellar temperature of 67° F. on September thirtieth, when the murk was drawn off, eight days from the crushing; the yield being 7.2 gallons from the above amount, or at the rate of 166 gallons per ton; pomace, 13.3 per cent.

Fermentation of the second lot (No. 243) of 68.6 pounds, received and crushed September thirtieth, began on the evening of October second (temperature, 66.2° F.) and reached its maximum of 75.4° F. on the evening of October fourth; then gradually fell to the cellar temperature of 68° F. on October eighth, when the murk was drawn off, nine days from the crushing, the yield being 5.3 gallons from the above amount, or at the rate of 153.9 gallons per ton.

Both wines were racked from the lees on October twenty-third, and again November eleventh and March twenty-fifth, the lees being very voluminous.

RECORD OF TASTING.

November 12, 1884. (Pohndorff.) No. 242. Good, but color less deep than expected.

No. 243—Character pretty neutral, but the expression of Aramon grape predominant. Perfectly sound.

Report of Convention Committee, December 7. Petit Bouschet U. No. 243 of Natoma, V. C. No. 8 of Stockton, and V. C. No. 14 of A. Haraszthy, from his Madison vineyard, all show excellent color, a fine flavor, mellowness in taste, and rich astringency; and, doubtless, the Petit Bouschet is an improvement upon the Teinturier, of which the Bouschet is a crossing. The grapes at Natoma reached maturity at the middle of September. This vine is a medium bearer and of vigorous growth at Natoma. Its adoption in California vineyards will be desirable, as its usefulness, chiefly for its coloring power, is great; and, seemingly, an addition of this grape to port grapes for sweet wines is of value for the utilization of that quality.

February 9, 1885. (Pohndorff.) Petit Bouschet in kegs. One sample (No. 242) in a three-gallon keg is of fine color and clean taste and bouquet; well preserved, and advanced in its development.

Sample in two-gallon keg (No. 243). Color, somewhat impaired, yet deep ruby; taste and flavor also have suffered from the thinness of the keg staves.

Sample in bottle since November eleventh: deep, brilliant color; taste, frank and mild; well developed.

April 1, 1885. (E. W. H.) No. 242. Condition, bright; color, ruby red, quite intense; bouquet, faint, but agreeable; astringency and acid, fair; dilutes a little better than No. 243.

No. 243. Not entirely clear; color, not very intense; little bouquet; a little sulphur perceptible; astringency and acid, rather low; does not bear dilution well.

ANALYSES.

	No. 242. Natoma Company.	No. 243. Natoma Company.
Must.		
Sugar by spindle	20.61	
Acid	.47	
Wine.		
Alcohol: Volume	11.00	11.55
Alcohol: Weight	8.84	9.27
Body	2.45	2.87
Tannin	.09	.12
Acid	.58	.49
Ash	.23	.37

In tannin, the Bouschet ranges in its average near to or a little above the Sirah, shows about double the amount in the Aramon, one of its ancestors, and nearly as high as its other ancestor, the Teinturier. In acid, also, the Bouschet ranges pretty high, and thus promises a wide usefulness for blending, even apart from its high color and good flavor.

CLAIRETTE ROUGE.

(According to the "*Vignobles*," the Clairette Rouge is identical with the Mataro. The Natoma grapes justify this conclusion.) This variety arrived in damaged condition and was worked on October 2, 1884, showing 23.04 per cent of sugar. Fermentation of 22.4 pounds crushed begun on the morning of October 5, 1884, at a temperature of 69.8° F., and reached its highest point on the next morning at a temperature of 73.4° F. (temperature of room, 67° F.), remaining so for the day, then slowly fell to the temperature of the cellar, 67° F., on October eleventh, when the murk was drawn off, nine days from the crushing; the yield from the above amount being 1.72 gallons, corresponding to 153.32 gallons per ton; pomace, 8.59 per cent. On November 10, 1884, the wine was racked from the lees; again on November twenty-fourth, and April 20, 1885. It fermented and cleared well, but was found to have a mouldy taste, notwithstanding care in picking over.

RECORD OF TASTING.

Viticultural Convention Committee, December, 1884. U. No. 244 Clairette Rouge shows equally very good characteristics, but owing to a very small quantity having been obtained for fermenting, and the grapes having arrived mouldy at the University, the test with this variety could not be thorough. The color is of a beautiful ruby tint and good density, and the expression apparently a satisfactory one.

February 11, 1885. (Pohndorff.) Wine of a deep ruby color, well developed, with a soft taste, but a slight flavor of mould prevents a definite judgment.

ANALYSIS.

Must.	
Sugar by spindle	23.95
Acid	.57
Wine.	
Alcohol: Volume	12.36
Alcohol: Weight	9.92
Body	2.72
Tannin	.06
Acid	.51
Ash	.29

BARBERA.

The Barbera is especially known as the grape forming the chief ingredient of the red wines of Asti, Italy, but it is now quite extensively grown in northern Italy on account of its hardiness, its fertility, and the high quality of its product. It often bears heavily the third year, and this productiveness is maintained for many years. The Barbera is not choice in respect to soil, but prefers a ferruginous clay and a warm east or south exposure. It is not easily hurt by frost nor is it much subject to mildew. Being very vigorous it does well with short pruning, being allowed more or less wood according to soil and vigor.

The rather large, olive-shaped, dark-tinted berries ripen during the second period; they have a light, special aroma, but are harsh and hardly agreeable to the taste.

A few bunches of this desirable variety, which was imported direct from Italy by Mr. John T. Doyle, were received from him and carefully worked, the vessel containing the small quantity being placed within a tub in which a larger mass was being fermented, in order to maintain the proper temperature. The wine when drawn off was of an intense and beautiful red tint, very heavy body and high astringency, and despite the precautions taken its fermentation was very slow in completing itself. Hence the sample shown at the Convention could exhibit only in a remote degree the best qualities of this noted grape.

Report of the Viticultural Convention Committee. U. No. 245, Barbera. This wine was represented in a small vial from the fermentation of a few bunches from J. T. Doyle, the first fruit of probably the only vines in the State. The fermentation of the insignificant quantity had been a tedious one, was not yet finished, but the grand qualities of this fruit were unmistakably apparent. Color and astringency, together with solids and taste matters, are most harmonious. The variety may confidently be expected to be an important one for California, and, in all its qualities, to rank with the Medoc varieties.

The quantity of the wine at command was insufficient for an analysis.

4. American Type.

LENOIR.

The Lenoir is well known to be a grape of the American stock, resisting the phylloxera well, and practically devoid of the "foxy" flavor to which the French object in most wines from American grapes. It is quite a prolific bearer, long-pruned, of course, like all American grapes, and yields heavy-bodied and heavy-tinted wines, which in California at least are rather low in their tannin contents. Few will find the Lenoir wine to their taste when by itself, but as an ingredient for blending, where its particular qualities are needed, it is of unquestionable importance.

No. 246. *Lenoir.* The grapes from Mr. Hagen's vineyard, Napa, arrived on October 9, 1884, and were crushed the same day, showing 17.18 per cent of sugar.

Fermentation of 32.8 pounds crushed began on the morning of October tenth, at a temperature of 68.9° F.; reached its maximum on the morning of October thirteenth, at a temperature of 73.4° F. (temperature of cellar, 67° F.), and remained at that point during the next thirty-six hours; then gradually fell until the morning of October sixteenth, when the cellar temperature of 67° F. was reached, and then the murk was drawn off, seven days from the crushing; the yield from the above amount being 2.31 gal-

lons, or at the rate of 151.6 gallons per ton; pomace, 15.33 per cent. The wine was racked from the lees on November 21, 1884; again racked April 4, 1885, and again in August following. The wine was analyzed April 4, 1885.

RECORD OF TASTING.

November 14, 1884. (Pohndorff.) More delicate in its fruit expression, and softer in taste than that from Anaheim. Very astringent, and color very deep.

Report of Viticultural Convention Committee, December, 1884. Lenoir. U. 246 and 247, the former from Napa, and the latter from Anaheim grapes, both show good flavor, beautiful color, and astringency; the Napa specimen greater delicacy in its taste composition, the latter a fuller body. No. 32, of Glen Ellen, No. 178 from St. Helena, No. 176, St. Helena, blend in which one eighth of Lenoir is added to one fourth Zinfandel, one eighth Mataro, and the excessive proportion of one half Grenache, and further U. No. 45, wherein about one third Lenoir is added to two thirds Zinfandel, instance the great power of this grape, chiefly for coloring and communicating astringent elements to other wines. This power, which is very great, must be husbanded, as sample U. 325 shows the overwhelming effect of so large a proportion as one third. That in the Lenoir vine we have one of the most valuable agents, of American derivation, for blending in red wines, may be confidently asserted, and the propagation of this phylloxera resistant vine be considered very advisable. The fermentation of the Lenoir proceeds smoothly, but it holds an enormous amount of lees and does not easily precipitate the same after fermentation.

February 9, 1885. (Pohndorff.) Sample in bottle kept its color very well; taste excessively astringent, and its fruitiness that of any berry except the grape, otherwise sound. Same in kegs, well preserved, tastes frank, color deep, quality middling, but decidedly useful for blending.

November 18, 1885. (E. W. H.) The wine is of an intensely red color, with a heavy body and vinous flavor; condition clear.

No. 247. *Lenoir.* Grapes sent from vineyard of L. Langenberger, Anaheim, arrived and were worked on October 13, 1884, showing 18.89 per cent of sugar.

Fermentation of 27.5 pounds crushed began on the morning of October 14, 1884, at a temperature of 71.6° F., and reached its maximum during the next morning at a temperature of 76.6° F. (temperature of the cellar, 67° F.), then slowly fell to the cellar temperature of 68° F. on October 20, 1884, when the murk was drawn off, seven days from the crushing; the yield from the above amount being 1.85 gallons, or at the rate of 134.50 gallons per ton; pomace, 11.80 per cent.

The young wine was racked from the lees on November 15, 1884; again racked February 18, 1885; and also in August following. The wine was analyzed November 19, 1884.

RECORD OF TASTING.

November 14, 1884. (Pohndorff.) Wine is of a very deep color, full of tannin and excellent expression. Foxiness slightly perceptible, well fermented and quite dry.

November 18, 1885. (E. W. H.) The condition of the sample was bright, with intense purple color. Body heavy and acid sharp. Flavor vinous, but bouquet undeveloped.

ANALYSES OF LENOIR AND HERBEMONT WINES.

	No. 246.	No. 247.	No. 150.
Must.			
Sugar by spindle	17.89	20.20	.....
Acid	.81	.63	.....
Wine.			
Alcohol: { Volume	10.16	11.17	10.00
Alcohol: { Weight	8.13	8.98	7.99
Body	3.00	3.71	1.80
Tannin	.06	.08	.04
Acid	.63	.58	.30
Ash	.38	.51	.20

The Herbemont is a resistant American stock, hardy and productive, and, like the Lenoir, completely exempt from "foxiness" of taste. It deserves greater attention than has been given to it thus far on the part of our vineyardists, and as it needs no grafting for protection against the phylloxera, it will meet the case of many who cannot afford the time and expense of transportation.

No. 105. Red Herbemont, 1883, from George Husmann.* Color of sample, light garnet; bouquet well developed, very agreeable; astringency, fair; acid, high; body, medium.

5. Rhenish Type.

BLUE ELBLING.

The Blue Elbling is a grape of the Rhenish region, and is there considered as a variety of the true Burger—White Elbling—or Kleinberger. (See under the head of Burger, below.) It is quite extensively planted as a quantity grape, but is lightly esteemed for quality, as yielding a light, watery wine without bouquet, and subject to ropiness in the cellar. In this State the Blue Elbling has justified a somewhat higher estimate of its wine-making qualities, while fully maintaining its European reputation for productiveness. Its lack of color and tannin points to its utilization preferably for white wines, or as a blend with red grapes having a full supply of the above ingredients. It seems to have yielded the most satisfactory results in the warmer parts of California.

No. 248. *Blau-Elbling.* The grapes sent by Messrs. Stern & Rose from their vineyard arrived on October 8, 1884, in good condition, and were crushed on the following day, showing 19.70 per cent of sugar.

Bunches rather large, short, usually shouldered on one side, thick; berries, reddish purple, with little color, semi-translucent; rather loosely put; size, medium.

The fermentation of twenty pounds crushed began on the morning of October 10, 1884, at a temperature of 65.3° F., and reached its highest point, 70.7° F. (temperature of the cellar, 67° F.), on the evening of October twelfth, then gradually fell to the temperature of the cellar (67° F.) on October 17, 1884, when the murk was drawn off, nine days from the crushing, the yield from the above amount being 1.37 gallons, or at the rate of 137.25 gallons per ton; pomace, 10.70 per cent. The young wine was racked from the lees on November 16, 1884; again racked on November 24, 1884, and also on April 8, 1885, on which day the wine was analyzed.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. No. 239. Blue Elbling (red). This sample shows most faithfully the type and aspect that the variety can attain. Color good, expression fruity, and really agreeable. But at the same time it proves that a fine type of wine, for direct use, cannot be made from this grape, the taste of the well-fermented sample being unclean, its flavors and acids denoting an early etherization and a discordant composition. In blends with appropriate varieties the matter may be different, and for white wine it is doubtless a good grape.

No. 144. Barton's Blue Elbling, poor color, has no merits beyond a slightly fruity expression.

Blue Elbling fermented white juice from Stern & Rose, No. 144, is a light, sound wine, apparently firmer, and in its construction better than the red wine made from that grape.

February 9, 1885. (Pohndorff.) Blau-Elbling in *vial*, fair quality, but has suffered.

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* Placed here for comparison with Lenoir, although a contributed wine.

ANALYSIS.

Must.

Sugar by spindle	20.62
Acid	.72

Wine.

Alcohol: Volume	10.25
Alcohol: Weight	8.27
Body	1.93
Tannin	.04
Acid	.59
Ash	.34

RED GRAPE BLENDS.

Claret Type.

No. 314. *Blend of Cabernet Sauvignon* from Natoma, and *Grossblaue* from Pellet.

Both varieties were in good condition, and were crushed on October 2, 1884. Of the 52.8 pounds crushed, 75 per cent were Cabernet Sauvignon and 25 per cent Grossblaue, yielding 4.41 gallons.

Fermentation commenced on the evening of October third, at a temperature of 68° F.; reached its maximum on October fifth at a temperature of 78.8° F. (temperature of the room, 69° F.), then very gradually fell to the cellar temperature (66° F.) on October eleventh, when the murk was drawn off, nine days from the crushing.

This young wine was racked from the lees on November 23, 1884; again racked February 27, 1885, and also in August, 1885.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. U. No. 314 is inferior to No. 14 (Cabernet Sauvignon of Mr. J. H. Drummond, Glen Ellen).

February 9, 1885. (F. Pohndorff.) A coarse tasting wine indicative of antagonism of the two grapes in the proportions used.

No. 326. *Cabernet Franc*, from Natoma, and *Grossblaue*, from Pellet.

The total weight of grapes crushed was 24 pounds, of which 75 per cent were Cabernet Franc, and 25 per cent Grossblaue, the yield being 1 gallon. The lots were worked on October 2, 1884.

Fermentation began on the evening of October fourth, at a temperature of 68.9° F.; reached its highest point of 72.5° F. (temperature of cellar, 69° F.), on the morning of October 6, 1884, where it stood for over three days; then very gradually fell to the cellar temperature (66° F.), on October eleventh, when the murk was drawn off, nine days from the crushing.

The blend was racked from the lees on November 12, 1884; again racked February 27, 1885, and again in August following.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. U. No. 326, consisting of Cabernet Franc and Grossblaue, has a certain degree of harshness, which indicates a too heavy proportion of the latter grape.

No. 327. Blend of *Cabernet Franc* (from Natoma), *Grossblaue* (Pellet), *Folle Blanche* (Natoma), and *Black Prince* (P. W. Butler).

The grapes for this blend were crushed on October 8, 1884; of the 48 pounds used 66⅔ per cent was Cabernet Franc, 12½ per cent of each of

Grossblaue and Folle Blanche, and $8\frac{1}{3}$ per cent of Black Prince; yield, 3.7 gallons.

Fermentation began on the morning of October 9, 1884, at a temperature of 66.2° F., reached its maximum two days later, at a temperature of 73.4° F. (temperature of cellar, 67° F.), where it remained for the day, then very gradually fell to the cellar temperature (67° F.) on October 15, 1884, when the murk was drawn off, seven days from the crushing.

On November 23, 1884, the wine was racked from the lees, again racked on February 25, 1885, and again in August, 1885.

RECORD OF TASTING.

November, 1884. (F. Pohndorff.) The young wine has too much carbonic acid present to judge of its taste as yet. On racking there was a large amount of lees which was rather sticky and slimy and full of coloring matter.

Report of Viticultural Convention Committee, December, 1884. U. No. 327 having 15 per cent Grossblaue, 10 per cent Black Prince, 15 per cent Folle Blanche, and 60 per cent Cabernet Franc, proves to be quite distinct and advantageously combined.

February 9, 1885. Sample in bottle not filled has kept well and developed though still containing a large amount of carbonic acid. The taste of Black Prince is predominant and injurious.

No. 328. Blend of *Mission* (Vina), *Carignane* (H. A. Pellet), and *Folle Blanche* (Fresno).

The grapes for this blend were crushed on October 10, 1884. Of the 69.52 pounds worked, 50 per cent was Mission and 25 per cent of each of Carignane and Folle Blanche. The yield was 5.38 gallons.

Fermentation began on the morning of October 11, 1884, at a temperature of 69.8° F., and reached its maximum of 78.8° F. (temperature of cellar, 67° F.) on the morning of October thirteenth, remaining so for about twenty-four hours, then gradually fell to the temperature of the cellar (68° F.) on October 16, 1884, when the murk was drawn off, six days from the crushing.

The wine of this blend was racked from the lees on November 1, 1884; again racked February 20, 1885, and finally in August of same year.

RECORD OF TASTING.

November 11, 1884. (F. Pohndorff.) Not a proper blend. The Mission is entirely too prominent.

Report of Viticultural Convention Committee, December, 1884. U. No. 328, blend of half Mission, Vina, Tehama County, one quarter Carignane and one quarter Folle Blanche, gives no signs of harmony, nor that the coarseness of this Mission element could be overcome by the addition.

February 9, 1885. (F. Pohndorff.) Color turned to a poor bluish tint, taste faulty in many respects.

No. 316. *Blend of Zinfandel* (Martinez), *Grossblaue* (Pellet), and *Folle Blanche* (Natoma).

Of the 28 pounds of grapes worked on October 2, 1884, for this blend, $71\frac{3}{7}$ per cent was Zinfandel; $21\frac{3}{7}$ per cent Grossblaue; and $7\frac{1}{7}$ per cent Folle Blanche, the number of gallons obtained being 2.5. The Zinfandel grapes were quite green; those of the other varieties were in good condition.

Fermentation began on the morning of October 4, 1884, at a temperature of 68° F., and reached its maximum of 75.2° F. (temperature of room, 69° F.) on the next evening, then slowly fell until the temperature of the cellar (66° F.) was reached on October eleventh, when the murk was drawn off, nine days from the crushing.

On November 13, 1884, the wine was racked from the lees; again racked December twelfth; again May 5, 1885; and lastly August, 1885.

RECORD OF TASTING.

November 12, 1884. (Pohndorff.) Blend in half bottle seems to be an improvement on the Zinfandel. Sample in two-gallon keg is not so successfully developed, nor is the color so deep as that of the bottle specimen.

Report of Viticultural Convention Committee, December, 1884. U. No. 316. Zinfandel, Grossblaue, and Folle Blanche is a model, or would have been if the Folle Blance juice addition, which was only 7 to 21 Grossblaue and 72 of Zinfandel, had been raised to double the proportion indicated.

February 9, 1885. (Pohndorff.) Color faded, but taste agreeable and acceptable. Zinfandel having influenced the blend favorably; but it has suffered from the thin staves of the kegs.

No. 329. *Blend of Cabernet Franc* (Natoma) and *Carignane* (Pellet).

The total amount of grapes crushed for this blend on October 4, 1884, was 20 pounds, 75 per cent Cabernet Franc and 25 per cent Carignane; the yield was 1.60 gallons.

Fermentation began at a temperature of 63.5° F. on the evening of October fifth, and reached its maximum at a temperature of 70.7° F. (temperature of cellar, 68° F.) on the evening of October eighth, then slowly fell to the cellar temperature of 67° F. on October thirteenth, when the murk was drawn off, nine days from the crushing.

The wine was racked from the lees on October 22, 1884; again racked November 20, 1884; again racked April 20, 1885, and also in August, 1885.

RECORD OF TASTING.

November, 1884. (F. Pohndorff.) Blend is of good color and mellow taste, but owing to a slight taint of mould the character of the wine cannot be judged.

No. 312. *Blend of Cabernet Franc and Petite Sirah* (Natoma grapes).

This blend was made from grapes in good condition on October 1, 1884; the total weight used was 26.4 pounds (33⅓ per cent Petite Sirah and 66⅔ per cent Cabernet Franc), yielding 1.53 gallons.

Fermentation of the crushed grapes began on the evening of October first, at a temperature of 68.9° F., and reached its highest point on the evening of the following day, at a temperature of 83.4° F. (temperature of the room, 68° F.), then gradually fell to the temperature of the cellar (69.8° F.) on October eleventh, when the murk was drawn off, ten days from the crushing.

This wine was racked from the lees on November 17, 1884; again racked February 27, 1885, and lastly, in August, 1885.

RECORD OF TASTING.

November, 1884. (Pohndorff.) The blend requires a third element in order to secure mellowness and a true vinous flavor.

Report of Viticultural Convention Committee, December, 1884. U. No. 312 is a successful combination.

February 9, 1885. (Pohndorff.) Blend delicate in construction, but has suffered from access of air owing to thin staves.

No. 319. *Blend of Malbeck and Petite Sirah* (Natoma).

The grapes used in this blend were in good condition; of the 27.5 pounds crushed on September nineteenth, 80 per cent were Malbeck and 20 per cent Petite Sirah, and yielded 2.5 gallons; pomace, 9.60 per cent.

Fermentation commenced on the evening of September twentieth, temperature 71.6° F., and reached its maximum the following morning, at a

temperature of 74.3° F. (temperature of cellar, 70° F.), where it stood for about thirty-six hours, then gradually fell to the temperature of the cellar (68° F.) on September twenty-seventh, when the murk was drawn off, nine days from the crushing.

The young wine was racked from the lees on October 18, 1884; again racked November 15, 1884; again April 23, 1885, and lastly, in August, 1885.

RECORD OF TASTING.

Report of the Viticultural Convention Committee, December, 1884. U. No. 319. One fifth Sirah to four fifths of Malbeck, although having apparently too small an addition of the former to modify the nature and taste of the latter, seems to be a homogeneous mixture.

No. 330. *Cabernet Franc and Mourastel* (Natoma).

Grapes were worked on October 4, 1884, and were in good condition. Twenty pounds were crushed, one half of each kind, and yielded 1.5 gallons. Fermentation began on the evening of October 6, 1884, at a temperature of 69.8° F.; reached its highest point on the morning of October eighth, at a temperature of 71.6° F. (temperature of cellar, 67° F.), and remained at that point during the day, then slowly fell to the temperature of the cellar (66° F.) on October thirteenth, when the murk was drawn off, nine days from the crushing. The wine was racked from the lees on November 15, 1884; again racked April 23, 1885, and finally in August following.

RECORD OF TASTING.

November, 1884. (F. Pohndorff.) Wine is slightly mouldy owing to Cabernet Franc grapes being kept too long before using. Wine is seemingly adapted for improving a middle class claret. The mouldy taste prevents any special study of the blend in that direction.

Report of the Viticultural Convention Committee, December, 1884. U. No. 330. Blend of one half Mourastel and one half Cabernet Franc has resulted in a full-flavored and deep-colored wine, which needs diluting with a homogeneous light wine of high order, and would then undoubtedly remain in a high category.

No. 311. Blend of *Cabernet Franc* (Natoma), *Carignane* (Pellet), *Grossblaue* (Pellet), and *Folle Blanche* (Livermore).

Of the 22 pounds crushed on October 4, 1884, 63.7 per cent was Cabernet Franc; 18.2 per cent Carignane, and 9.1 per cent each of Grossblaue and Folle Blanche; yielding 2.20 gallons.

Fermentation began on the morning of October sixth, at a temperature of 68° F., and reached its maximum on the following evening, at a temperature of 72.5° F. (temperature of cellar, 67° F.), where it stood for thirty-six hours, then gradually fell to the temperature of the cellar (67.1° F.), on October 13, 1884, when the murk was drawn off, nine days from the crushing.

On October 25, 1884, the wine was racked from the lees; again racked November twenty-sixth; again, February 27, 1885, and finally, in August following.

RECORD OF TASTING.

November, 1884. (F. Pohndorff.) Blend is of good type, but one can not judge of its merits owing to taint of mould from Carignane grapes.

Report of Viticultural Convention Committee, December, 1884. U. 311, having 64 per cent Cabernet Franc, 9 per cent of Grossblaue, 9 of Folle Blanche, and 18 of Carignane (the latter grapes having imparted a slightly mouldy taste to the blend, impaired thereby in its frank expression), seemed also measurably harmonious, showing that it is desirable to study the proper combinations of these varieties in different proportions.

No. 313. Blend of *Cabernet Sauvignon* (Natoma), *Mourastel* (Natoma), and *Carignane* (Pellet).

All the grapes used in this blend were in good condition, and were crushed on October 4, 1884. The total amount of grapes was twenty pounds, of which sixty per cent was Cabernet Sauvignon, and twenty per cent of each of Mourastel and Carignane; the yield being 1.25 gallons.

Fermentation began on the morning of October sixth, at a temperature of 68° F., reached its maximum on the evening of the next day at a temperature of 71.6° F. (temperature of the cellar, 67° F.), and remained so for about thirty-six hours, then gradually fell to the cellar temperature (67.1° F.), on October 13, 1884, when the murk was drawn off, nine days from the crushing.

The wine was racked from the lees on October 25, 1884; again racked November 15, 1884; again on April 21, 1885, and lastly, in August same year.

RECORD OF TASTING.

November 14, 1884. (F. Pohndorff.) Blend not homogeneous but color good. Carbonic acid still present. There is a slight taint of mould, probably from Carignane grapes.

Report of Viticultural Convention Committee, December, 1884. U. No. 313, Cabernet Sauvignon with Mourastel and Carignane, although the latter grape has imparted to it a taste of mould, showed distinctly the adaptability of this combination, which it would be well to continue trying in different proportions of the ingredients.

No. 321. *Blend of Zinfandel* and *Mondeuse*, from Natoma.

Grapes of both varieties were received on September 29, 1884, in quite bad condition; those of the Zinfandel were so far gone that of four boxes picked over but one half was fit for use. The total weight of grapes used was 67.3 pounds, of which 60 per cent was Zinfandel and 40 per cent Mondeuse; the yield being 5.15 gallons; pomace not determined.

Fermentation of the crushed grapes began the evening of October first, temperature 69.8° F., reaching its maximum of 70.7° F. (temperature of cellar, 66° F.) on October third, then slowly fell to the temperature of the cellar (68° F.) on October eighth, when the murk was drawn off, nine days from the crushing.

On November 21, 1884, the wine was racked from the lees; again racked March 2, 1885, and also in August following.

RECORD OF TASTING.

November 14, 1884. (F. Pohndorff.) A sound wine of good type, Zinfandel being modified. The color is good but not very deep.

Report of Viticultural Convention Committee, December, 1884. U. No. 325, already mentioned under the head of Mondeuse, contains 40 per cent of the latter and 60 per cent of Zinfandel. This sample illustrates the fitness for association of these two grapes. The mellow taste of the blend is owing to a thorough amalgamation of the Mondeuse with the Zinfandel, and the improvement of the taste over that of the latter wine alone is evident. In U. No. 322, consisting of one fourth Zinfandel, one fourth Mondeuse, one fourth Grossblaue, and one fourth Aramon, the proportioning of the first named grapes seems too small. A larger amount of them will no doubt characterize the blend very favorably. The acids in the blend, as it is, are too pungent and require softening or absorbing of the acids which are most pronounced, by another variety. The studies with similar grapes should be continued in future vintages, in order to reach a superior type in which Zinfandel will be a chief factor.

February 9, 1885. (F. Pohndorff.) Sample in keg well kept and developed; color very good. The taste of the blend shows the necessity of a third medium to insure a satisfactory type.

November 20, 1885. (E. W. H.) Condition of sample bright, with very good color and medium body. Bouquet fairly developed; acid somewhat high.

WINE BLENDS.

No. 332. *Wine Blend.*

Fifty per cent *Zinfandel*, from Charles Webb Howard, Lake County; 15 per cent *Grenache*, from Natoma Company; 20 per cent *Petit Bouschet*, from Natoma Company; 15 per cent *Bastardo*, from Natoma Company.

This blend was made from wines racked from their lees on October 7, 1884. The blend was racked again on February 28, 1885; again racked August, 1885.

RECORD OF TASTING.

November, 1884. (Pohndorff.) A sound wine, but Zinfandel expression not conquered. Type should be observed, however, to build blends of analogous characters for the purpose of studies in that direction.

February 9, 1885. (Pohndorff.) A well preserved wine, but owing to some one of the grapes having entered the blend in a slightly mouldy condition, the character can not well be judged.

No. 317. *Wine Blend.*

Fifty per cent *Aramon*, Natoma Company; 50 per cent *Zinfandel*, Martinez, Contra Costa County.

The wine was racked and blend made October 11, 1884; blend again racked November 14, 1884; again racked February 27, 1885, and lastly in August following.

RECORD OF TASTING.

November, 1884. (Pohndorff.) The heavy character of Zinfandel is neither mitigated nor improved by the addition of the Aramon; there being too much of the latter.

Report of Viticultural Convention Committee, December, 1884. U. No. 317. Aramon and Zinfandel, reconsidered, showed a pretty good union of softened taste and harmonious, proving Aramon in adequate proportion to be a useful material for blends with Zinfandel. U. No. 322, blend of equal parts of Grossblaue and Mondeuse added to blend 317, shows a well-covered wine as to color, of mellow taste, with fine full astringency, and an expression which is somewhat too loud, but shows the way whereon to reach satisfactory results by continuation of studies in some similar direction. U. No. 331, composed of 30 parts of Aramon with 26 of Crabb's Black Burgundy and 44 of Zinfandel, constitutes another satisfactory combination.

B.—DRY WHITE WINES.

SEMILLON.

The Semillon is grown chiefly in the Bordeaux region, where it forms the main ingredient of the Sauterne type of wines, usually blended with the Sauvignon Blanc, and more or less of the Muscadelle. The Semillon vine is a strong grower, and at the same time a good bearer; a somewhat rare combination. It is, therefore, specially adapted to the hill lands, where it produces well and lasts a long time. Few grapes of high quality give such satisfactory results on dry and relatively meager soil. The Sauvignon, while its peer in high qualities, is not nearly so vigorous, and not so well adapted to the hill lands, which are indispensable to the production of the "great wines." It is always pruned long; it matures medium late, and is somewhat liable to decay notwithstanding its rather thick skin; is somewhat used as a table grape, but would not bear shipment to a great distance.

The grapes sent from the Natoma Vineyard were obviously true to name. It is reported to be a small bearer; growth of medium vigor. It was gathered fairly ripe on September sixth, and fully ripe on September seventeenth, at the same time as Sauvignon Blanc.

Two lots of this grape were received in good condition, one (No. 251) on September ninth, with 18.89 per cent of sugar, and a second one September nineteenth, showing 20.99 per cent sugar. Both were crushed on the days when received. The yield from the first lot (No. 251) of 38.9 pounds was 3.04 gallons, or at the rate of 156.04 gallons per ton; pomace, 23.31 per cent.

The second lot (No. 252) of 61.2 pounds yielded 4.23 gallons, corresponding to 138.2 gallons per ton; pomace, 30.86 per cent.

Fermentation of No. 251 commenced on the evening of September twelfth at 70.7° F. temperature, and reached its maximum on the evening of September fourteenth at 73.4° F. temperature (temperature of cellar, 70° F.), then fell slowly to the temperature of the cellar (68° F.), on September twentieth.

The young wine was racked from the lees on September twenty-third; again on November 18, 1884; again on February 27, 1885, and lastly in August, 1885.

The fermentation of No. 252 began on the morning of September twenty-second at a temperature of 71.6° F., and reached its maximum on the evening of September twenty-third, temperature 82.4° F., then fell gradually to the cellar temperature, 69.8° F., on September twenty-eighth.

The wine was racked from the lees on October seventh, then on November 14, 1884; again on March 2, 1885, when a sample for analysis was taken, and also in August following.

SAUVIGNON (BLANC).

The culture of the Sauvignon is more widely distributed than that of the Semillon, as it forms not only an important ingredient of the wines of the Sauterne type in the Gironde, but is also well known southward to the Pyrenees, northward to the Loire, and eastward to the Rhone. Being only of fair vigor and rather a shy bearer, but of high quality, it is chiefly used in blending with both red and white wines of other varieties, to which it imparts its fine and delicate flavor, while at the same time losing the slight harshness that characterizes its wines during the first years. The Sauvignon is pruned short at Sauterne, and this should be done wherever the soil is not rich, as otherwise the vine is too soon exhausted. It ripens somewhat after the middle of the season. At Natoma the grape was gathered fairly ripe on September sixth, fully ripe on September seventeenth, with the Semillon, and overripe on September thirtieth. It is reported to be not quite as good a bearer as the Semillon, but of quite a vigorous growth.

Three lots of this variety were received from Natoma. The first lot, No. 253, on September ninth, in good condition, with 21.22 per cent of sugar; second lot, No. 254, on September nineteenth, having quite a large amount of the grapes dried almost to raisins, and showing 20.99 per cent of sugar; and the third lot, No. 255, on October 2, 1884, in bad condition, only a few being good enough for use; amount of sugar not determined.

The yield of must from the first lot (No. 253) of 52.14 pounds, was 3.7 gallons, or at the rate of 141.91 gallons per ton; pomace, 28.78 per cent. The yield from the second lot (No. 254) of 115.5 pounds, was 8.6 gallons, corresponding to 148.7 gallons per ton; pomace, 24.81 per cent. The yield from the third lot (No. 255) of 34.1 pounds, was 2.38 gallons, corresponding to 139.1 gallons per ton; pomace, 27.6 per cent.

It thus appears that the sugar of the grape had certainly not increased, and perhaps had decreased a little, after it had reached maturity, and that the yield of must was greater at "full ripeness" than either before or afterward.

The fermentation of No. 253 began on the evening of September twenty-

first, at a temperature of 73.4° F., and reached its maximum on September twenty-third, at a temperature of 80.6° F., then gradually fell to the cellar temperature of 68° F. on September twenty-ninth. The wine was racked from the lees on October third; again on February 25, 1885, and also in August following.

The fermentation of No. 254 commenced on the morning of September eleventh, at a temperature of 72.5° F., reaching its maximum on the morning of September fourteenth, at a temperature of 77.9° F. (temperature of cellar, 68° F.), and then gradually fell to the cellar temperature of 68° F., on September 20, 1884. This sample of wine was racked from the lees on September twenty-third; again on February 25, 1885, and in August following.

Fermentation of No. 255 began on the evening of October third, at a temperature of 68° F., reaching its maximum on the evening of October fourth, at a temperature of 71.6° F., then fell very slowly to the temperature of the cellar, 67° F., on October tenth. The wine was racked from the lees on October fourteenth; again on March 7, 1885, and in August following.

MUSCADELLE DU BORDELAIS.

The Muscadelle du Bordelais is cultivated only within a restricted area of southwestern France, and even there forms only a small proportion in the vineyards, as its use is mainly for blends with the Semillon and Sauvignon, in the production of Sauterne wines, and, to some extent, for the fine liqueur wines of Monbazillac, and a few other localities. Its Muscat perfume is very light and delicate, sometimes almost imperceptible in the grape, but coming out in the wines of which it forms a part. Its growth is vigorous, and it is very productive, even under short pruning. The bunch is rather large, sometimes loose, sometimes compact and crowded; the berry of medium size, with a delicate skin, and, therefore, subject to rot. It matures about the middle of the vintage, with the Semillon and Sauvignon.

From Natoma the *compact variety* is reported as being a rather light bearer, of good vigor, with small bunches and berries; ripening about middle of September. The *loose bunched variety* is reported to be a fair bearer, of medium vigor; having small or fair sized bunches, with medium berries. The time of ripening is about the same as that of the compact variety.

The two varieties of this grape arrived on September 19, 1884, and were immediately worked. The first variety (No. 256) of *loose bunches* had 22.23 per cent of sugar, and the second (No. 257) of *compact bunches* showed 22.67 per cent.

The yield from 112.64 pounds of *loose bunches* (No. 256) was 9.56 gallons or at the rate of 169.81 gallons per ton; pomace, 26.15 per cent.

The yield from 122.54 pounds of *compact bunches* (No. 257) was 7.66 gallons, corresponding to 125.15 gallons per ton; pomace, 31.54 per cent.

The fermentation of the former variety commenced on the morning of September twenty-first, at a temperature of 72.5° F., and reached its maximum on the next morning at a temperature of 80.6° F. (temperature of the room, 70° F.), then fell very slowly to the temperature of the cellar (68° F.) on October second. This wine was racked from the lees October 7, 1884; again on November 26, 1884, and on February 26, 1885; analyzed on March 12, 1885. Fermentation of the latter began at the same time as that of the *loose bunched* variety, and was completed under the same conditions.

This wine was racked from the lees on October 11, 1884; again on November thirtieth, and on February twenty-sixth, and on September, 1885; analysed on March 12, 1885.

No. 299. *Blend of Semillon* and *Sauvignon.* The total weight of grapes used in making this blend was 52.14 pounds, of which two parts were Semillon and one Sauvignon; the yield being 3.96 gallons, or at the rate of 153.2 gallons per ton; pomace, 21.60 per cent.

Fermentation began on the evening of September eleventh, at a temperature of 70.4° F., and reached its maximum on September fourteenth, at a temperature of 75.2° F., remaining so for that day, then fell very gradually to the temperature of the cellar (68.2° F.) on September 20, 1884.

This wine was racked from the lees on September 23, 1884; again on January 8, 1885, and once more in September, 1885.

No. 300. *Blend of Semillon, Sauvignon Blanc, and Muscadelle du Bordelais.* The total weight of grapes used was 161.92 pounds, of which three parts were Semillon, one part Sauvignon Blanc, and one part Muscadelle du Bordelais (one half loose and one half compact bunches); the yield being 11.28 gallons from the above amount.

Fermentation began on the morning of September twenty-first, at a temperature of 73.4° F., reaching its maximum the same evening, at a temperature of 78.8° F. (temperature of cellar, 70° F.), remaining so for about twenty-four hours, then gradually falling to the temperature of the cellar (68° F.) on October 3, 1884.

On October 7, 1884, the wine was racked from the lees; again on November fifteenth, and on February 26, 1885, and in September, 1885.

Semillon, Sauvignon, and Muscadelle.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. Among the white wine varieties considered novelties, Semillon was represented by three samples. Mr. J. H. Drummond, in No. 29, shows his third small vintage; and Mr. Crabb, in 190, his 1883 well developed wine from that grape—University No. 252 the second vintage from the Semillon vine. The results from this grape prove qualitatively a notable success, and the undoubted advisability of the propagation in our coast counties, and by those aiming at and capable of the production of high-class light wines. The bearing power at Natoma thus far is small.

For the purpose of Sauterne character wines the Sauvignon Blanc, represented by University samples Nos. 253, 254, and 255, which are of very acceptable quality and exquisite flavor, is to be planted conjointly with the Semillon. The Natoma plant, Sauvignon Blanc, is a small bearer. However, its quality is superior to the Sauvignon Vert, of which No. 189 is a sample of Mr. Crabb's 1883, the quality of which was acknowledged to be very satisfactory. U. No. 299 blend of two thirds Semillon and one third Sauvignon Blanc is a success, although sulphur flavor impairs the bouquet and taste of the same.

University sample No. 256, Muscadelle du Bordelais, of loose bunches and large berries, and U. No. 257, the same variety name, but of compact bunches and small berries, showed both a delicate fruit flavor, the first of the two of the higher expression, the taste of both remarkably clean.

No. 256, the preferable one of the two, will be a most welcome addition to our vines productive of decided flavor. For the perfection of the Sauterne-type wine, that grape will have to be considered indispensable.

University sample No. 300, noted in the catalogue erroneously as Semillon, called attention for its excellent quality in all regards. It is a blend of 50 per cent Semillon, 25 per cent Sauvignon Blanc, 12½ per cent Muscadelle du Bordelais, of large berries, and 12½ per cent Muscadelle du Bordelais, of compact bunches. This combinedly-fermented sample held a good place, its youth, of course, considered, against the imported cheapest Sauterne, with which it was contrasted in the hall. It may be arrogant to rebel against the artificial retention of part of the saccharine matter of the French Sauterne wines, sanctioned by commercial usage; but we are of the opinion that the system had best not be followed in California.

A perfect fermentation will enable us to render our future Sauterne-type wines of superior quality; and for hygienic reasons we should adopt simply the natural and intelligent way of a clean fermentation and nursing of that type of wine.

February 5, 1885. (Pohndorff.) *Semillon* and *Sauvignon Blanc* blend, not touched since November fourteenth, is remarkably well developed; taste very good, as well as expression. A portion in keg has suffered considerably from the thin staves.

Semillon, Sauvignon, and *Muscadelle* blend, in keg, has built itself up very well, and is

unimpaired by the influence of the air through the thin staves, while another sample, of similar composition, has suffered irredeemably from that cause.

Sauvignon Blanc, in bottles, has developed well.

The same, in a five-gallon keg, has a fine taste; has cleared remarkably well, and has a good bouquet.

The same, in a small keg, has suffered so much that it cannot be judged.

Muscadelle du Bordelais of compact bunches, in a large flask, is remarkably well developed, with fine taste and bouquet. Same in keg likewise well developed, fine taste and flavor.

Muscadelle du Bordelais of loose bunches, in kegs, is well preserved, but the smell of sulphur from the grapes influences it too strongly to judge of it, as it also holds a good deal of carbonic acid gas.

March 11, 1885. Semillon. No. 252. (E. W. H.) Sample taken for analysis. Pale topaz color, condition nearly clear, bouquet very decided and prominent in tasting; acid light pleasant, and body rather heavy. Excellent vinous taste and development remarkably well advanced for its age.

March 12, 1885. (E. W. H.) *Muscadelle du Bordelais. No. 257.* (Compact bunches.) Condition clear; dark topaz tint; bouquet pronounced, very agreeable, and a remarkably nutty flavor; acidity light, pleasant.

Sauvignon Blanc. No. 254. Condition clear; color white or pale topaz; bouquet faint as yet but very agreeable; somewhat covered by sulphur; acid light and pleasant; body lighter than Semillon or Muscadelle.

November 20, 1885. (E. W. H.) A comparative tasting of the Sauvignon wines made from three successive invoices of grapes sent from Natoma, gathered respectively on September sixth, seventeenth, and thirtieth, and numbered 253, 254, and 255. So far as known all these were treated alike. All alike are clear, but the color of No. 255 is decidedly more yellowish than the earlier samples. The earliest, No. 253, has most decidedly the Sauterne character, and is at present the best developed of the three. No. 254 is much more feebly developed and lacks character, being very soft and both acid and bouquet very light. No. 255, from grapes that were overripe and partly dried, has lost the Sauterne character and resembles more, in its present condition, the wine of the Palomino or Pedro Jimenes, with heavier body, high bouquet, and the nutty aftertaste of a sherry grape.

Semillon. Of the two samples received, the wine from the earlier grapes, No. 251, was so much injured by the thin staves of the keg in which it passed its first months, that it can not be judged, being too far acetified; but the peculiar bouquet and softness of the grape can even yet be noted.

The second sample, No. 252, from grapes gathered September seventeenth, is well developed, though not as fully as the Sauvignons, owing partly, perhaps, to its having been kept in glass for some months. While the bouquet is not very full it has a decided nutty aftertaste. Its acid is a little too high. Evidently is is a more delicate wine to keep than the Sauvignon.

Muscadelle du Bordelais. Both varieties—that from the compact as well as that from the loose-bunched grapes—are clear, almost bright; bouquet very pronounced and natural aroma very strong in both, but that from the compact bunches is more rounded and agreeable to the palate.

Blend of Sauvignon, Semillon, and Muscadelle ("Château Yquem Blend"). Finely developed, round, and expressive; much superior to either of the pure wines, unless it be the Sauvignon No. 253, which would be acceptable just as it is.

ANALYSES.

	1883. J. H. Drummond. Semillon.	Natoma Company—1884.					
		No. 251. Semillon.	No. 252. Semillon.	No. 254. Sauvignon Blanc.	No. 255. Sauvignon Blanc.	No. 256. Muscadelle du Bordelais.	No. 257. Muscadelle du Bordelais.
Must.							
Sugar by spindle	----------	18.89	20.99	22.20	----------	22.93	22.67
Acid	----------	.54	.42	.53	----------	.37	.53
Wine.							
Alcohol: Volume	10.58	--------	12.36	12.36	12.75	14.00	13.27
Alcohol: Weight	8.48	--------	9.92	9.92	10.26	11.46	10.81
Body	1.52	--------	1.93	2.10	2.18	2.13	2.44
Acid	.38	--------	.45	.45	.55	.43	.50
Ash	.22	--------	.18	.16	.19	.21	.34

No. 258. Folle Blanche.

A white grape, greatly resembling this variety, received from France under the erroneous name of Tannat.

Grapes were received in much crushed and partly damaged condition, and were worked on October 2, 1884, showing 21.97 per cent of sugar.

From the 126 pounds crushed, 10.91 gallons were obtained, corresponding to 173.11 gallons per ton; pomace, 23.39 per cent.

Fermentation started on October second, and continued quietly until finished. The young wine was racked from the lees on October 14, 1884, again on February 26, 1885, and lastly in August following.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. Nos. 25, 127, and University No. 258, Folle Blanche wines, there is discernable in the three samples the character of a light wine of considerable body and mellow taste. Quality not high, but the utilization of the Folle Blanche juice for blending with red-wine grapes, seems indicated in several of the red wine samples having that juice in their composition.

February 9, 1885. (Pohndorff.) This wine, which had two rackings since middle of October last, is good, and has depurated itself well. The same in another (smaller) keg is remarkably well advanced in development, and has a good taste.

March 17, 1885. (E. W. H.) Condition in keg, clear; in bottle, slightly turbid; color, topaz; a rather heavy body; fruity and vinous flavor, and strong, agreeable bouquet; acid, decided but pleasant; quality appears to be altogether above that of a Folle Blanche wine—more of a southern type. A sample for analysis was taken at this time.

November 20, 1885. Bright condition; bouquet and vinous flavor well developed, with a decided nutty aftertaste.

ANALYSIS.

Must.

Sugar by spindle	22.10
Acid	.66

Wine.

Alcohol:	Volume	12.36
	Weight	9.92
Body		1.66
Acid		.59
Ash		.21

BURGER.

The Burger, properly so called, is a grape of the northern part of the wine belt of Europe, and the grape passing under that name in California has been associated, both in the vineyards and cellars, with the (true) Riesling, the Gutedel or Chasselas, and other Rhenish grapes. Among these, it is in Europe held in but very light estimation as to quality, though known to produce large quantities of a light acid wine, poor in alcohol. Among its names is that of White Elbling; the Blue Elbling, largely cultivated by Mr. L. J. Rose at San Gabriel, being held to be one of its varieties.

However similar to the true Burger, or Kleinberger, in respect to the wine it yields, especially in northern localities, the California grape differs from the German type as well as from the Blue Elbling. From a comparison with a grape imported by Mr. Groezinger, Mr. Wetmore identifies our grape with the white Tokay, also known as Putszcheere, and Elender; both names indicative of no very high estimate of the quality of the variety, which seems to represent the Burger in Hungary. It is certain that the California Burger yields its best product in the hotter parts of the State, as Fresno and San Gabriel, and it is interesting to note the obvious effect of this transposition, which, however, appears similarly in the 1885 Burger from Lake County, as is shown in the table below. For farther

comparison are subjoined the analyses of wines from the Blue Elbling* (which is by German ampelographers accounted as a mere variety of the white Burger or Elbling) from the same locality (San Gabriel) as one of the Burger wines.

BURGER WINES.

Grower.	Locality.	Vintage.	Body.	Alcohol.		Ash.	Acid.
				By Weight.	By Volume.		
Chas. Krug	St. Helena	1880	1.25	7.24	9.00	.162	.562
D. C. Frely	Patchen	1885	1.52	4.76	6.00	.225	.480
M. Keatinge	Lower Lake	1885	1.68	8.84	11.00	.183	.540
Gov. Stanford	Vina	1885	2.69	9.63	12.00	.450	.675
C. Weller	Harrisburg	1885	1.93	8.13	10.16	.192	.645
Barton	Fresno	1883	2.24	9.12	11.36	.367	.487
Barton	Fresno	1884	*3.02	8.98	11.17	.255	.495
Rose	San Gabriel	1884	2.16	9.20	11.42	.308	.397
Rose, Blue Elbling	San Gabriel	1884	2.05	11.00	13.42	.264	.527

* Contained some unconverted sugar.

The first in the above list is perhaps an extreme example of the character of the Burger wines in the cooler parts of the State. The body and ash are extraordinarily low, as is the alcohol percentage for California at least; while the acid is quite full, for a white wine especially. Yet this wine, by an oversight left to itself under very adverse circumstances, has kept, and has acquired a respectable bouquet. The same, by the way, is true of a white wine made from Charbono in the same year, whose alcohol percentage is actually two per cent lower than that of the Burger; proving that certain wines will keep in our coast climate despite what is commercially considered an inadmissibly low content of spirit.†

Of the 1885 Burger from Patchen, Santa Clara County, it can at this time only be said that its excessive acid and low alcoholic contents render its wine altogether too harsh to the palate, and at most fit for some kinds of blends. The high elevation at which it was produced explains the fact that in a year of high sugar percentages it attained no higher contents than are shown above, at the end of October; showing that the grape is not adapted to that climate, while Riesling from the same locality shows a satisfactory composition in all respects.

The Fresno Burgers of 1883 and 1884 range closely together in respect to alcohol percentage, and that from San Gabriel scarcely differs materially. They run a little above nine per cent by weight or eleven by volume, and considering the latitude in which they were grown, are certainly light wines; yet they are known to be of good keeping qualities, and with their full, but not excessive or unpleasant acid, are sure to improve with age—as experience has shown to be the case.

The southern Burgers have a considerably heavier body than that from Napa. Barton's 1884 runs so high in this respect, as to be even with the Zinfandels, and has a deeper color than is usually seen; perhaps in consequence of a slight fermentation of the must on the skins.

* It is greatly to be desired that before the misnomer becomes inveterate, the so called "Blue Elba" should be called "Elbling," as it has no relation to the Italian island of Elba, but to the German river Elbe, and is a northern grape.

† Most of the wines made in 1880, at the Viticultural Laboratory, range lower in alcohol than the average of succeeding years.

Few will expect the Burger to yield a first-class wine anywhere, but being a prolific bearer, easily fermented, and a good keeper, it seems eminently adapted to the production of light and pleasant second and third-class wines which may be consumed as are the country wines in Europe, without any risk of intoxication—an excellent substitute for the fiery, heady Mission wines of yore. The uses of the Burger in carrying other musts safely through their fermentation are too well known to need comment.

The Elbling of San Gabriel, though a light-bodied wine like the Burger, and quite full in acid also, is a much more alcoholic wine, and in other respects of a somewhat different type. Whether this is due to the influence of a different location, or whether its relationship to the white Burger is not as close as has been supposed, remains to be determined hereafter.

No. 261. *Burger.* From R. Barton, Fresno. Grapes arrived on October 13, 1884, and were worked up the same day. Percentage of sugar, 19.96.

This grape is much more yellowish when ripe than the Napa Burger, and very much sweeter, but equally juicy and tender to overflowing. Bunches much larger, some eleven to twelve inches.

The yield from 20.5 pounds crushed was 1.25 gallons, corresponding to 121.10 gallons per ton of grapes. Fermentation began at a temperature of 66.2° F. on the morning of October fifteenth, and reached its maximum during the next morning at a temperature of 70.7° F. (temperature of cellar, 67° F.), and remained at that point for the day, then slowly fell to the temperature of the cellar (68° F.) on October eighteenth. On November twenty-first the young wine was racked from the lees; was again racked on April 24, 1885. It was analyzed on February 11, 1885.

No. 260. *Burger.* From L. J. Rose, San Gabriel. These grapes were received in good condition, and were worked on October 9, 1884, showing 19.15 per cent of sugar. The yield from 19.6 pounds crushed was 1.45 gallons, corresponding to 148.4 gallons per ton; pomace, 13.76 per cent.

The fermentation started on the morning of October 10, 1884, at a temperature of 66.2° F., and reached its maximum of 75.2° F. (temperature of cellar, 67.1° F.) on October 13, 1884, and stood so for the day; then fell quite rapidly to the cellar temperature of 68° F. on October 16, 1884.

The wine was racked from the lees on October 22, 1884; was racked again November fourteenth, taking sample for the Convention exhibit. March 10, 1885, it was again racked, and on April fourteenth tasted and analyzed.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. Burger wines, U. No. 260, from San Gabriel grapes, U. No. 261, from Fresno grapes, 119, ditto, do not show high quality.

April 14, 1885. (E. W. H.) No. 260 is clear, white, or very pale topaz tint, with fair body and quite a pronounced agreeable bouquet and vinous flavor, indicating remarkably quick maturity; acid, rather pronounced, but agreeable; a pleasant, light table wine.

ROUSSANNE.

The Roussanne is not a grape of wide distribution. It is most extensively cultivated in Savoy, and more or less in the adjacent departments of Isère and Drôme, forming in the latter an essential ingredient of the noted vineyards of the Hermitage, in the wines of which its product is mostly blended with that of the Marsanne. The Rousanne wines of Savoy have a peculiar perfume similar to that of the Hermitage wines; they keep indefinitely, improve greatly with age, and acquire remarkable qualities.

Near Chambery the wine, when bottled in March, is of a *liqueur* character, but becomes dry after several rackings from the cask; they are classed in the first rank.

The Roussanne is of good vigor, and is usually pruned short, yielding its best product under that treatment. It seems specially adapted to the steep and warm hillsides of the Rhone. The berry is of medium size, nearly globular, rather thick-skinned, at full maturity assuming a golden or even reddish-yellow tint. It is rather firm-fleshed, but juicy and sweet, without special aroma; matures late in the second period.

From Natoma the Roussanne is reported to be a fair bearer and of good vigor. It was gathered, fairly ripe, on September sixteenth, which places it among the earlier grapes of the second period, being markedly earlier than in its original home.

The grape was received in good condition on September seventeenth, and was crushed the next day, showing 22.58 per cent of sugar. The yield from 192.06 pounds was 13.79 gallons, or at the rate of 143.06 gallons per ton; pomace, 25.8 per cent. The grape corresponded accurately to the French description.

Fermentation began early on September twenty-first, the cellar temperature being at 70° F, and reached its maximum of 75.2° F. on the following morning, remaining at this point about forty-eight hours, and falling to the cellar temperature of 68° F. on September thirtieth.

The wine was racked from the lees on October fifteenth; again on November twenty-second; again on February 27, 1885, and finally in August following.

RECORD OF TASTING.

November 15, 1884. (Pohndorff.) Sample in ten-gallon keg. An excellent type of a mild-tasting wine, but not apparently adapted for drinking unblended.

December 7, Report of Viticultural Convention Committee. No. 193 and U. Nos. 263 Marsanne and U. 262 Roussanne are two excellent types of Hermitage white wines of fine bouquet and mellow frank taste; acids grateful. These varieties are adapted for blending with certain red grapes for red wines, as well as for white wines direct; are to be recommended for adoption in our vineyards.

February 9, 1885. (Pohndorff.) Sample in ten-gallon keg well developed, and the wine of excellent quality. Two other samples, in bottles, are similar to that in the keg. Sample in a small keg has suffered from the thinness of the staves.

March 11. (E. W. H.) The condition of the wine is clear, the color white or light topaz; the bouquet faint as yet, but very agreeable, with full vinous flavor; acid full, somewhat less than the Marsanne.

For analysis see table following Clairette Blanche.

MARSANNE.

The geographical distribution of the Marsanne is very nearly the same as that of the Roussanne, above given. Its wines fall considerably below those of the Roussanne in quality, but as the vine is very vigorous, and at the same time a heavy bearer, even under short pruning, it is in favor with the vintners of the region, and serves, as before remarked, as a blend for the Roussanne, and also, in small proportions, with the red wines from the Sirah and other varieties.

The Marsanne bears large bunches, somewhat straggling; its berries are rather small, with a thin and rather delicate skin, which remains of a greenish-white color where not much exposed to the sun, but assumes a fine golden hue under good exposure. Flesh soft, juicy, sweet, and agreeable, without special aroma. Maturity in the third period.

From Natoma the Marsanne is reported to be of good vigor and a fair bearer. The grapes were gathered, fairly ripe, on September sixteenth, being far ahead in maturity of the time assigned to the variety in France.

The grapes were received September seventeenth and worked on the eighteenth, showing 21.2 per cent of sugar: 93.12 pounds of grapes yielded 6.85 gallons of must, corresponding to 141.6 gallons per ton; percentage of pomace, 25.11.

Fermentation began in the night of September twentieth, and reached the maximum of 82.4° F. on the morning of September twenty-third, then gradually fell to the cellar temperature on October second; showing a violent fermentation, markedly different from that of the Roussanne, in which the maximum of temperature was 7° F. *lower*, but lasted much *longer*. This difference is the more remarkable as the quantity of grapes was in the Marsanne only half of that used in the case of the Roussanne; and this case illustrates forcibly the need of knowing and taking into account the peculiarities of each grape in the fermentation of its must. It is evident that Roussanne must might be safely fermented in much larger packages than that of the Marsanne, without endangering the life of its yeast germs by too great a rise of temperature. In French practice both are usually fermented together, so that their peculiarities are balanced in their joint fermentation.

The wine was racked from its lees on October twenty-eighth, having been much slower in clearing than the Roussanne. It was again racked on November twenty-second; again on February eighteenth, and also in August, 1885.

RECORD OF TASTING.

There is no record of the first tasting, in November, the condition of the wine being then hardly clear enough for a proper judgment.

For *Report of Committee of Viticultural Convention*, see above, under Roussanne.

February 11, 1885. (Pohndorff.) Marsanne in bottles since last racking has had a very satisfactory, even rapid, development; the wine is clear, and its quality very good. The same in kegs has suffered somewhat from the effect of the thin staves.

March 11, 1885. (E. W. H.) The condition of the wine is not quite clear; the bouquet has developed decidedly, and the flavor is vinous and agreeable, the acid is adequate, and the wine as a whole is agreeable, though not equal in quality to that of the Roussanne.

For analysis, see table following Clairette Blanche.

CLAIRETTE BLANCHE.

The Clairette Blanche belongs altogether to southern France, within the region of olive culture; from below Valence on the Rhone, to the Mediterranean coast and along the same from Nice to the Spanish frontier. Within this region it has been extensively cultivated from ancient times to the present. It is used not only to impart delicacy and spirit to red wines, but also by itself produces the wine commercially known as Picardan, as well as others locally designated as "Clairette." It is used for both dry and sweet wines. For the latter it is allowed to become overripe and shriveled on the vines. It is, besides, highly esteemed as a table grape. It bears transportation well, being firm-fleshed, crisp, sweet, and agreeably flavored.

The hardiness and vigorous growth of the Clairette are proverbial in southern France. No variety is longer lived, giving good crops even when old, and has resisted longer than any other southern variety the attacks of the phylloxera. It adapts itself readily to all soils, provided they are deep; on shallow, stony ground it is soon exhausted. On soils of the latter character it should receive very short pruning; on rich and deep soils, on the contrary, such treatment would tend to the development of suckers instead of fruit.

The berry is rather small, of an olive shape, and from greenish to yel-

lowish white, according to the degree of maturity. It ripens late (third period).

From Natoma it is reported as being of vigorous growth and a heavy bearer. It was gathered September twenty-third, fully ripe. The grapes were received in excellent condition at the University, and were crushed September twenty-fifth, showing at the time 21.1 per cent of sugar. The berries were somewhat smaller than in the figure given in the "Vignobles," but otherwise agree fully with the description.

The yield of must from 175.6 pounds crushed was 9.3 gallons, or at the rate of 106.05 gallons per ton, a remarkably low figure; pomace, 44.1 per cent. Fermentation started on the evening of September twenty-sixth, at a temperature of 65.3° F., and reached its maximum during the next evening at 73.4° F. (that of the cellar being 69° F.), and retained that temperature for forty-eight hours, when it slowly fell to the cellar temperature, on October third. The young wine was racked from the lees on October seventeenth. It had cleared remarkably well, and deposited but very little sediment afterwards, so that the second racking was deferred until February twelfth. The high qualities of the wine very soon became apparent, the development of its lively and full bouquet being very rapid and striking. No detailed notes of the earliest tasting are on record.

RECORD OF TASTING.

December 7, Report of Viticultural Convention Committee. University sample No. 264, Clairette Blanche, from Folsom grapes, was among the wines most remarked. Its high qualities invite the propagation of the variety on a more than moderate scale.

February 9, 1885. (Pohndorff.) Clairette Blanche in five-gallon keg has developed rapidly, though suffering somewhat from the effects of the thin keg staves.

A sample in full bottle is in good preservation and bright, though not as far advanced in development as the keg sample.

A remnant, kept in a loosely stoppered bottle since November, although suffering somewhat from access of air, has developed finely the fruity expression of the grape.

March 17, 1885. (E. W. H.) Sample from keg is clear, almost bright; color, white. The bouquet is decided and very agreeable, the acidity moderate but adequate, the body medium heavy. For its age the full vinosity of the sample is remarkable.

The subjoined analyses refer to the wines as last tasted, having been made in March, 1885:

No.	Variety.	Date of Receiving Grapes.	Must.		Wine.			
			Solid Contents by Spindle.	Acid as Tartaric.	Body.	Alcohol by Weight.	Alcohol by Volume.	Acid as Tartaric.
264	Clairette Blanche	Sept. 25	21.34	.453	1.850	10.540	13.000	.428
362	Roussanne	Sept. 18	22.60	.420	1.356	10.540	13.000	.468
363	Marsanne	Sept. 18	21.38	.423	1.880	9.200	11.460	.563

It will be noted above that at the same date the Roussanne had about one and a quarter per cent more sugar than the Marsanne, and exceeded to the same extent the Clairette, gathered a week later. The latter, however, slightly exceeds the others in the acid of the must.

In the transformation into wine, the Clairette has lost some acid, while both the others have increased it somewhat, the Marsanne most, yet not to excess. In body the Roussanne appears singularly low, while both the others show about the usual body of dry white wines of the more southern

class. In alcoholic strength the Marsanne falls singularly below the other two, notwithstanding that by the spindle indication its sugar was the same as that of the Clairette. Similar discrepancies have been heretofore noted, and may be connected with the peculiarly violent fermentation of the Marsanne.

Of the three wines, the Clairette is at this time unquestionably the farthest advanced towards acceptableness; and this rapid development will largely balance its low yield of must in the profits to be derived from its culture.

No. 265. A *white grape*, which came from France, misnamed Pecoui Touar, the latter being a red grape. This grape has rather large, compact bunches, a very juicy berry, above medium size, and of slightly oblong shape; not very sweet.

From Natoma it is reported to be a good bearer, with good vigor, and among the latest in ripening.

The grapes, when received, were to a large extent mouldy, and otherwise damaged. After careful picking they were worked on October tenth, when they showed 19.75 per cent of sugar.

The yield from 62.92 pounds crushed was 4.17 gallons, or at the rate of 132.7 gallons per ton; pomace, 25.18 per cent.

Fermentation began on the morning of October 11, 1884, at a temperature of 66.2° F.; reached its maximum on the morning of October fourteenth, at a temperature of 75.2° F. (temperature of room, 67° F.), where it stood for the day; then gradually fell to the temperature of the cellar (68° F.), on October seventeenth.

On October 22, 1884, the wine was racked from the lees; again on February 20, 1885, and also in August following.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. U. No. 265, Pecoui Touar, is wrongly named. The name belongs to a grape of red wine. This variety, at Natoma, a white grape, yields a good wine, of decidedly generous, hot character, available, probably, for sherry blends.

April 14, 1885. (E. W. H.) The condition is nearly clear; color, white or pale topaz; the body lightish; acid, light and pleasant; flavor, vinous, and remarkably well developed; bouquet, high and agreeable.

Whatever may be the true name of this grape, it deserves attention, both for white wines direct and for blending with reds. The character of its wine approaches nearly that of one of the Spanish sherry varieties, such as Palomino.

ANALYSIS.

Must.

Sugar by spindle	20.18
Acid	.48

Wine.

Alcohol:	Volume	11.50
	Weight	9.27
Body		1.66
Acid		.57
Ash		.23

C.—SHERRY AND MADEIRA VARIETIES.

No. 266. Pedro Jimenes.

The Pedro Jimenes is one of the most highly esteemed wine grapes of Spain, and enters largely into the celebrated wines of Malaga, Jeres, San Lucar, etc. It belongs decidedly to the warmer climates only, such as

southern France, Spain, and Algeria, and its success in the coast counties of California should, therefore, be doubtful. The vine being exceedingly productive requires short pruning and a fertile soil, since otherwise it would soon be exhausted.

This beautiful grape, which assumes a fine golden tint when fully ripe, is reported from Natoma as being a medium bearer with like vigor, having fair-sized and loose bunches with fair-sized berries; ripening during the first week of October; agrees well with Pulliat's description.

This variety was worked on October 10, 1884, and showed 20.61 per cent of sugar. From 56.54 pounds crushed, 4.3 gallons were obtained, corresponding to 152.33 gallons per ton; pomace, 20.24 per cent.

Fermentation started on the morning of October 11, 1884, at a temperature of 68.0° F., reached its heighth on October 14, 1884, at a temperature of 71.6° F. (temperature of the cellar, 67° F.), then slowly fell to the cellar temperature of 68° F. on October sixteenth.

The young wine was racked from the lees on October 22, 1884; again racked November twenty-third, again in February 18, 1885, and lastly in August. Analysis of wine was made on April 14, 1885.

RECORD OF TASTING.

November 14, 1884. (F. Pohndorff.) Wine as yet undeveloped, but sound.

Report of Viticultural Convention Committee, December, 1884. U. No. 266, Pedro Jimenes wine, from one of the finest of the sherry grapes, does not show properly the features expected from the variety, but having for comparison a sample of the first grapes of the grafts which, by the care of the Natoma Company, were in the vintage of 1883 made into a small quantity of wine, and that sample having stood for thirteen months now, with ullage, in a loosely corked bottle, is not only well preserved, but well developed, it is possible now to attribute the disadvantageous appearance of the sample of 1884 to immaturity of the grapes and too low saccharine contents.

February 9, 1885. (Pohndorff.) Wine in bottles—some half, others three quarters, and one full—are all remarkably well developed, full-bodied, clean tasting, fruity wines. Some small vials, not full, and loosely corked, hold especially well advanced wines, proving the ease with which, after a perfect fermentation, the Pedro Jimenes wine can be handled. Same wine in keg, clear, white in color, light, pleasant tasting, and well advanced in its growth. Same wine in smaller keg, has suffered somewhat. The keg was kept full. Ullage, provided the alcoholic strength has been the proper one (which the immature state of the grapes could not give), would have developed the wine.

April 14, 1885. (E. W. H.) Wine of a light Brazilian topaz color, heavy body, and clear condition. The bouquet is light, but very pleasant, likewise regarding the acid; flavor, vinous, with a strong fruity aftertaste. Compared with Palomino, it has high quality, but not equal to the latter at this time.

ANALYSIS.

Must.

Sugar by spindle	20.78
Acid	.33

Wine.

Alcohol: Volume	12.00
Alcohol: Weight	9.63
Body	1.80
Acid	.56
Ash	.39

PALOMINO, OR LISTAN.

The Palomino is one of the most important grapes of southwestern Spain, where it not only forms the foundation and sometimes the whole of the best wines of the regions of Jeres and Malaga, but is also highly esteemed as a table grape. Its earliness, and the rich flavor which it imparts to the wines of which it forms a part, make it a favorite throughout the vineyards of Andalusia. It has also been introduced into Algeria by the French, and is recommended for the vineyards of central and southern France. It

is a vigorous grower on all fairly productive soils, and is always pruned short. Its bunches are large and of very attractive appearance, and ripen early in the second period. From Natoma the Palomino is reported to be a fair bearer and of good vigor. It was gathered, fully ripe, on October sixth. It will be noted that this is much later than the French statements would lead us to expect.

No. 267. *Palomino.* Compared with Pulliat's description, it agrees well. Grapes were in good condition upon their arrival, and were worked on October tenth, showing 23.81 per cent of sugar. From 62.5 pounds crushed, there was obtained 4.25 gallons, corresponding to 135.3 gallons per ton; pomace, 30.3 per cent. Fermentation began on the morning of October 12, 1884, at a temperature of 68° F., reached its highest point the following morning, at a temperature of 71.6° F. (temperature of cellar, 67° F.), and remained so for forty-eight hours, then slowly fell to the temperature of the cellar (64° F.) on October 18, 1884.

The young wine was racked from the lees on October 22, 1884; again racked February 20, 1885, and lastly in August, 1885. An analysis was made on April 13, 1885.

RECORD OF TASTING.

November 15, 1884. (F. Pohndorff.) Wine now has too much carbonic acid gas to judge fully of it; but it is a fine type; delicacy and fragrance apparent to a certain extent.

Report of the Viticultural Convention Committee, December, 1884. U. No. 267. Palomino, of Natoma Company. This sample of the sherry variety of the highest class, from which the Manzanilla sherry is produced in Andalusia, was regarded with favor. It is of a most pleasing taste, delicate and apparently light in body, of the expression of a fine wine. In conjunction with U. No. 273, earliest of the grapes for sherry character wines, Boal of Madeira, the beauty of both is heightened in U. No. 307, composed of four parts of the latter and six parts of Palomino. This blend is of a grand nature, its rich etherous fragrance being due, in its early appearance, to the Boal, which seems to have reached this precocious faculty of emitting that fragrance from the happy accident of the grapes having been gathered at Natoma at an early stage, its saccharine contents being far from fully developed. These two varieties seem to be of great importance for the production of a wine in which, through ozonic influences, the aromatic essences are developed with vigor, and it is to be hoped that, as in the mother country, this will occur with increasing power as years pass over the wines. The precedent exists that wines of California growth, from foothill regions, have a fullness of aromatic ethers, and with a comparatively low alcoholic strength, remain uninfluenced in their keeping power quality by adverse circumstances (that is, chiefly being kept in loosely stoppered vessels, not kept full). We may, therefore, count upon the fulfillment of our hopes in regard to the two varieties named, which will be productive of superior wines of sherry character, if properly treated.

February 9, 1885. (F. Pohndorff.) Wine in vials: one five sixths full, stoppered loosely, stood since November fourteenth over lees; has splendidly developed yellow color, from oxidation; another half full, likewise yellow and well advanced with fine characteristic taste and perfume of great delicacy; a third with little ullage, also, of a high degree of development. A bottle filled and hermetically sealed: color white, and development retarded. Wine in keg with some ullage, splendidly developed, clean flavor, color white. This wine reaches the highest expectation.

April 13, 1885. (E. W. H.) Condition of sample clear, almost bright, with an almost white color, and a delicate and very agreeable bouquet; aftertaste decidedly pleasant; acid moderate; body heavy, with a vinous flavor.

ANALYSIS.

Must.

Sugar by spindle	23.86
Acid	.32

Wine.

Alcohol: Volume	13.50
Alcohol: Weight	11.08
Body	1.85
Acid	.53
Ash	.25

PERUNO.

The Peruno is one of the less known varieties of sherry grapes from southwestern Spain. No special details regarding its culture in Spain have been obtained. It is doubtless, however, a short pruning variety, and according to the results recorded below, one of the most promising for high quality.

From Natoma it is reported to be a fair bearer with good vigor, the bunches being loose with fair sized berries. Ripens about sixth of October. Bunches short, roundish, with many long pendant branches, loose berries, globular, somewhat flattened at base, greenish-yellow, with strong bloom, somewhat unequal in size, average medium juicy and sweet, skin rather thick, savor simple, yet somewhat flowery, aromatic, like Palomino.

On October 10, 1884, the grapes were worked, and showed 22.67 per cent of sugar. From the 16.5 pounds crushed, 1.25 gallons were obtained, corresponding to 150.5 gallons per ton; pomace not determined.

Fermentation started at a temperature of 68.9° F. on the evening of October 11, 1884, and attained its maximum of 75.2° F. (temperature of cellar, 67° F.) on the morning of October thirteenth, then slowly fell until the morning of October seventeenth, when the temperature of the cellar (68° F.) was reached.

The young wine was racked from the lees on October 21, 1884; again racked on November 23, 1884; again on April 13, 1885, and again racked in August, 1885. An analysis was made on April 13, 1885.

RECORD OF TASTING.

Report of the Viticultural Convention Committee, December, 1884. U. No. 268, Peruno, another sherry variety from Natoma, proves at this early moment, that its robust body and expression, accompanied by a clean taste in harmony with the latter, will serve for a grade of sherry, in which roundness and fullness is the feature, and in the blend.

U. No. 302, of half Peruno and half Beba, the possibility of having the delicacy of the latter combined with the stoutness of the Peruno is made apparent, flavor and taste being harmonious and of desirable character.

U. No. 303, blend of one fourth Palomino, one fourth Boal, and two fourths Peruno, is expressive of the high-class flavor of the two first grapes joined to a fuller body, obtained from the Peruno. The cultivation, in the best suited soils, of the six sherry grapes named, may be confidently encouraged.

The possibility of obtaining from the varieties which in southern Spain yield the sherry wines, at least approximations of the high qualities, which, of course, only the peculiar treatment and age brings to perfection, should stimulate to propagation of the six varieties above named, in order to be able to discard the low class varieties which it is deemed convenient as yet to utilize for sherry type wines, none of which can in any way satisfy even modest requirements of fragrance and corresponding taste.

February 9, 1885. (Pohndorff.) Blend of one half Peruno and one half Beba is somewhat coarse in taste, but well developed and clear; a heavy sediment having deposited.

April 13. (E. W. H.) A clear heavy-bodied wine of a "sherry" color, with a very agreeable bouquet and moderate acid.

ANALYSIS.

Must.

Sugar by spindle	22.76
Acid	.31

Wine.

Alcohol:	Volume	12.35
	Weight	9.92
Body		1.95
Acid		.52
Ash		.31

MANTUO DE PILAS.

Of this grape, as of the Peruno, little is known outside of the districts of southwestern Spain, where it is locally of considerable importance. While

it is related to the Palomino, yet it yields wines of a different character, and is very distinct in its growth and the size of its berries. It is naturally presumed, also, to be adapted to short pruning.

From Natoma it is reported as being a good bearer of fair vigor. The bunches are loose and of fair size; ripening in early part of October; berries medium size.

This variety resembles the Palomino but the berries are larger and more elongated and compact. Apparently a very desirable table grape.

No. 269. Grapes arrived in good condition and were worked October 9, 1884; showing a sugar percentage of 18.89. The number of gallons obtained from 74.4 pounds was 6.13, corresponding to 164.95 gallons per ton; pomace, 20.71 per cent.

Fermentation began on the morning of October 10, 1884, at a temperature of 66.2° F., and reached its maximum on the evening of October twelfth, at a temperature of 73.4° F. (temperature of cellar, 66° F.), where it remained for about forty-eight hours, then gradually fell to the temperature of the cellar (68° F.) on October 16, 1884.

The wine was racked from the lees on October 21, 1884; again racked November 23, 1884; again racked February 20, 1885, and lastly in August, 1885.

An analysis of the wine was made April 9, 1885.

RECORD OF TASTING.

November 15, 1884. (F. Pohndorff.) Wine has a good fruit expression, but in a sense neutral. Can not yet be judged; too little developed.

Report of the Viticultural Convention Committee. U. No. 269, Mantuo de Pilas, of Natoma, introduction from Jeres, is expressive rather than delicate, still far from coarse. Taste very agreeable.

February 9, 1885. (Pohndorff.) Wine in half full bottles not closed tightly has suffered. In bottles completely filled and tightly corked the wine has remained in an excellent state of preservation but not advanced in development.

April 9, 1885. (E. W. H.) A heavy-bodied wine; reddish topaz in color, with a very agreeable and pleasant bouquet; acid high, somewhat pungent; flavor fruity, vinous.

ANALYSIS.

Must.

Sugar by spindle	18.63
Acid	.35

Wine.

Alcohol:	Volume	9.82
	Weight	7.85
Body		1.32
Acid		.53
Ash		.27

MAURISCO BRANCO (Portugal).

The bunches are shorter and more compact than those of Pedro Jimenes; berries of the same size, a little more elongated and firmer fleshed; much alike in taste, a little more acid.

From Natoma it is reported to be a heavy bearer, of good vigor, with loose and large bunches; berries, fair size, ripening in the first part of October.

No. 270. The grapes were crushed on October 9, 1884, and showed 22.67 per cent of sugar. From the 53.25 pounds crushed 4.17 gallons were obtained, corresponding to 156.81 gallons per ton; pomace, 19.00 per cent.

Fermentation began at a temperature of 64.4° F. on the evening of October 10, 1884, and reached its highest point on the morning of October fourteenth at a temperature of 73.5° F. The fermentation then stopped, and one pound of Malaga grape juice was added on October twenty-fourth to start

fermentation again. After two weeks the fermentation again stopped, and some of the wine was heated and put back in the keg. On November second the wine was still sweet, and two and one half bottles of alcohol were added to fortify it.

BEBA.

The Beba is like the Peruno and Mantuo; is but little known save as an ingredient of sherries in southwestern Spain. Its name seems to indicate that it is supposed to contribute materially to the "drinkableness" of wines.

From Natoma it is reported to be a fair bearer, of good vigor, and loose bunches with medium sized berries. Grapes were picked October 6, 1884. Small, short bunches; berries a little below Palomino; rather dry and tough; thick skinned, yet well flavored.

No. 271. These grapes were crushed on October 9, 1884, and showed 21.80 per cent of sugar. The yield from 72.16 pounds was 4.1 gallons, or at the rate of 113.5 gallons per ton; pomace, 33.54 per cent.

The fermentation began on the morning of October 11, 1884, at a temperature of 64.4° F., and reached its maximum on the morning of the thirteenth, at a temperature of 75.2° F. (temperature of room, 67° F.), where it stood for the day, then very slowly fell to the cellar temperature (67.1° F.) on October 17, 1884.

On October 23, 1884, the young wine was racked from the lees; again racked November 23, 1884; again, February 20, 1885, and lastly, in August. Wine was analyzed April 10, 1885.

RECORD OF TASTING.

November 14, 1884. (F. Pohndorff.) Wine has yet some sugar; it is a good type of its kind, and an excellent choice, as it is a quantity grape, and for its neutral taste will enter advantageously in blends of different natures.

Report of Viticultural Convention Committee, December, 1884. U. No. 271, Beba, also from Natoma, one of the sherry grapes, has the advantage of great delicacy with firmness over the preceding one (Montuo de Pilas). The composition of this fine tasting wine is a very good one, proving its power of developing by age, and under the influence of the oxygen of the air allowed to act upon it, into a wine of quality.

February 9, 1885. (Pohndorff.) Beba in bottles; white, clear, has not a high aroma, but its taste is clean and very agreeable. Wine in bottles hermetically closed down by paraffine, is of yellow color, great finesse in flavor, and of clean excellent taste. Of six bottles—three loosely and two tightly corked—hold the wine in fine state of preservation and advancement, while one tightly corked has its wine spoiled.

April 10, 1885. (E. W. H.) A light straw-colored wine, of a heavy body, with a very agreeable acid and high bouquet. The flavor is pleasant and vinous.

ANALYSIS.

Must.

Sugar by spindle	22.60
Acid	.25

Wine.

Alcohol:	Volume	14.27
	Weight	11.62
Body		2.10
Acid		.50
Ash		.37

VERDELHO.

This grape is largely cultivated in the Island of Madeira, where it enters into the finest qualities of wines. It is also cultivated to some extent in France, but mainly as a table variety. Excellent wine is made of it in the Crimea. The Verdelho is a vigorous stock and requires short pruning. It is very productive, and thus makes up largely for the smallness of its bunches; the latter resist rains very well. Under glass it has manifested

its tendency to productiveness by the bearing of two crops in one season. Although at home in so southerly a location, it does well not only in southern but also in middle France, and may thus be expected to succeed even in the cooler portions of California, and near the coast. The more as, unlike other sherry varieties, it ripens comparatively early. It is, however, much subject to mildew, and preventive sulphuring must be practiced. The beauty and firmness of its almost transparent berries render it well adapted to table use as well as for wine making. From Natoma it is reported to be a fair bearer of good vigor, with medium sized and compact bunches, having small berries. It was picked fully ripe on thirtieth of September. Some of the grapes were in bad condition, and the lot (No. 272) was worked on October second, showing 25.88 per cent of sugar.

The yield from 94.6 pounds was 7.8 gallons, or at the rate of 164.77 gallons per ton; pomace, 21.86 per cent.

Fermentation started on the morning of October fourth at a temperature of 70.7° F., reached its maximum the following evening at a temperature of 74.3° F. (temperature of room, 69° F.), then gradually fell to the cellar temperature (67° F.) on October tenth.

The young wine was racked from the lees on October 15, 1884; again racked November twenty-fifth; again racked February 18, 1885, and lastly in August following. Wine was analyzed March 18, 1885.

RECORD OF TASTING.

November 15, 1884. (F. Pohndorff.) A grand wine, but unmistakably a southern hot wine, going towards the Andalusian white types.

Report of Viticultural Convention Committee, December, 1884. Of white wines of ardent nature, we have our acclimated Verdelho, No. 164, of Mr. Eisen, Fresno, bearing out the character of a hot wine, but the expression of this sample is comparatively neutral.

U. No. 272, grown by the Natoma Company, on grafts of recent introduction, is of excellent quality, showing real fruity delicacy. Both samples, however distinct they are, indicate that this variety should be utilized in connection with others for generous wines. The employment of Verdelho grapes with others of bland light-bodied juice may not be excluded, if rightly proportioned. Studies in this direction are desirable.

February 8, 1885. (F. Pohndorff.) Splendidly developed in all respects; is of a nature to withstand influence of air.

March 18, 1885. (E. W. H.) A clear, white wine of heavy body and delicate bouquet; acid, low; aftertaste, decidedly fruity.

ANALYSIS.

Must.

Sugar by spindle	27.34
Acid	.50

Wine.

Alcohol: Volume	15.20
Alcohol: Weight	12.39
Body	2.82
Acid	.42
Ash	.33

BOAL MADEIRA.

No details regarding this grape are given.

From Natoma it is reported as being a heavy bearer, of good vigor, with large and rather loose bunches; berries, medium in size.

No. 273. Grapes were picked ripe on September sixth. Grapes were received on September ninth, in bad condition, and were carefully picked over and crushed the next day, showing 21.38 per cent of sugar.

The yield from 66.4 pounds was 4.75 gallons, corresponding to 143.2 gallons per ton; pomace, 24.6 per cent. The fermentation began on the morning of September twelfth, at 68.9° F., and reached its maximum of 85.1° F. (temperature of the room, 68° F.), on the morning of September fourteenth;

then fell, very slowly, to the temperature of the cellar (68.9° F.), on September twentieth.

This wine was racked from the lees on September 23, 1884; again racked November 15, 1884; again on February 26, 1885, and, lastly, in August. An analysis was made March 18, 1885.

RECORD OF TASTING.

November 15, 1884. (Pohndorff.) Wine in keg sound and mild for a southern hot wine, owing probably to the maturity of the grapes. The development of the bouquet remarkable for so young a wine, and not exactly in accordance with the mellow taste.

It surpasses (at least at this time) in development the highest of the sherry varieties, which are all yet, as is but natural, backward in depurating themselves. Necessarily, the degree of ripeness at which the grapes were crushed has much to do with the remarkable development of its bouquet.

February 9, 1885. (Pohndorff.) Wine in vials and bottles: in some of the former, not filled and in which were lees, the wine could not stand the action of oxidation, evidently owing to the low alcoholic strength consequent upon the small sugar percentage the grapes contained.

In full bottles the wine is in good state of preservation, but in its development apparently backward. The fine flavor is there which so distinguished the wine two months ago, but is now present in a less degree of intensity, and the wine is feeble. It was not deemed advisable at the proper time to strengthen the wine by the addition of alcohol, for fear of destroying its early appearing ethers. The subject requires study in the future; a greater maturity of the grapes will be a necessity, and we may count on having a very valuable variety for sherry purposes in the Boal grape.

ANALYSIS.

Must.

Sugar by spindle	21.76
Acid	.53

Wine.

Alcohol: Volume	11.58
Alcohol: Weight	9.27
Body	2.00
Acid	.66
Ash	.26

UGNI BLANC—(*Trebbiano?*)

The Ugni Blanc belongs almost exclusively to the Provence, where it serves both for white wines and for the improvement of reds such as the Mataro, with which it is frequently found associated. It succeeds well in almost any soil—its product being in proportion to the fertility of the latter. The lateness of its budding-out renders it suitable for the level country where late frosts are to be feared, but away from the immediate coast region of the Provence the grape oftentimes does not acquire full maturity. Of course then it cannot thrive in colder climates. It should always be pruned short; when pruned long the quality of its wine is greatly lowered. Its bunches are long and loose, slightly shouldered, cylindroconical. The berries of medium size, almost round, rather thick-skinned, when fully ripe of a more or less intense yellow tint, which in gravelly soils with warm exposure sometimes passes into a light rose color. It matures late in the third period. The flesh is somewhat firm, but very juicy and sweet and without special aroma.

From Natoma it is reported to be a heavy bearer of good vigor, with both loose and compact bunches. The berries are of medium size, and ripen during the first week of October.

Compared with Pulliat's description, agrees well.

No. 274. Grapes arrived in good condition, and were worked on October 10, 1884, showing 20.61 per cent of sugar. The yield from 20.5 pounds crushed was 1.6 gallons, corresponding to 149.95 gallons per ton; pomace, 20.75 per cent.

Fermentation started at a temperature of 66.2° F., on the morning of October 11, 1884, and reached its maximum of 71.6° F. (temperature of cellar, 67° F.) on the morning of October 14, 1884, then gradually fell until the temperature of the cellar (68° F.) was reached, on October eighteenth.

This wine was racked from the lees on October 21, 1884. Some of it was put in bottles, which were filled to within one inch of the top and left standing. On November eighth, when the wine was again racked, these bottled samples were found to be unsound. Again racked on April 11, 1885, on which day it was analyzed, and lastly in August following.

RECORD OF TASTING.

Report of the Viticultural Convention Committee, December, 1884. U. No. 274, Ugni Blanc, does not show the fine taste expected from the grape; there is full body and flavor in the sample, but the acids are too expressive. It will require new tests, in the next vintage, to pronounce with more certainty on this variety. It seems important, as it is said to be a fine accompaniment for fermenting red grapes for red wines.

February 9, 1885. (Pohndorff.) Wine in half-full bottle has kept well and advanced in its development; fine, fruity flavor, and mild; good taste.

ANALYSIS.

Must.

Sugar by spindle	20.70
Acid	.59

Wine.

Alcohol: Volume	11.00
Alcohol: Weight	8.91
Body	2.00
Acid	.51
Ash	.30

MALMSEY.

The identity of this grape with either of the true white Malvoisie grapes, usually described, is not satisfactorily made out.

From Natoma it is reported to be a medium bearer of good vigor, having loose and rather large bunches; berries, fair size. Grapes were picked September sixth.

No. 275. Grapes arrived here on Saturday, September ninth, and were not worked until the following Monday, when they had become quite injured, many bunches being sour and rotten. *Mondeuse*, picked at the same time, was in good condition. Malmsey showed 18.58 per cent of sugar.

The yield from 68.64 pounds of grapes was 4.95 gallons, or at the rate of 144.33 gallons per ton; pomace, 21.96 per cent.

Fermentation began on September fourteenth at a temperature of 75.2° F., and reached its maximum at a temperature of 78.8° F. (temperature of cellar, 68° F.) on September sixteenth, remaining at that temperature for one day, and then gradually falling to the temperature of the cellar (70° F.) on the twenty-third of September.

The young wine was racked from the lees on September twenty-fourth; again racked in November; again on February 25, 1885, and also in August, 1885.

Analysis of the wine was made March 18, 1885.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. U. No. 275, Malmsey. This variety was recently introduced from Madeira in the Natoma Company's plantation, and the product is of quality, the wine having a pronounced fine etherous flavor imparted to its taste. Adding a proper proportion of the Malmsey grape to others, for sherry blends, may have the effect of communicating its delicate perfume and expression.

February 9, 1885. Malmsey raised thus far with ullage, has developed quite rapidly, influenced well by access of air, and because of repeated early rackings.

March 18, 1885. (E. W. H.) Condition of sample slightly turbid; color, light topaz, and body heavy; bouquet, pronounced and agreeable; acid, somewhat high, owing to presence of acetic acid.

ANALYSIS.

Must.

Sugar by spindle	17.91
Acid	.56

Wine.

Alcohol: Volume	9.91
Alcohol: Weight	7.92
Body	1.60
Acid	.54
Ash	.16

No. 276. Malaga.

From the vineyard of P. W. Butler, Penryn. Apparently the rather roundish berried variety commonly known in California as "White Malaga."

Grapes were in good condition, and were worked October 4, 1884, showing 17.18 per cent of sugar.

From 22.7 pounds crushed, 1.85 gallons were obtained, corresponding to 163.22 gallons per ton; pomace, 18.45 per cent.

Fermentation began on the morning of October sixth; temperature, 71.6° F., reached its highest on October tenth, at a temperature of 77° F. (temperature of cellar, 69° F.), then slowly fell to the cellar temperature (68° F.) on October 16, 1884.

The wine was racked from the lees on October 19, 1884; again racked November 15, 1884; again racked March 7, 1885. Wine was analyzed March 31, 1885.

ANALYSIS.

Must.

Sugar by spindle	17.14
Acid	.300

Wine.

Alcohol: Volume	9.82
Alcohol: Weight	8.13
Body	1.69
Acid	.22
Ash	.24

D.—PORT WINE VARIETIES.

TINTA CAO.

No detailed description of this grape is at hand.

No. 277. From Natoma it is reported as being a light bearer of medium vigor, with small and loose bunches; berries, medium in size and ripening in the latter part of September. These grapes arrived in good condition, and were crushed on September 26, 1884, showing 21.80 per cent of sugar.

Bunches, small; in good condition; loose, not at all compact; grapes, firm; sugar, good; acid, medium; grapes not too ripe; some very small bunches; quite sour. This variety was used in blends, 64.34 pounds being the total weight of grapes crushed.

TINTA MADEIRA.

No description of this variety is available.

From Natoma it is reported to be a light bearer, of good vigor, having small and loose bunches, with medium sized berries, ripening in the second week of September.

No. 278. Grapes were mouldy when received on September 9, 1884, and after picking over were crushed on the following day, showing 21.22 per cent of sugar.

Fermentation of 18.26 pounds crushed commenced on the evening of September twelfth, at a temperature of 74.3° F., reaching its maximum on September fourteenth; temperature, 76.1° F. (temperature of cellar, 68° F.); then very gradually falling to the temperature of the cellar (71.6° F.), on September eighteenth, when the murk was drawn off, nine days from the crushing, the yield from the above amount being 1.11 gallons, or at the rate of 121.5 gallons per ton; pomace, 13.25 per cent.

RECORD OF TASTING.

September 29, 1884. (Pohndorff.) Wine well fermented; good color (not ruby); fresh clear taste and expression.

November 14, 1884. (F. Pohndorff.) Wine in a small bottle has suffered considerably; fine bright ruby color; good fruit expression; stamping the wine as a hot one rather than claret-like.

Report of the Viticultural Convention Committee, December, 1884. U. No. 278, Tinta of Madeira, a wine of light ruby color, had suffered and was not therefore thoroughly recognizable. From observations during fermentation, and just after having accomplished the same, it was apparent that the variety is an eminent one in all regards, its excellent delicate but decided fruity expression and flavor stamping it as one of the most acceptable varieties for our vineyards.

Reconsidering U. No. 378, Tinta Madeira, we must abstain from deciding whether or not this grape is to enter into the category of those yielding juice for full-bodied sweet wines. The sample of wine not being a success, and judging from the aspect of the same during and just after the fermentation, the high qualities, then fully apparent, a fine color and a characteristic delicate etherous flavor, would suggest its classification among the superior grapes for gentle light wines, but the origin of the variety from Madeira would indicate its adaptedness likewise for generous wines, and as an ingredient in port-character ones.

MOURISCO PRETO.

Not described in any accessible work.

From Natoma it is reported as being a heavy bearer of good vigor, having large and loose bunches with fair sized berries ripening in the latter part of September.

No. 279. The amount received of this variety was 56.32 pounds, all being used in blends. The grapes were worked on September twenty-sixth, and showed 21.38 per cent of sugar.

TINTA AMARELLA.

No description available.

From Natoma it is reported to be a fair bearer, with good vigor; bunches compact, and of medium size, with fair-sized berries, ripening in the latter part of September.

Nos. 280 and 281. Grapes were received on September 22, 1884, and before being crushed were separated into two lots—one (No. 280), of the unevenly matured and very light-colored samples, but in good condition, and another (No. 281), of the fully ripe and matured samples. No. 280 was not analyzed, owing to the sour bunches. No. 281 showed 20.29 per cent of sugar.

Fermentation of 100.32 pounds crushed, of "unripe" sample (No. 280), began on the morning of September 24, 1884, at a temperature of 73.4° F.,

and reached its maximum the next morning, at a temperature of 76.1° F. (temperature of the room, 67.5° F.); then fell, very gradually, to the temperature of the cellar (68° F.), on September 30, 1884, when the murk was drawn off, eight days from the crushing, the yield from the above amount being 8.5 gallons, or at the rate of 169.60 gallons per ton; pomace, 8.77 per cent.

On November 17, 1884, the young wine was racked from the lees; racked again January 13, 1885; again racked August, 1885. Analysis of wine made February 6, 1885.

RECORD OF TASTING.

November 15, 1884. (F. Pohndorff.) A wine of deep color, acid straight, expression fruity and full. The grapes were unripe, but this fault seems exactly to have been favorable, for there is nothing disharmonious in the wine. It depurated itself thoroughly and rapidly. While of southern character, this sample is decidedly not of a hot nature, but amply rich and available as or for a full-bodied claret.

Report of Viticultural Convention Committee, December, 1884. U. No. 280. Tinta Amarella ports, from Natoma Company. Of fruity expression and mild taste; color poor. Evidently the grapes, which when ripe have a rich amount of color, had not attained anything near perfection of maturity. Thus the true characteristics of the wine are not recognizable. Continued experiments with this grape, said to be an active factor for good ports in Portugal, are necessary.

Blend U. No. 304, in which Tinta Amarella entered to the amount of three tenths with blends U. Nos. 305 and 306, is of a rich, but mild taste, expressive, of middling color, and good sweetness.

February 6, 1885. (E. W. H.) The condition of the sample was clear, with a pleasant bouquet and a heavy body, acid medium, and astringency light.

February 9, 1885. (F. Pohndorff.) Wine in good condition, of light violet color, and indifferent in character, holding still a large amount of carbonic acid.

March 20, 1885. A very light garnet colored wine with a decidedly developed bouquet. Condition bright, acid and astringency low, the latter too much so.

Fermentation of 49.5 pounds crushed of "ripe" (sample No. 281) commenced on the morning of September 24, 1884, at a temperature of 67.1° F., and reached its maximum on the morning of September twenty-seventh, at a temperature of 71.6° F. (temperature of room, 68° F.), then gradually fell to the cellar temperature (68° F.) on September 30, 1884. The fermentation throughout was very quiet and regular. When the murk was drawn off, seven days from the crushing, the yield from the above amount was 4.18 gallons, corresponding to 168.7 gallons per ton; pomace, 7.11 per cent.

The wine was racked from the lees on November 22, 1884; again racked February 18, 1885; again in August, 1885; wine analyzed November 22, 1884.

RECORD OF TASTING.

February 9, 1885. (F. Pohndorff.) Wine made from ripe grapes is of very good color and decidedly fine taste. It is a heavy wine, and the grape is a very proper one for port.

November 20, 1885. (E. W. H.) Condition of samples is bright, with a strongly developed bouquet; body, medium; astringency, a little higher than that of wine made from unripe grapes; acid, high.

ANALYSES.

	No. 280.	No. 281.
Must.		
Sugar by spindle	.....	20.08
Acid	.....	.47
Wine.		
Alcohol: Volume	11.27	11.91
Alcohol: Weight	9.05	9.56
Body	2.36	2.39
Tannin	.06	.06
Acid	.50	.53
Ash	.45	.47

MORETTO.

The Moretto or Croetto is cultivated mainly in the upper valley of the Po, in Piedmont, where it forms one of the quantity grapes of the region, it being more productive than even the Mataro, and apparently of somewhat lower quality than the latter. It is a very hardy vine, not choice in respect to soils or location, and, on account of its late sprouting, not liable to damage from Spring frosts. It also resists the mildew well. In view of its high productiveness it must always be pruned short, since otherwise it rapidly exhausts its vitality; but with proper restriction of the bearing wood, it is a long-lived vine, when the soil is properly sustained. Its bunches are large, shouldered, and somewhat loose. The berries, of a form varying from round to oval, have a thick and highly colored skin; mature late in the second period. There is no special aroma, and the taste is somewhat roughish. It produces only ordinary wines, which are improved by blending with musts of higher quality.

From Natoma it is reported to be a light bearer, with fair vigor. The bunches are of medium size and compact, with medium sized berries; ripening during the last week of September.

No. 282. All of the grapes (21.78 pounds) of this variety were blended, and were crushed on September twenty-sixth, showing 18.71 per cent of sugar.

BASTARDO.

This variety, quite widely cultivated in Spain for red wines, has been supposed to be identical with the Trousseau, to which it bears some resemblance in its growth and aspect of bunches, but its far earlier ripening, and the totally diverse character of its wine, prove conclusively that it is entirely distinct.

From Natoma it is reported to be a light bearer, of medium vigor, with small and compact bunches, and small berries. It ripens earlier than any variety in the vineyard; at least five weeks sooner than the Trousseau, whose leaf it somewhat resembles in shape, but is much broader.

No. 283. Grapes were in a bad condition, and samples were carefully selected for making the wine.

Fermentation of 113.7 pounds crushed began on the morning of September eleventh, at a temperature of 73.4° F., and reached its maximum on September twelfth, at a temperature of 86° F., while that of the room was 70° F., then gradually fell to the temperature of the cellar, 68° F., on September seventeenth, when the murk was drawn off, nine days from the crushing; the yield being 8.9 gallons from the above amount, or at the rate of 156.9 gallons per ton; pomace, 14.93 per cent.

The young wine was racked from the lees on November 12, 1884; again racked February 25, 1885; again in August following. Wine was analyzed February 4, 1885.

RECORD OF TASTING.

September 23, 1884. Sample comparatively clear, of good, fruity flavor, but deficient in color.

November 14, 1884. (F. Pohndorff.) A hot, sound wine, with no color, and apparently not at all successful for red wine by itself.

Report of Viticultural Convention Committee, December, 1884. Among the varieties for port type wines the Bastardo must be classed, for sample U. No. 283 shows anything but a light red wine; it is full bodied, but failed to draw any color, only a slight tinge, probably because the grapes, cut in the first week of September, had not the necessary degree of maturity; its taste is coarse. Trials of blending this wine with Mondeuse proved that its harsh taste would not be sufficiently softened by the influence of the mellow wine from the latter grape. This single experiment with the Bastardo may not be conclusive, and trials should

be continued during the next years. There must be merit in the grape, which is a very early ripening one, and its appropriate use in sweet reds may not be doubted. The similarity or identity of the Bastardo grape with Trousseau is not apparent from the Natoma samples.

February 4, 1885. (E. W. H.) A clear, heavy-bodied wine, of pale red color, with an undefined bouquet, but a decided alcoholic odor; acid fair; astringency low.

February 9, 1885. (F. Pohndorff.) Poor in quality and feeble in color.

ANALYSIS.

Must.

Sugar by spindle	23.74
Acid	.43

Wine.

Alcohol: Volume	12.83
Alcohol: Weight	10.35
Body	3.12
Tannin	.06
Acid	.51
Ash	.56

No. 306. *Blend of Tinta Cao and Mourisco Preto.*

Grapes for this blend were crushed on September 27, 1884. The total weight was 94.38 pounds, of which 54 per cent was Mourisco Preto and 46 per cent Tinta Cao, and the yield 9.77 gallons.

Fermentation commenced on the morning of September 28, 1884, at a temperature of 73.4° F. (temperature of the room, 68° F.), and was completely stopped the next day by the addition of .80 gallons of alcohol. The murk was drawn off on October first, three days from the crushing.

On March 2, 1885, the wine was racked from the lees; again racked in August following.

REPORT OF TASTING.

Report of the Viticultural Convention Committee, December, 1884. Blend U. No. 306, Mourisco Preto two thirds, Tinta Cao one third, of fine but feeble color and good taste. Sweetness very moderate. The taste is not fruity enough, thus indicating the need of a third medium to obtain a good effect.

February 9, 1885. (F. Pohndorff.) Blend has depurated itself splendidly, hardly any sediment being apparent after two rackings since November; taste good, with flavor of oxidation.

November 20, 1885. (E. W. H.) Condition of wine bright, with a well developed bouquet and good color. Acid and astringency adequate. Body too low, for port not sweet enough.

No. 305. *Blend of Moretto, Mourisco Preto, Petit Bouschet, and Tinta Cao.*

All the grapes (from Natoma) used in making this blend were in good condition, and were crushed on September 27, 1884, showing the following percentages of sugar: Moretto, 18.71; Mourisco Preto, 21.38; Petit Bouschet, 20.61, and Tinta Cao, 21.80. The bunches of the Tinta Cao were small and loose, not at all compact; some of the smallest were quite sour. Grapes firm, not too ripe, sugar good, and acid medium. The total weight of grapes was 54.56 pounds; 40 per cent Moretto, 40 per cent Tinta Cao, and 10 per cent of each of the Mourisco Preto and Petit Bouschet. The above amount yielded 4.57 gallons.

Fermentation began on the morning of September twenty-eighth at 71.6° F. temperature (temperature of the room, 70° F.), and was stopped the next morning by being fortified with 1.9 litres of alcohol. The murk was drawn off on October first, three days from the crushing.

On March 1, 1885, the wine was racked from the lees; racked again August, 1885.

RECORD OF TASTING.

Report of Viticultural Convention Committee, December, 1884. Blend U. No. 305, of four tenths Tinta Cao, four tenths Moretto, one tenth Mourisco Preto, and one tenth Petit

Bouschet, shows good expression, pretty color, and moderate sweetness, the blend having been over-fermented.

Blend U. No. 307, of one half blend U. No. 305, and one half U. No. 306, has a fine color, due chiefly to the Petit Bouschet introduced, and excellent fruit expression, but does not indicate truly the result to be expected from the Oporto grape varieties composing the blend, as the grapes ought to have reached a more perfect maturity to form all the elements necessary for good port wine, in duly developed shape.

Blend U. No. 308, of 60 per cent Tinta Cao, 10 per cent Moretto, 15 per cent Mourisco Preto, and 15 per cent Petit Bouschet, gives measurable satisfaction, but the blend has fermented away too much of the sugar of the grapes to hold sufficient sweetness. There is withal in the different blends a clean taste and mellowness, which, if properly proportioned in sweetness, would allow a general favorable judgment, regarding the new acclimatizations from Oporto in the Natoma plantations, as to attaining the object of their propagation.

February 9, 1885. (F. Pohndorff.) Color of blend very fine and deep for a port, owing to influence; Petit Bouschet which seems homogeneous in the blend.

November 20, 1885. (E. W. H.) The wine has a more intense color than blend No. 305. Condition, bright; body low on account of wine not being sweet enough; acid and astringency both good. The bouquet is better developed in this blend than in No. 305.

TABLE No. 5.

Of Grapes worked in the Viticultural Laboratory, 1884.

Number.	Variety.	Grower.	Place of Production.	Date of Receiving Grapes.	Weight of Grapes in pounds.	Percentage of Pomace.	Percentage of Stems.	Gallons of Must resp. Mark.	Gallons of Must per ton of Grapes.
	Bordeaux Type.								
211	Malbeck	Natoma Company	Natoma	Sept. 7	84.92	14.57	4.40	6.71	158.04
212	Cabernet Franc	Natoma Company	Natoma	Sept. 20	121.22	10.34	4.63	9.49	156.48
213	Cabernet Franc	Wm. Pfeffer	Gubserville	Oct. 21	13.20	11.25	7.50	0.98	148.10
214	Cabernet Sauvignon	Natoma Company	Natoma	Sept. 26	84.48	17.18	4.30	6.47	153.23
215	Merlot	Natoma Company	Natoma	Sept. 20	50.60	14.35	4.35	4.03	159.34
216	Verdot	Natoma Company	Natoma	Sept. 20	95.04	12.04	4.63	7.53	158.45
217	Tannat	H. W. Crabb	Oakville	Oct. 21	Bad	condition.		.50	
218	Beclan	Natoma Company	Natoma	Sept. 26	80.08	12.36	4.67	6.47	161.66
219	Carignane	Natoma Company	Natoma	Oct. 4	36.30	6.67	3.57	3.01	158.73
220	Grossblaue	H. A. Pellet	St. Helena	Oct. 9	32.34	10.71	4.08	2.35	154.41
	Burgundy Type.								
221	Black Burgundy	H. W. Crabb	Oakville	Oct. 21	19.80	13.89	5.56	1.32	133.42
222	Black Pinot	L. P. Berger	Lakeport	Oct. 18	6.44	9.23	10.26	.32	98.53
223	Meunier	Wm. Scheffler	St. Helena	Sept. 19	83.60	14.79	4.67	4.89	116.93
224	Meunier	H. Mel	Glenwood	Oct. 8	10.34	12.28	4.26	.62	120.10
225	Zinfandel	Chas. W. Howard	Lower Lake	Sept. 10	73.48	14.67	4.60	5.18	140.90
226	Zinfandel	J. L. Black	Livermore	Oct. 4	11.22	10.79	5.49	1.06	188.47
227	Zinfandel	P. W. Butler	Penryn	Oct. 4	18.26		3.62	1.24	136.29
228	Zinfandel	E. B. Smith	Martinez	Oct. 4	37.18	16.27	4.88	2.50	134.48
229	Zinfandel	Natoma Company	Natoma	Sept. 29	39.82	20.44	4.42	Blended.	
	Southern French Type.								
230	Trousseau	George West	Stockton	Oct. 18	62.92	11.54	4.02	5.02	159.55
231	Trousseau	Wm. Pfeffer	Gubserville	Oct. 21	11.44	9.62	4.23	.79	138.56
232	Petite Sirah	Natoma Company	Natoma	Sept. 13	104.72	11.34	5.99	8.90	170.07
233	Petite Sirah	Natoma Company	Natoma	Sept. 30	86.90		4.94	7.00	161.11
234	Serine	Natoma Company	Natoma	Sept. 13	15.62	14.08	3.30	.98	125.16
235	Mondeuse	Natoma Company	Natoma	Sept. 10	148.06	13.37	10.40	12.38	167.23
236	Mondeuse	Natoma Company	Natoma	Oct. 1	56.32	12.58	5.47		

TABLE No. 5—Continued.

Of Grapes worked in the Viticultural Laboratory, 1884.

Number	VARIETY.	Grower.	Place of Production.	Date of Receiving Grapes.	Weight of Grapes in pounds.	Percentage of Pomace.	Percentage of Stems.	Gallons of Must resp. Mark.	Gallons of Must per ton of Grapes.
	American Type.								
237	Cinsaut	Natoma Company	Natoma	Sept. 25	121.66	11.57	2.93	10.74	176.54
238	Aramon	Natoma Company	Natoma	Oct. 4	46.86	7.75	3.38	3.50	149.48
239	Mourastel	Natoma Company	Natoma	Oct. 4	31.54	10.83	4.78	2.74	156.25
240	Grenache	Natoma Company	Natoma	Sept. 7	43.56	13.53	4.04	3.04	139.50
241	Grenache	Wm. Pfeffer	Guberville	Oct. 21	14.96	9.56	5.88	1.12	150.11
242	Petit Bouschet	Natoma Company	Natoma	Sept. 22	86.24	13.26	4.21	7.16	166.04
243	Petit Bouschet	Natoma Company	Natoma	Sept. 30	68.64	.....	4.49	5.28	153.96
244	Clairette Rouge	Natoma Company	Natoma	Oct. 2	22.40	8.59	3.93	1.72	153.32
245	Barbera	J. T. Doyle	Cupertino	Oct. 6	1.05	.....	10.47	.....	.....
246	Lenoir	H. Hagen	Napa	Oct. 9	32.78	15.33	6.71	2.31	151.55
247	Lenoir	H. Langenberger	Anaheim	Oct. 12	27.50	11.80	10.00	1.85	134.50
248	Blau-Elbling	Stern & Rose	San Gabriel	Oct. 9	20.02	10.71	4.40	1.37	137.24
249	Mission	Governor Stanford	Vina	Oct. 10	34.76	.....	3.32	Used in	bl'n'g.
250	Black Prince	P. W. Butler	Penryn	Oct. 14	Used in	blend'g.	Used	in blen	ding.
	White Wine Varieties.								
251	Semillon	Natoma Company	Natoma	Sept. 9	38.94	23.31	3.39	3.04	156.04
252	Semillon	Natoma Company	Natoma	Sept. 20	61.16	30.86	4.14	4.23	138.23
253	Sauvignon Blanc	Natoma Company	Natoma	Sept. 9	52.14	28.78	4.75	3.70	141.88
254	Sauvignon Blanc	Natoma Company	Natoma	Sept. 19	115.50	24.76	4.24	8.59	148.67
255	Sauvignon Blanc	Natoma Company	Natoma	Oct. 2	34.10	27.10	5.42	2.38	139.14
256	Muscadelle du Bordelais (loose bunches)	Natoma Company	Natoma	Sept. 19	112.64	26.15	5.13	9.56	169.81
257	Muscadelle du Bordelais (compact bunches)	Natoma Company	Natoma	Sept. 19	122.54	31.54	3.09	7.66	125.15
258	Folle Blanche ("Tannat")	Natoma Company	Natoma	Oct. 2	126.06	23.39	4.71	10.91	173.11
259	Folle Blanche	J. L. Black	Livermore	Oct. 6	13.64	16.13	6.77	1.26	185.16
260	Burger	Stern & Rose	San Gabriel	Oct. 9	19.58	13.76	5.90	1.45	148.42
261	Burger	R. Barton	Fresno	Oct. 13	20.46	.....	5.38	1.24	121.10
262	Roussanne	Natoma Company	Natoma	Sept. 18	192.06	15.81	5.38	13.79	143.61
263	Marsanne	Natoma Company	Natoma	Sept. 18	98.12	25.11	5.72	6.95	141.62
264	Clairette Blanche	Natoma Company	Natoma	Sept. 25	175.56	44.15	4.51	9.30	106.03
265	Pecoui Touar (?)	Natoma Company	Natoma	Oct. 10	62.92	25.18	4.90	4.17	132.68

	Sherry and Madeira Varieties.								
266	Pedro Jimenes	Natoma Company	Natoma	Oct. 10	56.54	20.24	3.21	4.31	152.33
267	Palomino	Natoma Company	Natoma	Oct. 10	62.48	30.28	4.40	4.23	135.31
268	Peruno	Natoma Company	Natoma	Oct. 10	16.50		3.06	1.24	150.51
269	Mantuo de Pilas	Natoma Company	Natoma	Oct. 9	74.36	20.71	2.81	6.13	164.95
270	Mourisco Branco	Natoma Company	Natoma	Oct. 9	52.34	19.01	3.93	4.17	156.81
271	Beba	Natoma Company	Natoma	Oct. 9	72.16	33.51	4.95	4.10	113.50
272	Verdelho	Natoma Company	Natoma	Oct. 2	94.60	21.86	4.88	7.79	164.77
273	Boal Madeira	Natoma Company	Natoma	Sept. 9	66.44	24.59	5.70	4.76	143.15
274	Ugni Blanc	Natoma Company	Natoma	Oct. 10	20.46	20.75	4.30	1.59	149.95
275	Malmsey	Natoma Company	Natoma	Sept. 9	68.64	21.96	5.77	4.95	144.33
276	Malaga	P. W. Butler	Penryn	Oct. 4	22.66	18.45	4.61	1.85	163.22
	Port Wine Varieties.								
277	Tinta Cao	Natoma Company	Natoma	Sept. 26	65.34		4.61	Blended.	
278	Tinta Madeira	Natoma Company	Natoma	Sept. 10	18.26	13.25	5.06	1.11	121.53
279	Mourisco Preto	Natoma Company	Natoma	Sept. 26	56.32		4.79	Blended.	
280	Tinta Amarella (not fully ripe)	Natoma Company	Natoma	Sept. 22	100.32	8.77	3.44	8.51	169.60
281	Tinta Amarella (fully ripe)	Natoma Company	Natoma	Sept. 22	49.50	7.10	3.60	4.18	168.70
282	Moretto	Natoma Company	Natoma	Sept. 26	21.78		5.30	Blended.	
283	Bastardo	Natoma Company	Natoma	Sept. 9	113.74	14.93	3.64	8.90	156.90

TABLE No. 6.

Composition of Musts and Wines made at Viticultural Laboratory, 1884.

Number	Variety.	Grower.	Place of Production.	Date of Receiving Grapes.	Must.							Wine.					
					Solid Contents by Spindle.	Ash.	Grape Sugar.	Fruit Sugar.	Total Sugar by Copper Test.	Acid as Tartaric.	Acid after Pressing.	Body.	Alcohol. By Weight.	Alcohol. By Volume.	Tannin.	Acid as Tartaric.	Ash.
	Bordeaux Type.																
211	Malbeck	Natoma Company	Natoma	Sept. 7	20.94	.330	11.08	10.25	21.33	.610	.416	2.68	8.31	10.42	.100	.450	.393
212	Cabernet Franc	Natoma Company	Natoma	Sept. 20	20.60	.284	10.39	9.49	19.88	.619	.384	2.84	9.63	12.00	.035	.480	.432
213	Cabernet Franc	Wm. Pfeffer	Gubserville	Oct. 21	22.43	.296	10.58	10.80	21.38	.765	.633	2.13	8.48	10.58	.070	.607	.293
214	Cabernet Sauvignon	Natoma Company	Natoma	Sept. 26	22.67	.315	12.14	10.99	23.13	.462	.495	3.19	9.92	12.36	.079	.540	.447
215	Merlot	Natoma Company	Natoma	Sept. 20	20.66	.219	11.24	10.15	21.39	.472	.498	2.44	9.20	11.42	.065	.467	.394
216	Verdot	Natoma Company	Natoma	Sept. 20	23.04	.313	12.23	10.81	23.04	.656	.517	2.77	9.78	11.82	.071	.438	.409
217	Tannat	H. W. Crabb	Oakville	Oct. 21	21.52	.293	10.74	10.41	21.15	.810	.777	2.69	7.46	8.92	.171	.633	.353
218	Beclan	Natoma Company	Natoma	Sept. 26	20.92	.272	10.20	10.04	20.24	.435	.387	2.64	8.84	11.00	.053	.381	.260
219	Carignane	Natoma Company	Natoma	Oct. 4	19.56	.288	9.95	9.08	19.03	.593	.480	2.18	7.92	9.90	.063	.527	.285
220	Grossblaue	H. A. Pellet	St. Helena	Oct. 9	21.31	.177	10.55	10.06	20.61	.563	------	2.10	9.20	11.42	.065	.572	.252
	Burgundy Type.																
221	Black Burgundy	H. W. Crabb	Oakville	Oct. 21	22.95	.301	11.27	11.49	22.76	.885	------	2.77	9.34	11.64	.188	.765	.277
222	Black Pinot	L. P. Berger	Lakeport	Oct. 18	19.58	------	------	------	------	.633	------	2.11	6.42	8.00	.133	.750	.310
223	Meunier	Wm. Scheffler	St. Helena	Sept. 19	22.73	.463	10.93	11.46	21.39	.484	.330	2.55	10.07	12.55	.025	.525	.419
224	Meunier	H. Mel	Glenwood	Oct. 8	19.35	------	------	------	------	.600	.618	2.44	6.95	8.64	.055	.622	.285
225	Zinfandel	Ch. Webb Howard	Lower Lake	Sept. 10	20.16	.310	10.63	9.12	19.75	.713	.510	Blended.		Blended.		Blended.	
226	Zinfandel	J. L. Black	Livermore	Oct. 4	18.81	------	------	------	------	.552	.473	2.36	7.85	9.75	.036	.450	.425
227	Zinfandel	P. W. Butler	Penryn	Oct. 4	16.05	------	------	------	------	.585	.780	1.93	7.43	9.25	.080	.633	.200
228	Zinfandel	E. B. Smith	Martinez	Oct. 4	18.50	------	------	------	------	.765	.528	Blended.		Blended.		Blended.	
229	Zinfandel	Natoma Company	Natoma	Sept. 29	23.61	.377	------	------	------	.562	------	Blended.		Blended.		Blended.	
	Southern French and Italian Types.																
230	Trousseau	George West	Stockton	Oct. 18	23.94	------	------	------	------	.330	.453	2.66	11.23	13.73	.075	.485	.379
231	Trousseau	Wm. Pfeffer	Gubserville	Oct. 21	22.87	.301	11.73	11.12	22.85	.518	.469	2.28	9.92	11.64	.050	.474	.349
232	Petite Sirah	Natoma Company	Natoma	Sept. 13	21.60	.327	11.67	10.13	21.80	.663	.450	2.65	10.07	12.54	.092	.401	.406
233	Petite Sirah	Natoma Company	Natoma	Sept. 30	------	------	------	------	------	.375	2.79	10.81	13.27	.108	.393	.339	
234	Serine	Natoma Company	Natoma	Sept. 13	21.43	.280	11.35	9.96	21.31	.585	.450	2.49	8.48	10.58	.063	.510	.400
235	Mondeuse	Natoma Company	Natoma	Sept. 10	20.16	.216	10.73	9.66	20.39	.510	.413	2.64	9.56	11.89	.173	.498	.242
236	Mondeuse	Natoma Company	Natoma	Oct. 1	22.60	------	------	------	------	.533	2.84	9.92	12.27	.111	.405	.362	
237	Cinsaut	Natoma Company	Natoma	Sept. 25	23.94	.317	12.29	11.03	23.32	.528	.381	2.60	10.44	12.90	.070	4.90	.375
238	Aramon	Natoma Company	Natoma	Oct. 4	18.72	.326	9.71	8.58	18.29	.663	.495	2.32	9.05	10.73	.065	4.96	.356
239	Mourastel	Natoma Company	Natoma	Oct. 4	18.79	.290	9.51	8.79	18.30	.633	.540	2.60	7.92	9.88	.054	5.53	.291
240	Grenache	Natoma Company	Natoma	Sept. 7	21.82	.260	11.92	9.83	21.75	.620	.492	1.67	8.48	10.58	.105	.480	.281
241	Grenache	Wm. Pfeffer	Gubserville	Oct. 21	18.12	------	------	------	------	.413	.507	1.93	7.43	9.27	.065	.532	.277

242	Petit Bouschet	Natoma Company	Natoma	Sept. 22	20.61	.363	10.87	9.74	20.61	.465	.420	2.44	8.84	11.00	.089	.583	.234
243	Petit Bouschet	Natoma Company	Natoma	Sept. 30							.503	2.87	9.27	11.55	.117	.493	.369
244	Clairette Rouge	Natoma Company	Natoma	Oct. 2	23.95	.281	12.07	10.97	23.04	.572	.495	2.72	9.92	12.36	.063	.510	.293
245	Barbera	J. T. Doyle	Cupertino	Oct. 6	Not enough for complete analysis.					1.014							
246	Lenoir	H. Hagen	Napa	Oct. 9	17.89	.320	8.57	8.60	17.17	.807	.672	3.00	8.13	10.16	.060	.630	.376
247	Lenoir	H. Langenberger	Anaheim	Oct. 12	20.20	.444	9.53	9.36	18.89	.627		3.71	8.98	11.17	.075	.582	.511
248	Blau-Elbling	Stern & Rose	San Gabriel	Oct. 9	20.62	.285	10.27	9.43	19.70	.717		1.93	8.27	10.25	.040	.585	.340
249	Mission	Governor Stanford	Vina	Oct. 10	24.03	.483	11.92	12.00	23.92	.303		Blend	ed.	Blend	ed.	Blend	ed.
250	Black Prince	P. W. Butler	Penryn	Oct. 14	22.43	.358	10.82	11.23	22.06	.297		Blend	ed.	Blend	ed.	Blend	ed.
	Dry White Wine Varieties.																
251	Semillon	Natoma Company	Natoma	Sept. 9	18.83	.276	9.87	9.02	18.89	.540							
252	Semillon	Natoma Company	Natoma	Sept. 20	21.69	.279	10.97	10.02	20.99	.424		1.93	9.92	12.36		.450	.175
253	Sauvignon Blanc	Natoma Company	Natoma	Sept. 9	21.66	.310	11.38	9.84	21.22	.615							
254	Sauvignon Blanc	Natoma Company	Natoma	Sept. 19	22.20	.292	11.43	9.56	20.99	.533		2.10	9.92	12.36		.453	.157
255	Sauvignon Blanc	Natoma Company	Natoma	Oct. 2								2.18	10.26	12.75		.553	.192
256	Muscadelle du Bordelais (loose bunches)	Natoma Company	Natoma	Sept. 19	21.93	.342	11.93	10.30	22.23	.366		2.13	11.46	14.00		.432	.208
257	Muscadelle du Bordelais (compact bunches)	Natoma Company	Natoma	Sept. 19	23.63	.422	12.32	10.35	22.67	.529		2.44	10.81	13.27		.498	.342
258	Folle Blanche ("Tannat")	Natoma Company	Natoma	Oct. 2	22.10	.267	10.96	11.01	21.97	.664		1.66	9.92	12.36		.593	.214
259	Folle Blanche	J. L. Black	Livermore	Oct. 6	18.00					.474		1.80	7.43	8.75		.570	.235
260	Burger	Stern & Rose	San Gabriel	Oct. 9	19.19	.309	10.08	9.07	19.15	.540		2.05	8.41	10.50		.600	.260
261	Burger	R. Barton	Fresno	Oct. 13	20.06	.449	10.37	9.59	19.96	.450		1.65	8.55	10.63		.528	.181
262	Roussanne	Natoma Company	Natoma	Sept. 18	22.60	.271	11.96	10.63	22.59	.420		1.36	10.54	13.00		.468	.260
263	Marsanne	Natoma Company	Natoma	Sept. 18	21.38	.277	11.14	10.06	21.20	.423		1.88	9.20	11.46		.563	.176
264	Clairette Blanche	Natoma Company	Natoma	Sept. 25	21.34	.310	10.88	10.19	21.07	.453		1.85	10.54	13.00		.428	.212
265	"Pecoui Touar" (?)	Natoma Company	Natoma	Oct. 10	20.18	.403	10.31	9.44	19.75	.480		1.66	9.27	11.58		.573	.234
	Sherry and Madeira Varieties.																
266	Pedro Jimenes	Natoma Company	Natoma	Oct. 10	20.78	.402	10.44	10.12	24.61	.330		1.18	9.63	12.00		.555	.390
267	Palomino	Natoma Company	Natoma	Oct. 10	23.86	.395	12.01	11.80	23.81	.321		1.85	11.08	13.50		.528	.250
268	Peruno	Natoma Company	Natoma	Oct. 10	22.76	.334	11.50	11.17	22.67	.312		1.95	9.92	12.50		.519	.306
269	Mantuo de Pilas	Natoma Company	Natoma	Oct. 9	18.63	.264	9.49	9.40	18.89	.345		1.32	7.85	9.82		.525	.265
270	Mourisco Branco	Natoma Company	Natoma	Oct. 9	23.02	.307	11.74	10.93	22.67	.353							
271	Beba	Natoma Company	Natoma	Sept. 9	22.60	.328	11.03	10.77	21.80	.250		2.10	11.69	14.27		.503	.372
272	Verdelho	Natoma Company	Natoma	Oct. 2	27.35	.374	13.43	12.45	25.88	.501		2.82	12.39	15.20		.417	.330
273	Boal Madeira	Natoma Company	Natoma	Sept. 9	21.76	.398	11.49	9.89	21.38	.528		2.00	9.27	11.58		.660	.264
274	Ugni Blanc	Natoma Company	Natoma	Oct. 10	20.70	.485	10.67	9.42	20.61	.587		2.00	8.91	11.10		.510	.299
275	Malmsey	Natoma Company	Natoma	Sept. 9	17.91	.222	10.12	8.46	18.58	.504		1.60	7.92	9.91		.543	.160
276	Malaga	P. W. Butler	Penryn	Oct. 4	17.14	.211	9.02	8.16	17.18	.300		1.69	8.13	9.82		.217	.240
	Port Wine Varieties.																
277	Tinta Cao	Natoma Company	Natoma	Sept. 26	21.50	.326	11.25	10.55	21.80	.525							
278	Tinta Madeira	Natoma Company	Natoma	Sept. 10	21.38	.265	11.57	9.65	21.23	.555	.375						
279	Mourisco Preto	Natoma Company	Natoma	Sept. 26	21.60	.409	10.73	10.65	21.38								
280	Tinta Amarella (not fully ripe)	Natoma Company	Natoma	Sept. 22							.405	2.36	9.05	11.27	.058	.501	.446
281	Tinta Amarella (fully ripe)	Natoma Company	Natoma	Sept. 22	20.08	.318	10.60	9.69	20.29	.469	.435	2.39	9.56	11.91	slight.	.525	.470
282	Moretto	Natoma Company	Natoma	Sept. 26	19.40	.306	9.78	8.92	18.70	.600							
283	Bastardo	Natoma Company	Natoma	Sept. 9	23.74	.397	12.10	11.04	23.14	.430	.341	3.12	10.35	12.83	.062	.507	.564

EXHIBIT OF WINES MADE AT THE ANNUAL VITICULTURAL CONVENTION, DECEMBER, 1884.

(From the Report of the State Viticultural Convention, 1884.)

Experimental fermentations and blends, made at the State University, by Prof. E. W. Hilgard, from grapes furnished as indicated below, by vine growers in different parts of the State:

Number.	Number of Samples.	Variety.	Vintage.	Vine Grower.	Place of Production.
1					
2	3	Malbeck	1884	Charles Lefranc	San José.
3	2	Bastardo	1884	Natoma W. & M. Co.	Natoma.
4	½	Boal	1884	Natoma W. & M. Co.	Natoma.
5	1	Zinfandel, Mataro, Meunier	1884	Doyle, Drummond	
6	1	Sauvignon Blanc	1884	Natoma W. & M. Co.	Natoma.
7	2	Semillon, two thirds Sauvignon Blanc, one third	1884	Natoma W. & M. Co.	Natoma.
8					
9	1	Tinta Madeira	1884	Natoma W. & M. Co.	Natoma.
10					
10 A	3	Mondeuse	1884	Natoma W. & M. Co.	Natoma.
11	1	Zinfandel	1884	C. W. Howard	Lower Lake.
12	2	Petite Syrah	1884	Natoma W. & M. Co.	Natoma.
13	1	Malvoisie, Lenoir, Trousseau	1884	Warfield, Doyle	
14	2	Marsanne	1884	Natoma W. & M. Co.	Natoma.
15	2	Roussanne	1884	Natoma W. & M. Co.	Natoma.
16	½	Malbeck, four fifths Petite Syrah, one fifth	1884	Natoma W. & M. Co.	Natoma.
17	2	Semillon	1884	Natoma W. & M. Co.	Natoma.
18	2	Muscadelle du Bordelais (loose bunch)	1884	Natoma W. & M. Co.	Natoma.
19	2	Muscadelle du Bordelais (compact bunch)	1884	Natoma W. & M. Co.	Natoma.
20	2	Meunier	1884	William Scheffler	St. Helena.
21	1	Sauvignon Blanc	1884	Natoma W. & M. Co.	Natoma.
22	2	Merlot	1884	Natoma W. & M. Co.	Natoma.
23	3	Verdot	1884	Natoma W. & M. Co.	Natoma.
24	3	Cabernet Franc	1884	Natoma W. & M. Co.	Natoma.
25	2	Semillon	1884	Natoma W. & M. Co.	Natoma.
26	1	Zinfandel, Lenoir	1884	Warfield, De Turk	
27	2	Tinta Amarella	1884	Natoma W. & M. Co.	Natoma.
28 A	4½	Petit Bouschet	1884	Natoma W. & M. Co.	Natoma.
29	2	Clairette Blanche	1884	Natoma W. & M. Co.	Natoma.
30	3	Cinsaut	1884	Natoma W. & M. Co.	Natoma.
31	2½	Mourisco Preto, one tenth Moretto, four tenths Petit Bouschet, one tenth Tinta Cao, four tenths	1884	Natoma W. & M. Co.	Natoma.
32	2	Tinta Cao, one fifth Mourisco Preto, two fifths	1884	Natoma W. & M. Co.	Natoma.
33	3	Beclan	1884	Natoma W. & M. Co.	Natoma.
34	4	Cabernet Sauvignon	1884	Natoma W. & M. Co.	Natoma.
35	1	Zinfandel, three fifths Mondeuse, two fifths	1884	Natoma W. & M. Co.	Natoma.
36					
37	1½	Folle Blanche	1884	Natoma W. & M. Co.	Natoma.
38	2	Verdelho	1884	Natoma W. & M. Co.	Natoma.
39	1	Sauvignon Blanc	1884	Natoma W. & M. Co.	Natoma.
40	1	Clairette Rouge	1884	Natoma W. & M. Co.	Natoma.
41	2	Zinfandel, 72 pounds Grossblaue, 21 pounds Folle Blanche, 7 pounds	1884	Natoma W. & M. Co.	Natoma.
42	2	Port, blend of 31 and 32	1884	Natoma W. & M. Co.	Natoma.
43	2	Cabernet Sauvignon, 66 pounds Grossblaue, 34 pounds	1884	Natoma W. & M. Co.	Natoma.
44	1½	Cabernet Franc, two thirds Grossblaue, one third	1884	Natoma W. & M. Co.	Natoma.

EXHIBIT OF WINES, ETC.—Continued.

Number.	Number of Samples.	Variety.	Vintage.	Vine Grower.	Place of Production.
45	1	Zinfandel, 62½ pounds Lenoir, 37½ pounds	1884	---------- ----------	Martinez. Napa.
46	2	Carignane	1884	Pellet	St. Helena.
47	2	Aramon	1884	Natoma W. & M. Co.	Natoma.
48	2	Cinsaut, one half Petite Syrah, one half	1884	Natoma W. & M. Co.	Natoma.
49	2	Mourastel	1884	Natoma W. & M. Co.	Natoma.
50	1	Zinfandel, 72 pounds Crabb's Black Burgundy, 28 lbs.	1884	E. B. Smith H. W. Crabb	Martinez. Oakville.
51	2	Zinfandel	1884	P. W. Butler	Penryn.
52	1	Zinfandel	1884	E. B. Smith	Martinez.
53	2	Cabernet Franc, 64 pounds Carignane, 18 pounds Grossblaue, 9 pounds Folle Blanche, 9 pounds	1884	Natoma W. & M. Co.	Natoma.
54	1	Caber. Sauvignon, eight tenths Mourastel, one tenth Carignane, one tenth	1884	Natoma W. & M. Co.	Natoma.
55	1	Cabernet Franc, three fourths Carignane, one fourth	1884	Natoma W. & M. Co.	Natoma.
56	2	Cabernet Franc, one half Mourastel, one half	1884	Natoma W. & M. Co.	Natoma.
57	1	Zinfandel, two thirds No. 44, one third	1884	C. A. Wetmore Nat. W. & M. Co.	Livermore. Natoma.
58	1	Barbera	1884	J. T. Doyle	Cupertino.
59	1	Meunier	1884	Henry Mel	Glenwood.
60	2 2vls	Cabernet Franc, 60 pounds Black Prince, 10 pounds Grossblaue, 15 pounds Folle Blanche, 15 pounds	1884	---------- ---------- ---------- ----------	Natoma. Penryn. St. Helena. Livermore.
61	2	Mantuo de Pilas	1884	Natoma W. & M. Co.	Natoma.
62	2	Burger	1884	Stern & Rose	San Gabriel.
63	2½	Beba	1884	Natoma W. & M. Co.	Natoma.
64	1	Trousseau, one half Zinfandel, one fourth Mondeuse, one fourth	1884	George West E. B. Smith Nat. W. & M. Co.	Stockton. Martinez. Natoma.
65	2	Lenoir	1884	H. Hagen	Napa.
66	2	Blau-Elbling	1884	Stern & Rose	San Gabriel.
67	2	Grossblaue	1884	A. Pellet	St. Helena.
68	2	Ugni Blanc	1884	Natoma W. & M. Co.	Natoma.
69	2	Peruno	1884	Natoma W. & M. Co.	Natoma.
70	2½	Palomino	1884	Natoma W. & M. Co.	Natoma.
71	2	"Pecoui Touar"*	1884	Natoma W. & M. Co.	Natoma.
72	2	Pedro Ximenez	1884	Natoma W. & M. Co.	Natoma.
73	2	Carignane, one fourth Mission, one half Folle Blanche, one fourth	1884	H. A. Pellet Gov. Stanford J. C. Eggers	St. Helena. Vina. Fresno.
74	1	Lenoir	1884	A. Langenberger	Anaheim.
75	2	Burger	1884	Robert Barton	Fresno.
76	1	Trousseau	1884	George West	Stockton.
77	1	Black Pinot	1884	L. P. Berger	Lakeport.
78	2	Grenache	1884	W. Pfeffer	Santa Clara.
79	1	Trousseau	1884	W. Pfeffer	Santa Clara.
80	2	Cabernet Sauvignon	1884	W. Pfeffer	Santa Clara.
81	2	Black Burgundy	1884	H. W. Crabb	Oakville.
82	1½	Tannat	1884	H. W. Crabb	Oakville.
83	2	Aramon, one half Zinfandel, one half	1884	Natoma W. & M. Co.	Natoma.
84	1	Tinta Amarella, three tenths 31 and 32, seven tenths	1884	Natoma W. & M. Co.	Natoma.
85	1	Zinfandel, 83 pounds Cabernet Franc, 12 pounds Petite Syrah, 5 pounds	1884	Chas. W. Howard Nat. W. & M. Co. Nat. W. & M. Co.	Lower Lake. Natoma. Natoma.
86	1	Boal, four tenths Palomino, six tenths	1884	Natoma W. & M. Co.	Natoma.

EXHIBIT OF WINES, ETC.—Continued.

Number.	Number of Samples.	Variety.	Vintage.	Vine Grower.	Place of Production.
87	1	Beba, one half Peruno, one half	1884	Natoma W. & M. Co.	Natoma.
88	½	Aramon, 30 pounds Black Burgundy, 26 pounds Zinfandel, 44 pounds	1884	Natoma W. & M. Co.	Natoma.
89	1	Aramon, 25 pounds Zinfandel, 25 pounds Grossblaue, 25 pounds Mondeuse, 25 pounds	1884	Nat. W. & M. Co. E. B. Smith H. A. Pellet Nat. W. & M. Co.	Natoma. Martinez. St. Helena. Natoma.
90	1	Cinsaut, 30 pounds Petite Syrah, 30 pounds Zinfandel, 40 pounds	1884	Natoma W. & M. Co.	Natoma.
91	1	Trousseau, 66⅔ pounds Zinfandel, 33⅓ pounds	1884	George West E. B. Smith	Stockton. Martinez.
92	1	Zinfandel, 51 pounds Charbono, 33⅓ pounds Trousseau, 33⅓ pounds Gros Mancin, 50 pounds	1884	I. De Turk J. T. Doyle J. T. Doyle J. H. Drummond	Santa Rosa. Cupertino. Cupertino. Glen Ellen.
93	⅓	Carignane, 15 pounds Black Burgundy, 15 pounds Aramon, 28 pounds Zinfandel, 42 pounds	1884	J. H. Drummond H. W. Crabb Nat. W. & M. Co. Chas. W. Howard	Glen Ellen. Oakville. Natoma. Lower Lake.
94	½	Cinsaut, 30 pounds Petite Syrah, 30 pounds Zinfandel, 40 pounds	1884	Nat. W. & M. Co. Nat. W. & M. Co. E. B. Smith	Natoma. Natoma. Martinez.
95	1	Palomino, 25 pounds Peruno, 50 pounds Boal, 25 pounds	1884	Natoma W. & M. Co.	Natoma.
96	1	Port	1884	Natoma W. & M. Co.	Natoma.

* Incorrectly named.

DESCRIPTIVE LIST OF WINES SENT FOR EXAMINATION, AND ANALYZED DURING THE SEASON OF 1884–85.

No. 160. *Trousseau, 1883.* (From M. Denicke, Fresno.)

A clear, medium-bodied wine of a moderately deep garnet color, decided acid and astringency, and vinous flavor; bouquet is decided and fruity, accompanied by an alcoholic odor. After diluting with fifty per cent water, the wine is very good, and fair after one hundred per cent of water has been added.

No. 159. *Trousseau, 1883.* (From J. T. Doyle, Cupertino.)

Condition of the sample, clear; color, light red; body, heavy; acid and astringency, moderate; bouquet, very light; wine probably made from young vines.

No. 161. *Trousseau.* (From C. A. Wetmore, Livermore.)

Condition of sample, clear, with a red color of medium intensity; bouquet, agreeable, but not well developed; body, heavy; acid and astringency, light; flavor, vinous, but taste is somewhat bitterish.

No. 152. *Charbono, No. 1, 1883.* (From J. T. Doyle, Cupertino.)

Condition of the sample, bright, with an intense red color, heavy body, sharp acid, and good astringency. The bouquet is characteristic of the wine.

No. 153. *Charbono, No. 2, 1883.* (From J. T. Doyle, Cupertino.)

A wine of high astringency; medium acid and body. The flavor is somewhat flattish; condition, clear; color, intense red.

No. 167. *Claret, 1883.* (From R. Barton, Fresno.)

Wine has high, rough acids; not much of a bouquet, it being covered by the acetic odor; similarly as regards the flavor, which is vinous; astringency, high; body, heavy; condition, clear; color, deep garnet; wine dilutes well; but acid and astringency are too high, and there is hardly any flavor.

No. 157. *Malvoisie, 1884.* (From J. T. Doyle, Cupertino.)

A wine of decided acid, very light body, and no bouquet; color, very deficient; condition, slightly turbid.

No. 151. *Malbeck, 1884.* (Ch. Le Franc, New Almaden Vineyard.)

Condition of sample, bright; color, intense purple-red; astringency, high; acid, medium. The bouquet could not be judged from sample. Flavor, vinous, agreeable; general quality, good.

No. 131. *Grenache, 1883.* (From J. B. J. Portal, Burgundy Vineyard.)

A medium-bodied wine, of low acid; decided and adequate astringency, and faint but vinous and agreeable bouquet; color, light, deficient; acid too low to admit dilution of wine.

No. 126. *Carignane, 1883.* (From J. B. J. Portal, Burgundy Vineyard.)

Condition of sample, bright; color, deep purple-red; body, medium; acid, good; astringency, fair; flavor, vinous, well developed; bouquet, light.

No. 142. *Ploussard, 1884.* (From J. B. J. Portal, Burgundy Vineyard.)

Condition of sample, clear with deep-purple color; acid, adequate; and astringency medium; bouquet is covered by a somewhat mouldy odor; flavor is vinous, but tastes bitterish; body, heavy; dilution, good, with 50 per cent water.

No. 125 A. *Mataro, 1884.* (From J. B. J. Portal, Burgundy Vineyard.)

A wine of moderate color; heavy body; high, agreeable, somewhat sharpish acid, and good astringency; bouquet is claret-like, and promising condition; clear. Wine, after the addition of 50 per cent water, is very good; 100 per cent, fair.

No. 141. *Cabernet, 1884.* (From J. B. J. Portal, Burgundy Vineyard.)

A bright deep-red colored, heavy-bodied wine, of undeveloped bouquet; medium acid, and good astringency. Result of diluting wine with 50 per cent water, very good; 100 per cent, good.

No. 116. *Blau-Elbling, 1884.* (From Stern & Rose, San Gabriel.)

A very light-bodied wine, of topaz color; bouquet, very faint; acid, high; flavor, slightly nutty; sample in bottle has suffered.

No. 115. *Seedless Sultana, 1884.* (From Stern & Rose, San Gabriel.)

Condition of sample, clear; color, white; body, very light; bouquet, faint; acid, high.

No. 114. *Burger, 1884.* (From Stern & Rose, San Gabriel.)

Bouquet, undeveloped; acid, deficient; body, light; condition, slightly turbid.

No. 112. *Burger, 1883.* (From R. Barton, Fresno.)

A bright topaz-colored wine, of medium body; light acid; fairly developed bouquet, and nutty vinous flavor.

No. 113. *Burger, 1884.* (From R. Barton, Fresno.)

A clear white wine, of thin body; high, sharp acid, and fairly developed bouquet.

Chauché Gris, 1884. (From R. Barton, Fresno.)

A light topaz-colored wine, of heavy body; medium acid; clean vinous flavor, accompanied by very characteristic bouquet.

TABLE No. 7.

Analyses of Wines sent for examination during the Season 1884–85.

No.	VARIETY.	Grower.	Place of Production.	Vintage.	Body.	ALCOHOL.		Tannin.	Acid as Tartaric.	Volatile Acid as Acetic.	Ash.
						By Weight.	By Volume.				
	Reds.										
160	Trousseau	Denicke	Fresno	1883	3.07	10.63	13.10	.172	.645	.....	.534
159	Trousseau	J. T. Doyle	Cupertino	1883	2.69	11.15	13.50	.040	.600	.....	.447
161	Trousseau	C. A. Wetmore	Livermore	1884	3.04	9.78	12.18	.041	.435	.....	.328
152	Charbono, No. 1	J. T. Doyle	Cupertino	1884	2.84	8.34	10.40	.175	.506	.....	.453
153	Charbono, No. 2	J. T. Doyle	Cupertino	1884	2.84	7.99	10.00	.200	.507	.....	.409
194	Zinfandel	J. T. Doyle	Cupertino	1884	3.44	10.54	13.00	.077	.592	.....	.344
196	Zinfandel	R. Barton	Fresno	1884	3.34	9.34	11.64	.121	.395	.077	.400
167	Claret	R. Barton	Fresno	1883	3.37	9.56	12.10	.232	.504	.156	.483
200	Zinfandel claret, No. 2	Eggers	Fresno	1884	3.00	9.56	11.90	.344	.607	.041	.271
201	Zinfandel claret, No. 3	Eggers	Fresno	1884	3.47	9.34	11.64	.239	.637	.....	.296
202	*Zinfandel claret, No. 9	Eggers	Fresno	1884	3.00	10.03	12.55	.256	.558	.....	.338
203	Zinfandel claret, No. 12	Eggers	Fresno	1884	3.21	9.56	11.90	.260	.675	.....	.273
157	Malvoisie	J. T. Doyle	Cupertino	1884	2.05	7.64	9.54	.050	.590	.....	.250
151	Malbeck	Le Franc	New Almaden V'rd.	1884	3.62	9.99	12.45	.172	.461	.....	.446
131	Grenache	J. B. J. Portal	Burgundy Viney'rd.	1883	2.17	9.78	12.17	.093	.543	.....	.219
136	Burgundy	J. B. J. Portal	Burgundy Viney'rd.	1883	2.45	9.70	12.10	.073	.750	.....	.277
126	Carignane	J. B. J. Portal	Burgundy Viney'rd.	1883	2.06	9.27	11.54	.055	.627	.....	.227
142	Ploussard	J. B. J. Portal	Burgundy Viney'rd.	1884	2.77	10.69	13.12	.091	.543	.....	.273
125 A	Mataro	J. B. J. Portal	Burgundy Viney'rd.	1884	2.90	9.92	12.36	.138	.600	.....	.270
141	Cabernet	J. B. J. Portal	Burgundy Viney'rd.	1884	3.02	9.78	12.18	.110	.480	.....	.270
208	Blend: Mataro, 8.16 per cent; Zinfandel, 16.33 per cent; Malbeck, 8.16 per cent; Chauche Noir, 16.33 per cent; Trousseau, 44.89 per cent; West's White Prolific, 6.13 per ct.	C. A. Wetmore	Livermore	1884	2.77	9.63	12.00	.032	.450	.....	.312
209	Blend: Mataro, 8.70 per cent; Zinfandel, 26.10 per cent; Trousseau, 56.50 per cent; Folle Blanche, 8.70 per cent	C. A. Wetmore	Livermore	1884	2.82	9.20	11.45	.046	.566	.....	.272
210	†"Milk-sour Wine"	Per W. B. Rising	.....	.....	5.75	8.84	11.00	.149	.718	.469	.511

*Pure press wine. †Bitartrate, 2.118 per cent

TABLE No. 7—Continued.

Analyses of Wines During the Season 1884–85.

No.	VARIETY.	Grower.	Place of Production.	Vintage.	Body.	ALCOHOL.		Tannin.	Acid as Tartaric.	Acid as Acetic.	Ash.
						By Weight.	By Volume.				
	Whites.										
116	Blue Elbling	L. J. Rose	San Gabriel	1884	2.05	11.00	13.42		.527		.264
115	Sultana	L. J. Rose	San Gabriel	1884	3.87	10.81	13.30		.477		.319
114	Burger	L. J. Rose	San Gabriel	1884	2.16	9.20	11.42		.397		.308
112	Burger	R. Barton	Fresno	1883	2.24	9.12	11.36		.488		.367
113	Burger	R. Barton	Fresno	1884	3.02	8.98	11.17		.495		.255

THE VINTAGE OF 1885.

The vintage of 1885 presents a striking contrast to that of 1884. The extraordinary and persistent rains of the latter year, together with an unusual coolness of the summer, gave rise to a very large yield of wine of low alcohol percentage, and, generally speaking, of low quality; while early rains gave or caused a good many of the late grapes to burst open and become mouldy before they could be gathered, thus giving rise to unsoundness from the presence of improper fermentations.

The early cessation of rains in 1885, together with some late frosts followed by a very warm summer and autumn, caused a large portion of the grape bloom to fail in setting at all, and much of what did set was afterwards lost by premature dropping off—"*coulure*." The crop was therefore a light one as a whole, and in some regions almost a total failure. Where a fair crop remained on the vines, the bunches very generally contained a good many of the berries that had at various times succumbed to *coulure*, and toward the vintage many had become more or less tainted with mould; at all events had in them much material that should, if possible, have been excluded from the red-wine vat. The sound grapes matured very early and rapidly, so that the vintage had to be done in a hurry, even though there was only a half crop; hence the needful picking over of the bunches was but rarely done. Except in the high locations, as on the Santa Cruz Range, and some parts of the higher foothills, nearly all grapes of the first crop contained an unusual amount of sugar, ranging from 24 to 32 per cent, so that in many cases a complete fermentation was practically impossible. It was generally reported that fermentation started in very rapidly and continued so for some days; then it often suddenly ceased and left the wine sweet, to the extent of from 3 to 6 per cent, and even more. Where a second crop or late Mission grapes were available, these were successfully used to carry the main crop through, by reviving the fermentation. But where this resource was not available, the sweet wines remained still or, in many cases, gradually resumed a feeble fermentation. Where only sound grapes had entered the tanks this second fermentation has often carried the wine to dry safely to dryness; but where unsound grapes had been thrown in, and after the stoppage of the vinous fermentation had had time to develop their various fermentative germs, "milk-sourness" has promptly supervened, and the wines, still sweet, have had to be consigned to the still.

There can be little question as to the main cause of the so called "difficult fermentations" of 1885. The season being very hot, the gathering and crushing hasty, and the grapes full of sugar and fermentative germs, the tanks very commonly started at and over 80° F., and within twenty-four hours, with a stormy evolution of carbonic gas, rose to 100° F. and over, paralyzing and in very many cases completely killing the yeast, and in the case of unsound grapes having been used, starting the lacto-butyric and mannite fermentation at the appropriate high temperature. Then on cooling, the vinous fermentation might or might not be resumed, but the other processes would surely progress and carry the wine toward milk-sourness. Many suggestions of miscellaneous additions to remedy this state of things were made at the time, but nothing short of a complete destruction of the unsound germs by pasteurizing, and a revival of a sound fermentation by means of raisin mashes, could now make such wines safe. The fundamental fault, that of allowing hot grapes to go into a tank and start fermentation in a still hotter atmosphere freely admitted to the fermenting

rooms, has not generally been recognized, and all kinds of crude explanations have been offered; but when it comes to be understood that wherever the faults above referred to were sedulously avoided, no difficulty whatever has been experienced in carrying all wines not having an excessive proportion of sugar to a sound dryness, the situation will be better appreciated.

It is true that cases have been reported in which it is stated that the temperature did not rise too high for the vinous fermentation; but we have still to learn how those temperatures were ascertained. No matter what may be the *average* temperature of a tank after stirring, all the needful mischief may have been done by the yeast, rising from below, being consecutively brought in contact with the hot under surface of the cap; while neither the top of the latter, nor the wine in the body of the tank, would show a higher temperature than might be admissible. It is still to be hoped that the lesson taught by this vintage will not pass unheeded, and that the mischievous practice of hot-and-fast fermentations will be abandoned by those who desire to make sound shipping wines hereafter.

Some special points, noted in the vintage of 1885, are given in the subjoined Bulletin (No. 51), and the data upon which they are based may be found in the tables given in the body of this report. The majority of the wines made in the Viticultural Laboratory in 1885 have not as yet been tasted or analyzed.

BULLETIN No. 51.

THE WINES OF 1885.

As the time for the first racking of the vintage of 1885 is at hand, it is of some interest to discuss the results obtained in the fermentations made at the Viticultural Laboratory, and in the examination of wines sent in for analysis, in order that the merits and defects of this vintage may be compared with those of previous seasons, and the after treatment and blending governed accordingly.

Of forty lots of grapes sent in, thirty-four were sufficiently large for wine-making. Of these thirty-four fermentations not one offered any difficulty, the temperature of the cellar being kept somewhat higher than last season, viz., at or near 75°. This temperature would, of course, have been undesirably high for larger masses of wine, but for the samples not exceeding ten gallons proved just right, the highest temperature reached by any one during the violent fermentation being 86°. All fermented out completely during the usual time (of about a week for red wines), cleared rapidly after drawing off, and are sound in every respect. The only exception in regard to regularity of fermentation arose from an accident to the gas jet regulating the temperature in a space set apart for the fermentation of small samples, in which the temperature one morning was found to have risen to 110°. This had completely stopped the fermentation, and apparently killed the yeast, for fermentation was not resumed in the course of three days, although the sugar was only half fermented out. But upon addition of about 30 per cent of fresh must just started in fermentation, the whole went through rapidly and made a perfectly sound, dry wine. There is, of course, nothing new in this, but it is mentioned as undoubtedly typical of a great number of cases of reported "difficult fermentation" during the past vintage, exemplified in a number of samples of wine received for analysis.

Of thirty-nine such samples thus far received, the extraordinarily large proportion of 17 or nearly 44 per cent contained unfermented sugar in proportions varying from a trifle (say ½ per cent) to a little more than 6, but mostly from 3 to 5. In one case as much as 10 per cent remained in a wine which, besides, was thoroughly acetified and "milk-sour." This wine, it was ascertained, started finely during very hot weather; was allowed to form a "cap" without stirring-in (*foulage*), and suddenly stopped while sweet, evidently from a too great rise of temperature. Then, while being left with the hope that the fermentation would revive of its own accord, it went wholly wrong and was fit only for the still.

In this case, as in many last season, the total amount of sugar originally in the must was considerably greater than that which could ferment out in any case, viz., over 35 per cent. But the alcohol had only been formed to the extent of 11 per cent, while under proper treatment over 15 might have been reached before fermentation stopped, as was actually done in several cases now before us.

TANNIN AND ACID.

Apart, however, from the unfermented sugar, and from cases of gross mismanagement like the above, both the wines made at the Viticultural Laboratory and the bulk of those sent in, exhibit peculiarities which seem to belong to the vintage as such, independently of grape varieties; and also, to some extent, of the unusual degree of ripeness attained

by them. The most prominent of these are larger proportions of both tartaric acid and tannin, appearing in cases where comparison with previous seasons is available.

Thus we find in Gallegos' Zinfandel, from Mission San José, in which the tannin usually ranged between 7 and 8.5 (10,000ths), from 11 to 12, and in a sample from the old Palmer (hill) vineyard, at the same place, the extraordinary amount of 24; in the Cabernets from the Santa Clara Valley, heretofore showing from 10 to 11, now from 16 to 17.5 tannin. Similar results are now shown from other localities and varieties; and where the determinations have not yet been made the taste indicates a similar increase over previous vintages.

As regards acid, the analyses show that where from 4.5 to 5.0 *pro mille* has been the rule, from 6 to 8 now frequently appear in the must, at least, and so proportionally for lower degrees of acidity. But neither in the musts nor in the wines did this higher acidity appear unpleasantly, doubtless for the reason that the unusually heavy body and high alcoholic strength disguises the acidity and renders it harmonious with the other characters of the product.

It is hardly necessary to insist upon the importance of these points as regards not only the quality of the 1885 wines for direct consumption, but especially their value for blending with previous vintages. It would be extremely desirable to verify the general validity of the above indications by wider comparisons, both as to varieties and localities.

ALCOHOLIC STRENGTH—ARRESTED FERMENTATIONS.

Since in all but the higher locations the saccharine strength of the musts was high in 1885, so ought to be the alcoholic strength of the resulting wines; and this is found to be the case where fermentation has gone through, the extraordinary strength of 16 per cent having been observed in one case, and 15 in quite a number. But, as stated above, in a great many cases some sugar has remained unconverted, and that not only where the sugar exceeded the amount that can be fermented out, but also in many in which the maximum of alcohol would not nearly have been reached; and yet only from 10 to 12 per cent was actually formed. In all of these that have been reliably reported, the great vigor of the first fermentation is noted, and surprise expressed that, after such a good beginning, it should not have gone through. In fact, the prompt and vigorous starting of the fermentation is very commonly dwelt upon, and has been similarly noted in the fermentations made at the University Laboratory, as well as in the wineries visited during the vintage. It is the usual and predicable outcome of a season like that of 1885, in which all grape varieties matured fully, and should exhibit their best qualities in their wines, if carefully treated.

A vigorous beginning of fermentation necessarily implies an abundance both of yeast-forming material—"germ food"—and of yeast germs. If it stops short of the natural limit imposed by the formation of alcohol or exhaustion of sugar, it must be because some influence hostile to the life of the yeast has intervened; and unless more than mere guesswork or conjecture shows the contrary, that influence must be supposed to be excessive rise of temperature, as a result of this same vigorous action. The common practice of crushing grapes coming hot from the vineyard, renders this a matter of much more easy and common occurrence than most persons imagine; and considering the warm weather prevailing during the last vintage season, it is probable that most of the cases of arrested fermentation would lose their alleged mysteriousness, if this simple and well-known cause were properly taken into account.

Omitting for the present the discussion of the means to be employed for the completion of the fermentation of wines containing several per cent of unconverted sugar, I desire to call the attention of those having only a small remnant of sugar to deal with, to the importance of a thorough *äeration* of such wines in racking. This is easily done by using a rose spout instead of a solid stream from the faucet or hose, and letting the stream fall some distance.

The effect of äeration in promoting the vinous fermentation and in eliminating undesirable ingredients, is well understood, and is in Germany very commonly applied to the must previous to fermentation, in order to carry it through more promptly and regularly. In France it is more especially used in the "*foulage*" of red wines—the daily repeated stirring-in of the pomace; in Spain and Portugal it forms the essential effect of the long and laborious treading given to the grapes, and is among the main points in the after-treatment of ports and sherries. It is not, therefore, an innovation, but a well-proved means of promoting the fermentation, the soundness, and especially the clearing of wines. Its efficacy has been well exemplified during the past vintage, by the ready fermentation of Zinfandels subjected to regular *foulage*, to over 15 per cent of alcohol, while others, of the same saccharine strength, but fermented without äeration by the aid of a submerged frame, have remained partially sweet. Similarly the äeration in racking, suggested above and forming a good general rule as well, promotes the after-fermentation and will help to get rid of small remnants of sugar, up to one per cent or thereabouts. With proper care in the after-treatment, such äeration involves no danger of acetification or "pricking," and tends to prevent "milk-sourness."

THE UNIVERSITY EXPERIMENTAL VINEYARD AT CUPERTINO, SANTA CLARA COUNTY.

Section nine of "an Act for the promotion of the viticultural interests of the State," contains the following provision:

> The Board of Regents of the University shall be authorized to receive and accept donations of lands suitable for experimental vineyards and stations, and shall submit in their next annual report an economical plan for conducting such vineyards, and for the propagation and distribution of specimens of all known and valuable varieties of grape vines.

Extended operations under this section have not been practicable, in the absence of appropriations sufficiently large to permit of the acceptance, on the condition of actual occupancy, of several tracts offered. In one case, however, the conditions were so generous as to require no more than the proper attention and instructions on the part of the University, the expenses of cultivation being borne by the proprietor, Mr. John T. Doyle, of Menlo Park. The vineyard plot of which the use is granted the University, forms part of Mr. Doyle's vineyard at Cupertino, Santa Clara County, and consisted originally of thirty-seven rows, eight feet apart, of forty vines each, the latter being, at the time, three-year-old Zinfandels. These were, in 1884, grafted to the following varieties of wine grapes:

Grossblaue.
Crabb's Burgundy.
Ploussard (Portal).
Gamay Teinturier (Crabb).
Barbera.
Malbeck.
Verdot.
Carignane.
Cabernet Franc (Portal).
Petite Sirah.
Poulsart?
Chauché Noir.
Fresa (Monfra).
Bonarda.
Malbenie?
Barbarossa.
Herbemont.
Franken Riesling.
Pisutello di Roma.
Chauche Gris (Gris D'Ischia).
Sauvignon Blanc.
Johannisberg Riesling.
West's White Prolific.
Kleinberger (True Burger).
Chasselas Fontainebleau.
Semillon.
"Golden Chasselas."
Burger.
Seedless Sultana.
Muskateller.
Huasco Muscat.
Lignanga.

Five other varieties, partly imported by Mr. Doyle from Italy.

Besides these, Mr. Doyle's vineyard contains, on soil substantially identical, the following other varieties: Zinfandel, Charbono, Grenache, Cabernet Franc, and Cab. Sauvignon (direct importation), Trousseau.

Most of the grafts took well, and those which had not, were re-grafted to the same varieties in 1885. It was expected that in that year at least a small crop would be obtained from them, but the season being so universally unfavorable, the product was too small to serve for more than an identification of varieties in doubtful cases.

In view of the additional important varieties that have come prominently into notice in 1884, Mr. Doyle has offered to increase the allotment by twenty or more rows, making sixty in all, or twenty-four hundred vines, covering about three and one half acres.

The land on which this tract is located forms part of the gently undulating valley slope that lies between the Santa Clara Valley proper and the Coast Range, and into the higher part of which Cupertino Creek and its branches have cut narrow and deep abrupt valleys. The experimental plot assigned to the University lies immediately adjacent to the valley of the main Cupertino on the west, and about 50 feet above it. The soil is a drab-tinted clay loam, largely intermixed with gravel and rock fragments, showing the whole to consist of the wash from the adjacent and other

ranges lying toward New Almaden. In the bluff banks that fall off steeply into the creek bottom, it can readily be seen that the same materials, only with larger proportions of gravel and yellow, instead of a drab-colored loam, extend down nearly to the creek level. It is perfectly penetrable by both water and root, the latter being seen in it at levels from twelve to even twenty feet below the trees and vines to which they belong. The land is, therefore, perfectly underdrained, and fulfills one essential condition of first class wine grape land. It is, of course, easily workable soon after rains.

The analysis of the soil has not been completed, but it is undoubtedly similar in composition to other tracts located near the foot of the Coast Range, a few miles away, the analysis of which shows from 2.5 to 3.0 per cent of lime, about 1.0 of potash, .10 of phosphoric acid, and over 2.0 per cent of humus; therefore, a very rich and durable soil, likely to yield heavy-bodied wines of high alcoholic strength.

So far as the wines from Mr. Doyle's vineyard have come under observation, they amply fulfill the anticipations based upon the quality of the soil. The representative Zinfandel yields, annually, wines having over 3.0 of body, and from 13.0 to 15.0 of alcohol, together with the relatively high proportion of tannin that seems to belong to the west-side slope of the Santa Clara Valley. Other varieties show similar characteristics.

The University tract being practically level, and the soil of remarkable uniformity, it will thus show characteristically the natural differences between the grapes and wines of the several varieties; being, in this respect, parallel to the case of Mr. H. W. Crabb, a comparison of whose varied wines is given under the report of the work for 1883, page 70. Moreover, the soil being a very much generalized one for the west side of the Santa Clara Valley, the points elicited will be applicable to a large region, from the neighborhood of Mountain View to that of New Almaden. The number of vines representing each variety (40) was gauged upon the expectation that each should yield, on an average, not less than ten pounds of grapes, which would be sufficient to yield the desirable minimum quantity of a half barrel of wine for experimental fermentations. The latter will, in part, be conducted at the well equipped winery of Mr. Doyle, close at hand; partly, so far as it may seem advisable, at the University Viticultural Laboratory.

Should the example of wise liberality set by Mr. Doyle be followed by others having vineyards in representative locations, it would soon become possible, by combining the local study of soils with that of the wines yielded by the several classes of grapes, to predict for extended regions the general and most essential characteristics to be looked for, thus indicating the direction in which those planting new vineyards would be likely to find the best results.

PART IV.

RECORD OF WORK RELATING TO THE PHYLLOXERA AND ITS REPRESSION.

BIOLOGY OF THE PHYLLOXERA.

The subjoined bulletin concerning this subject is self-explanatory:

BULLETIN No. 19.

OBSERVATIONS ON THE PHYLLOXERA, MADE DURING 1884.

[When, a few years ago, the vineyard plot on the University grounds passed into the charge of the College of Agriculture, it was soon discovered that it was strongly infested with the phylloxera. It was at first intended to extirpate the pest as quickly as possible; but, when it became obvious that the law intended to prevent the further spread from infested districts could and would not be enforced, the fact that there are no vineyards so situated as to be liable to infection through natural causes from this locality, while it offers an excellent opportunity for the systematic observation of the habits of the insect in this climate, and for experiments with remedies and resistant vines, caused the idea of the immediate extirpation to be abandoned in favor of the experimental use of the plot. It is hardly necessary to say that ever since, a rigorous system of disinfection has obviated all danger of the accidental transmission of the insect to uninfected districts. The summary report of Mr. Morse, given below, shows the results of this season's observations.—E. W. HILGARD.]

It has been supposed, heretofore, that only a part of the recognized forms of the phylloxera exist in California. This apparent divergence from the natural habits of the insect has given direction to the investigations which have been carried on at the University.

A partial report on the forms found in our own vineyard plot was published in the report of the Agricultural Department for 1882, and may here be briefly summarized. It shows that the larvæ, and a small proportion of the wingless mother insects, pass the winter in a dull, lifeless condition, but are easily brought to life and activity by a proper change in temperature; that the middle of April finds the adult mother beginning to lay; and that soon after young larvæ are produced and scattered to all parts of the roots. The increase is slow until about the middle of June. Shortly after, the larval form with rudimentary wings appears, and by the first of July the winged form is found fully developed. The eggs of the mother louse are most abundant at the end of the same month, and at the same time a decrease in the number of adult mothers becomes apparent; the maximum number of larvæ is also reached. Only a few eggs are usually found after October, and very little action is noticeable after November. The time of these changes, however, will vary greatly with the season.

In the laboratory it was found that a single insect produced seventy-five eggs, laid frequently at the rate of five per day; some days none at all were produced. Thirteen days are required to hatch them, and seventeen more for the development into egg-laying mothers.

The object of investigation since the above was published has been toward determining the existence, habits, and movements of less familiar forms.

The late rains this summer have stimulated a generous growth of those finer roots on which the winged-form is produced in greatest abundance. Around such roots were placed properly arranged "traps," viz.: glass jars or bottles, partially buried in the soil. A rapid production of the winged form was noted from the twentieth of August to the beginning of September; some were developed as late as October tenth. As many as five eggs were laid by some of the confined winged insects, before death; none of these eggs, however, were observed to hatch, hence no sexual individuals were obtained.

In arranging the glass jar "traps," the soil was considerably loosened up, and thus was prepared the way for the migration of the winged insects, which occurred about the twentieth of August, when they could be found in considerable numbers crawling about upon the small lumps of earth, preparatory to taking wing. Only one was actually seen to fly up to the vine, although others were found quietly fixed upon the under side of some of the leaves. This, passing through the loosened earth, and later, through the unmolested soil, continued up to the present time.

The insect, in various stages of development, could be found in the earth from the surface to the roots, the most incomplete forms being found deepest below the surface of the ground. Some were found under stones, and in such positions as to place it beyond a doubt that they passed through the changes under-ground, and came to the surface in a transformed condition, contrary to the accepted belief of a transformation at the surface of the ground.

A peculiar circumstance was noticed on the twentieth of August, in the appearance of a large number of larvæ upon the surface of the ground. They were found as much as two feet from the stock, and from three to twelve inches from the fine roots, as well as through the soil to the roots. The significance of their appearing in this manner can be appreciated when we learn that they crawl upon bits of rubbish, sticks, leaves, etc., upon the spot, and even take kindly to growing canes placed in their way.

Up to August twenty-sixth no specimens of the gall louse, or leaf-inhabiting form of the phylloxera, had been identified at the University, or elsewhere in California, so far as known. At this time the fresh young leaves near the ends of three canes, which stretch from a "Canada" vine toward the infested stock, bore a few peculiarly formed galls, containing egg-laying mother-lice as well as eggs, and numerous larvæ. A few isolated and abandoned ones were also found on the old leaves, nearer the stock of the vine. It thus seemed probable that the root-inhabiting form had here changed its habit toward that of the gall louse, a point still held in dispute by the French scientists.

An attempt was, therefore, made to produce more galls upon the foliage of the "Canada" vine, by infecting it with larvæ from the roots of the adjoining infested stock. A cane was led from the opposite side of the resistant vine, and its terminal leaves fastened to an infested spot of soil. The leaves and part of the canes were soon covered with young larvæ, and a few quiet winged insects, the former passing freely about upon the leaves, but forming no galls, or, at least, only doubtful and abortive attempts. Some of the young leaves upon the infested canes were pierced by young larvæ, which had settled just outside of the fresh galls, and had remained until a red, dead spot had been formed. Others of the larvæ were seen crawling about; but they did not seem to establish galls. Contrary to the usual habit of the gall louse, they kept mostly upon the *under* side of the leaf. It thus appears that, at least so late in the season, the change of habit from root to leaf is not readily made.

Of the known *enemies to the phylloxera*, only two forms were identified during our observations. The *phylloxera thrips* were seen passing about in considerable numbers upon the leaves, and some even came from the galls, many of which they had cleared of their inhabitants. A few specimens of the *tyroglyphus*, or *phylloxera mite*, appeared among the winged insects that were taken from the "trap." They were also found upon the roots of adjoining vines. It is, therefore, probable that its usual enemies have accompanied the phylloxera to California.

Several practically important conclusions result from the above observations. It appears that the light summer rains of the season have favored, to an extraordinary degree, the development and activity of the pest, especially of its winged form, most dangerous as the carrier of infection; and that this form was developed through the months of July, August, and September, and a part of October, while the numbers and activity of the larvæ, in ascending through and diffusing themselves over the soil, was greatest toward the end of August. Any measures to prevent the spread of the insect during the season should, therefore, be taken prior to August, at least.

It is also shown how readily the young insects will ascend through the soil from superficial rootlets, and will attach themselves to any object lying in their way, so that infection may be carried readily from one vineyard to another by the mere passage of a wagon, plow, or other implement, as well as through fruit boxes, prunings, and cuttings. Especially are the eggs of the winged form liable to be thus carried, even by gusts of wind taking up leaves, etc. The gall louse form, now also recognized here, adds danger to this vehicle.

Finally, it is clearly shown that, in ordinary soils, no preventive used only *around the stock of the vine*, can offer security against the ascent of either the winged or wingless form to the surface from outlying shallow rootlets, from which they can freely migrate to other uninfested stocks; and that, therefore, the utmost care alone can check the progress of the pest after it has once gained a footing.

BERKELEY, October 10, 1884. F. W. MORSE.

The record of the observations, upon which the above statements are based, together with additional observations made during 1885, are given in the subjoined report of Mr. Morse:

1. OBSERVATIONS ON THE LIFE HISTORY AND HABITS OF THE PHYLLOXERA IN CALIFORNIA.

Made from 1881 to 1886 by F. W. Morse, Assistant in the General Agricultural Laboratory.

In the following pages I give a summary of the results of observations made upon the phylloxera, since its discovery in the University vineyard plot in November of 1881. Partial reports of the same have already appeared in previous publications of the Agricultural Department, the whole of which, with additional observations made since, are here arranged in a somewhat modified form.

The subject was taken up immediately after the discovery of the insect, the object at first being simply to study the more prominent types here, in order to become familiar with the prevailing forms generally known to exist in other vineyards; and, also, to note any special habits wherein they might differ from those observed in other countries. No special attention was originally intended to be given to the prosecution of new investigations tending toward the settlement of disputed points regarding the biology of the insect.

No stated time was set apart for this work, which has at all times been carried along in conjunction with other University duties. The available apparatus, too, has not always been all that could be desired for obtaining thorough and complete results.

At the outset, only one form of the insect was recognized, but as the work advanced, new and unfamiliar forms continually appeared, until we have, by a happy coincidence of special fitness of vine varieties and surroundings, witnessed the production of most of the forms known to foreign investigators.

The importance of such a line of investigation, under such circumstances, becomes apparent, when we consider that among the various forms which the insect is capable of assuming only a part, and these of the forms which are least easily spread, have thus far been seen in appreciable numbers in California vineyards. A solution of this apparent divergence from the habits of the insect, as observed elsewhere, gives direction to the investigations which have been carried on.

THE UNIVERSITY VINEYARD PLOT.

The University vineyard plot, in which the field observations were made, and the specimens for laboratory work were taken, is situated upon the north side of the University grounds, and upon the extreme east of that part of the tract which was placed under the control of the Agricultural Department, and set apart for experimental purposes. It has a southeast exposure, which renders it somewhat more favorable than the lower lands to the earlier "putting out" of the vine and consequent longer season which is needed in this locality.

The soil is a heavy, refractory clay loam, not easily cultivated except upon the surface, and is underlaid by a stiffer clay at a depth of a few inches, followed at a slightly lower depth by an intermixture of coarse gravel and rocks, thus forming a soil ill adapted to vine growth, and a subsoil not easily penetrated by the roots. The plot, which is from the nature of the soil difficult to drain, is relieved of this trouble, to a great extent, by the steep inclination and loose-walled bank on the lower side.

The total number of old vines (and some young ones intermixed, which

have been grafted on resistant stocks) amount to only sixty-eight, including, beside the common *vinifera* varieties, some that in other countries have shown special fitness for certain forms of the phylloxera, and which are not found among the infected vineyards of our State. Some of these are hybrids of stock, elsewhere bearing the gall type of insects in abundance.

Thus we have been specially fortunate in having a collection of varieties which, presumably, make it possible to produce and study all types that have been observed elsewhere.

The Winter State of the Insect.—The first important point to be considered was to determine the habits and movements of the insect at different seasons of the year, and especially to note their condition during the winter. This was accomplished by repeated examinations during each of the winter months, of vines most productive of the insect. No obvious movement to lower parts of the root-system, such as was predicted, was noticeable; but merely a dying out of the different forms upon the older and most decayed parts of the root; the healthier fibers and wood always supporting the insect most abundantly. Even in mid-winter the wingless root form appeared clear to the surface, and even above the ground, where tuberous spots afforded them nourishment and protection. If the winter proved too severe, portions of the root-bark were often found covered with black "lumps" of dead phylloxera mingled with small and shriveled brown ones, in positions similar to those in which they were found late in the fall.

Field Observations during the Season of 1881–2.—The observations during the winter of 1881–2, which was cold and was followed by a late spring, revealed the insects numerously settled upon all parts of the roots and even in mid-winter at the surface of the ground on the base of a last year's sucker. On December eighth the insect was found in decreasing numbers on the old roots, and confined to groups of five or six on the healthiest parts of young roots. They were mostly of the mother form and only a few larvæ. Later in December the preponderance of the mother form was still apparent, and the general settled conditions of the groups was specially noted.

Frequent examinations during the months of January, February, and March, showed no special change, save a more sluggish condition and a darkening of color.

It was not until the twenty-eighth of April that signs of returning life were visible. Scattering eggs, in groups, from three to five in number, very transparent and quite large, were found surrounding some of the more mature insects which were then becoming yellow but still seem not to have moved from their winter positions. No very young larvæ were to be found, although they were soon after, May first, hatched from a bottled specimen taken from the vineyard at this time and placed under more favorable conditions, in a warm laboratory. A casual examination of specimens put aside in an unsealed fruit-jar proved the roots to be literally covered with insects, only a few of which were mothers; the remainder consisted of young larvæ and eggs. The warm and even temperature of the room was undoubtedly the cause of their earlier activity, and demonstrates the fact that a relatively high temperature is all that is required for the continuance of activity during the winter. This presumption is further borne out by their earlier appearance in 1884, when the spring was fully six weeks in advance of an average year. In the early part of March, before the begin-

ning of the budding of the vine, specimens could be found which would do credit to the insect under the favorable conditions of fall.

The month of May showed a slow but steady increase of the different forms, beginning particularly under the bark of older roots and later increasing most rapidly on fibrous roots of the present year's growth. The insects seemed to be of a more greenish color than at other times. A marked increase in the rapidity of production was noticeable during the last days of June; still the spread had not yet become general for the season.

First Appearance of the Winged Form.—It was in the following month (July, 1882), that the first indication of the winged form appeared. Insects resembling larvæ were found, with black antennæ and legs, and upon each side of the back, extending along the body, were dark spots, covering the rudimentary wings which distinguishes this as the wing-pad, or "pupa" stage of development. One of these insects was preserved, and by the twenty-sixth of July had developed into a small, live, fertile winged phylloxera, and was transferred to a small vial, where she laid a single egg and died. Others of these pupæ were found later without much difficulty on similar roots; and others of the winged form have since been easily developed. Their changes during metamorphosis into complete forms were watched with exceeding interest, but need not be described here.

Some of the insects which were most developed, and had the wing-pads well formed, were placed upon a glass slide, covered with a watch glass, and then properly arranged under a microscope. The transformation soon took place. A shedding of the skin precedes the spreading of the wings, and is begun by the dark skin separating horizontally over the wing-pads, a part shedding toward the abdominal segment, and the remainder passing over the head and legs, thereby changing these members and the antennæ to a much lighter color. This operation, in one case, was completed in about fifteen minutes. The wings, which appeared to be folded in a light-colored bunch directly across the back, now part in the middle, giving them the appearance of two white or light-colored sacks. These gradually expand laterally from the base, continually carrying the apparent casings in a bunch at the end of the wings until the full length is reached, after which the greater part of the spreading is done. The whole apparent casings are merely folded wings.

One hour and fifteen minutes was consumed in passing from the beginning of the shedding of the skin to the complete winged insect, which soon became active and began crawling about. The body of the insect, in the meantime, had passed from a light hue to a more intense dark yellow, or golden color, while the wings, which before the moulting were black, pass to a light, or white opaque, then become transparent, and, as they spread, become thinner and darker, and in the fully developed condition are almost black.

A newly developed winged insect was taken from a moist bottle and placed upon a glass plate, where she soon made attempts to fly. Her wet wings were repeatedly brought perpendicularly over her back and rubbed together, apparently to free them from moisture, and then she attempted to leap, or fly, often raising, by a peculiar curve, from two to six inches high. With the last attempt she flew away.

Roots Producing the Winged Form.—The vigorous, bushy, fibrous growth, or network of roots around the tap-root, evidently caused by manuring and moisture, seemed best to fulfill the necessary conditions for the develop-

ment of the winged females. It was later shown that these fibrous roots were specially productive of this form; in fact, it is very seldom that it is found on other roots.

Conditions of their Development—Invasion of 1884.—Here it may be well to suggest as a possible explanation for the greater production of the winged form in France, that the more thorough fertilization of the vineyards in that country has favored a more general growth of the surface roots upon which the winged form is mainly produced; also, that the late spring and summer rains bring about a similar condition of growth. The summer rains alone of France, which last far into *August and September*, would be quite sufficient to produce surface roots of the kind required to produce winged insects in great abundance. It is just previous to this time that the winged invasion occurs, when the insect is carried in swarms to adjacent vineyards This is a point which I believe has never been suggested, and the truth of which seems to be supported by experience in this State, for neither of the conditions spoken of is ordinarily realized to any extent in California. But the unusual summer rains that occurred in 1884, and which were followed by such a great general development of insect pests in 1885, seemed to impart also to that of the winged phylloxera a similar impetus; as for the first time since observations were begun, this form was during that season found to issue in swarms like those observed elsewhere, doubtless greatly increasing its spread.

We are further justified in supposing that there must be some peculiar condition for their development in districts where only occasionally evident signs of their workings are visible; and in no case have the winged insects been found in such numbers as were developed in 1884.

At the middle of October, 1882, the insects were still numerous, eggs plentiful, and the mothers still laying; the winged form had entirely disappeared. About the middle of November I found only one of the mother-lice fully developed; the remaining insects scattered over the roots were young larvæ, healthy and quite active. Some were blackened and lifeless, but still retained the larval form. Only one egg was found.

December twentieth none of the mother insects could be found; only larvæ, bright but motionless, were present.

Summary of Observations in 1881–2.

The condition of the insect during different times of the year may therefore be summarized as follows: There is a dull, lifeless condition of both larvæ and mother lice during the winter, lasting until about the middle of April of a late season, when the hibernating mothers begin to lay their eggs. The young larvæ soon begin hatching out and scatter to all parts of the roots. The increase is very slow until the middle of June. The winged form begins developing about the first of July. Eggs are most numerous about the last of July or first part of August. The old mother lice are soon found in decreasing numbers, and young larvæ are most abundant. A gradual decrease in the number of insects begins about the first of October. No eggs, or scarcely any, are to be found after this month. Very little action or life is noticeable after November.

Observations in the Laboratory, from 1881–1885.—For the better verification of the facts observed in the field, and especially for the observation of the habits of the insects during propagation, a series of laboratory experiments was carried on simultaneously with the field observations.

Conservation of Root Specimens.—The first difficulty met with was to preserve the root specimen in such a shape that it would not mould, and yet remain sufficiently moist to afford sustenance to the insects. This is best accomplished by placing a piece of root containing the required number of insects into a wide-mouthed bottle, supplied with a close fitting cork. If it becomes necessary to remove the cork very often, a few drops of water may be dropped into the bottom of the bottle to supply any lost moisture, and then, by regulating the temperature, the water can be vaporized and condensed so as to reach all parts of the root. Some specimens were kept in the sunlight, with a good circulation of air through the bottle, but the insect did not thrive under this treatment. Roots thus treated are more difficult to keep in good condition, and the insect becomes more restless. A cool dark place seems best fitted for these experiments.

The leading questions studied were:

1. Number of eggs laid by each mother louse.
2. Rate of laying.
3. Time required to hatch them into larvæ.
4. Time from the hatching of larvæ to the egg-laying age.
5. Pupa form.
6. Winged form.

Number of Eggs Laid.—Two or three specimens containing isolated mothers were placed in bottles and observed every few days. The highest number of eggs from any of these insects was about seventy-five. Numerous bottled roots have specimens of sixty to seventy eggs and larvæ together. It is not uncommon to see a nest of forty to fifty in a row, upon one end of which the young larvæ are just hatching out and moving away, while at the other end are newly laid eggs and the old mother, now reduced to a very small, dark colored ball without apparent life or insect shape. This large number is not so frequently found in the vineyards.

The most prolific insects do not seem to produce a generation of the numerous egg-laying kind. As soon as the eggs are hatched into larvæ the latter move away, while those insects producing eggs that are destined to become laying mothers lay but few eggs, which when hatched move less rapidly than the other kind, and are often found in groups.

Rate of Laying and Time of Hatching.—To determine the rate of laying, properly isolated individuals were watched during their complete season of laying. The rate was found to be very irregular, depending largely upon circumstances. It often amounted to five per day, while at other times the insects ceased laying altogether for several days. A single individual laid thirty-five in seven days; another thirty-four in two weeks. At the end of four weeks the whole generation had left the spot. The relatively limited supply of sap furnished by a detached root probably served to restrict the number of eggs laid. Still another insect, under less favorable circumstances, surrounded by a meniscus of water, which kept her almost submerged, continued laying for a much longer time and at a much slower rate. It was found that it required about thirteen days to hatch the eggs.

Duration of Larval Condition.—By deducting the time for hatching from the total number of days from the first egg-laying to the egg-producing period of the second generation, we have the time of the larval condition. This was found to be about seventeen days.

PUPA FORM.

Much interest attaches to this form, since it is through it that we know the conditions which will produce the winged form. The latter is found with great difficulty upon the vine, while the former is readily distinguished among its associates, the common root louse or larva, which is first sought after in the examination of an infested vineyard. The pupæ once found, it becomes easy to trace them to the winged form, which is usually near by.

Conditions Governing the Production of Pupæ.—My first observations on the fertile winged form were made on specimens accidentally produced in the laboratory. By tracing back to its origin the root upon which these first individuals were found, the needful conditions and surroundings could be determined, and thus the winged form could be sought for more intelligently, and found in greater numbers. As before noted, the small, soft, fibrous rootlets of the current year's growth had seemed to be most productive of the form from which the winged insect is developed. (See page 166.)

Movements and Transformation of the Pupa Form.—The movements of the pupa, or wing-pad insect, observed chiefly during 1884, were not found to be altogether along the smaller roots and thence up the main body to the crown of the root, as is usually supposed, but the insects frequently left the roots and passed up through the soil, which in no place was less than three inches deep. This movement afforded an excellent opportunity for determining where the transformation into the winged form takes place.

The insect in various stages of development could be found in the earth from the surface to the roots, the most incomplete forms being found deepest below the surface of the ground. Some were found under stones, and in such positions as to place it beyond a doubt that they passed through the changes underground, and came to the surface in a transformed condition, contrary to the accepted belief of a transformation at the surface of the ground.

THE WINGED FORM.

The late rains of the Summer of 1884, the season in which nearly all the field studies of the pupa and winged form were made, produced a generous supply of the white, club-shaped rootlets, thus enabling us with properly arranged "traps," and bottles buried in the soil, to study the winged and other forms. A beaker was also inverted over some of the bared roots, and in one or two days an abundant supply of the winged form was found flying about, and crawling upon the side of the beaker which was most exposed to the light and warmth. The young larvæ which left the roots for the smooth glass constituted a large proportion of the active insects. A bottle which was in a cooler place, showed them in far less numbers.

A steady and rapid production of winged individuals ensued from the beginning of the experiment, August twentieth, through September, and a few were developed even later. A large number of the confined winged insects soon laid eggs, often as many as five for each individual. None of these eggs, however, were observed to hatch; hence no sexual individuals were produced.

Migration of Winged Insects.—In arranging the glass jar "traps" the soil was considerably loosened up, and thus was prepared the way for the mi-

gration of the winged insects, which occurred about the twentieth of August, when they could be found in considerable numbers crawling about upon the small lumps of earth, preparatory to taking wing. Only one was actually seen to fly up to the vine, although others were found quietly fixed upon the under side of some of the leaves. This passing through the loosened earth, and later through the unmolested soil, continued up to the tenth of October, when the rains fallen a few days before put an end to the development.

We had thus a continuous movement of this form coming to the surface of the ground, not only from the loosened earth, but as was seen later, also from the harder and unmolested soil. This was kept up until the fibrous roots were destitute of pupæ, though still badly infested with young larvæ.

After the discovery of the winged form in the University vineyard, a considerable increase in numbers was noticed elsewhere. Never before had it appeared so plentifully as during the summer of 1884. While the peculiarly favorable conditions of root growth found at Berkeley may not obtain in all vineyards elsewhere, still equally favorable ones may be presented. Yet, the more numerous cases of obvious rapid devastation raise a strong presumption in favor of the belief of a more widespread increase of this pest since, than before 1884.

Movement of Young Larvæ through the Soil.—A peculiar circumstance was noticed on the twenty-sixth of August, 1884, in the appearance of a large number of larvæ upon the surface of the ground. They were found as much as two feet from the stock, and from three to twelve inches from the fine roots, as well as through the soil to the roots. The significance of their appearing in this manner can be appreciated when we learn that they crawl upon bits of rubbish, sticks, leaves, etc., upon the spot, and even take kindly to growing canes placed in their way.

Just how far they can travel on the surface of the ground in this manner we are not able to say, but certainly it increases the probability of their being transported upon boxes and loose packages which are scattered so promiscuously about the vineyard at that time of the year. It further shows that the insect is not altogether dependent upon interlacing roots beneath the ground for the means of spreading from vine to vine. Small lumps of earth below the surface of the ground, supplied with the smallest rootlets, were thoroughly infested with the insect. Thus it is evident that the rapidity of infection, or spreading, will surely be influenced by the nature of the soil, *i. e.*, the greater or less facility with which the insect can travel over it, or along the cracks in heavy soil. In sandy soils the progress of the larvæ is very slow and toilsome.

THE GALL LOUSE.

Up to August twenty-sixth, 1884, no specimens of the gall louse, or leaf inhabiting form of the phylloxera, had been identified at the University, or elsewhere in California, so far as known. At that time the fresh young leaves near the ends of three canes, which stretched from a "Canada" vine toward an infested stock, bore a few peculiarly formed galls, containing egg-laying mother lice as well as eggs, and numerous larvæ. A few isolated and abandoned ones were also found on the old leaves nearer the stock of the vine. This arrangement of a few isolated and odd galls nearest the stump, and the peculiar fact that all the canes infested are suckers coming from near the surface of the ground, suggests the probability that the infection comes from the roots of the vine rather than through other

means. It is also noticeable that one of these canes passes directly up through a portion of the foliage, and still does not infect the adjoining canes. Why the gall louse should appear just at this time, when the conditions for the rapid production of other forms were favorable, and not at other times, is a question not easily answered. We are aware that similar freaks of change have occurred in eastern experience in numerous localities, where in 1870 the gall louse prevailed largely, the following year it had almost entirely disappeared, or in some instances had attempted, with more or less success, to locate upon other varieties. The change during that same year even extended to France, showing that atmospheric changes could not be its sole cause.

Influence of Root Conditions.—It is more probably attributable to the influence of the root. During the whole investigation there has been noticed a very decided effect upon the different forms, caused undoubtedly by the nature of the roots upon which the insects are living. In our laboratory experiments the larvæ are much smaller, more active or restless, and apparently more numerous than upon roots in their normal state; our specimens being, of course, drier, and in a poorer condition. The wing-pad insects, in the vineyard, are formed only upon the smallest and most tuberous roots, and in proportionately decreasing numbers as the roots become harder, scarcely ever appearing upon those which have become tough and woody.

Identity of the Root and Leaf Louse.—Regarding the above anomalous appearance of the gall-louse type, it should be noticed that it has come upon a vine which has had no communication with any outside of those with which it has been associated for years, and probably has had no way of becoming infected with any foreign type. If, as some maintain, there be no direct relation between the two types, how is it that the vine has borne them for a single year only, and that they have not appeared again in 1885? They came at a time, too, when we know that the temporary change of the nature of the root system of the vine, caused by seasonal peculiarities, had materially changed the nature of the other forms produced upon them. It is said that climatic changes influence, to a certain extent, the type which shall predominate. If it holds in this case, it must be through the stimulating influence of climate on the peculiar root growth which made possible the development of a large number of winged insects, which may possibly have been the means through which the gall-type were developed; all extraordinary growth of vine having disappeared before the gall type had been noticed to any extent. It at least seems probable, that the root-inhabiting form had changed its habit toward that of the gall-louse.

So soon as this opportunity of studying the relations of the two types was presented, an attempt was made to infect a clean cane of the "Canada" vine with the root-louse coming from the "Cornucopia" and appearing upon the surface of the ground.

A cane was bent from the opposite side of the resistant vine, and its terminal leaves fastened to an infested spot of soil. The leaves and part of the canes were soon covered with young larvæ, and a few quiet winged insects; the former passing freely about upon the leaves but forming no galls, or at least only doubtful or abortive attempts. Some of the young leaves upon the infested canes were pierced by young larvæ, which had settled just outside of the fresh galls, and had remained until a red dead spot had been formed. Others of the larvæ were seen crawling about; but

they did not seem to establish galls. Contrary to the usual habit of the gall-louse, they kept mostly upon the under side of the leaf.

In fact, there were very few galls formed except upon the smallest leaves. One of these delicate leaves, an inch square, bore about thirty galls, a large proportion of which contained young larvæ which were easily seen by looking through the leaf toward the light. Some galls even contained the mother, larvæ, and eggs.

It thus appears that, at least so late in the season, the change of habit from root to leaf is not readily made.

Enemies to the Phylloxera.—Of the known *enemies to the phylloxera*, only two forms were identified during our observations. The *phylloxera thrips* were seen passing about in considerable numbers upon the leaves, and some even came from the galls, many of which they had cleared of their inhabitants. A few specimens of the *tyroglyphus*, or *phylloxera mite*, appeared among the winged insects that were taken from the "trap;" they were also found upon the roots of adjoining vines. It is, therefore, probable that its usual enemies have accompanied the phylloxera to California.

There have been other specimens of the same seen at different places, especially on roots taken for experimental purposes. Some were found on the fourteenth of April, the root specimen having been taken nearly a month before.

Varieties of Vines Bearing the Several Forms.—In speaking of the forms found during the investigations, it must not be understood that all of the vines are productive of the same forms; nor must it be understood that when we speak of the rapid production of any particular form that this applies to all the vines infested. We are specially favored in this direction by having in our vineyard plot a few vines representing those varieties which are more or less resistant to either type of the phylloxera. Only one vine has developed the gall type, only one has produced the winged form in appreciable numbers, others only when transiently assuming the necessary conditions have produced them at all. If a slight growth of soft "tuberous" rootlets be formed, we *may* find pupæ upon them; but upon the rootlets of the same vine having a firmer texture none will be found. Upon the "Cornucopia," however, this adaptability of rootlets to the production of the winged form extends to roots of a larger and firmer growth. This hybrid of the West's St. Peters and Clinton has produced all the forms we have thus far observed, except the gall type, thereby showing a special fitness for the production of the root-inhabiting types.

Here, too, we should note the peculiarity of these two vines, adjoining each other, hybrids of the same original varieties, one producing the gall type and not specially adapted to the root type, and the other producing all forms of the root type with great ease and during the longest period, but in no case bearing galls. Nearly all the observations in the past have been taken from this vine. It still remains strong and vigorous.

Danger of Spreading by the Winged Form.—The fact that the winged form, so far as it appeared in considerable numbers, was limited to a single vine in our vineyard plot, necessarily diminishes greatly the probability of its spreading to any other vineyard district from this place, and by this form. If all the vines were equally productive of the winged insect, the probabilities for infection would certainly be greatly multiplied; but there would still be great doubts as to whether they would be carried to any great dis-

tance and find lodgment in a spot where the proper conditions for continued life obtain. The winged insects have mostly been found crawling upon the ground quite near the vine, being thus protected by the foliage above them from the winds which might otherwise take them up into the air and transport them to other districts. A few scattering ones only have been found on the foliage, but the thick screen of trees and the ranges of high hills in the direction of the regular winds prevailing at their time of development, renders any actual danger from this source exceedingly remote.

COMPARISON OF EASTERN AND CALIFORNIA TYPES.

As a basis for comparison of the forms which have come under our notice with those known to exist elsewhere, I insert the following tabulated arrangement of the various forms which this insect may assume, as presented in a report by Professor Riley. It shows at once the complexity of its forms, and the diversity of its habits:

I.—The gall-inhabiting type, forming galls on the leaves, and presenting:

a. The ordinary egg with which the gall is crowded.

b. The ordinary larva.

c. The swollen, parthenogenetic mother, without tubercles.

II.—The root-inhabiting type, forming knots on the roots, and presenting:

aa. The ordinary egg, differing in nothing from *a*, except in its slightly larger average size.

bb. The ordinary larva, also differing in no respect from *b*.

d. The parthenogenetic, wingless mother, the analogue of *c*, but covered with turbercles.

e. The more oval form, destined to become winged.

f. The pupa, presenting two different appearances.

g. The winged, parthenogenetic female, also presenting two different appearances.

h. The sexual egg or sac deposited by *g*, being of two sizes, and giving birth to the true males and females.

i. The male.

j. The true female.

k. The solitary impregnated egg deposited by *j*.

bbb. The larva hatched from *k*, which, so far as is known, differs not from the ordinary larva, except in its greater prolificacy.

l. The hibernating larva, which differs only from *b* in being rougher and darker.

Forms Observed in California.—In the course of our work we have met all the forms thus far known in the gall-inhabiting type: in the root-inhabiting type nearly all of the active forms represented in the table have been observed. They have been developed up to the production of what we have called the true sexual individuals, or, as designated in the table, the true male and female. The winged females, which developed upon the roots and were caught in the trap, laid the sexual eggs, but none of them produced the individuals which would naturally have followed. No reason can be given for the failure, more than the suggestion that the conditions may not be favorable in a glass vessel for the production of the form whose natural home is upon the leaves or stock. There is, also, a possibility that these eggs may not hatch even when under favorable conditions in this district; for the winged insect has been repeatedly seen upon the stock and leaves in a perfectly quiet condition, but no eggs have ever been found with them. In fact, no eggs of any kind have ever been found upon the upper

part of the vine. When the insects are confined in a vessel the eggs are soon laid.

Winter Egg.—The solitary egg, commonly called the winter egg, has also not been found, although it has been the object of diligent search at all times. It is to this form that much attention is being directed in European countries, as its extinction offers a possible means of checking the ravages of this pest. It is also supposed that a close relation exists between this egg and the gall-type. If such a relation does exist we should have found this form later in the summer upon the vines which bore the gall last year. A careful search did not reveal it last winter.

Probable Underground Development in place of the Winged Form.—The larvæ from the winter egg, of course, we have not met as a product from the natural course of development through the winged form, but their appearance may have escaped our notice through the other parallel line of development which is accomplished entirely underground, and which is described as differing only in its possible greater prolificacy from the ordinary root louse.

This line of production may have been that from which come the insects noted in a previous report (1882). Their peculiar appearance at the time led to doubts as to what stage of development they really represented. It was even conjectured that they were the sexual individuals.

Professor Riley has omitted to mention in the table this supposed underground male and female spoken of by M. Balbiani, which does not pass through the winged state. According to this belief, a form similar to that produced by the winged insects may be developed on the roots and pass along the main trunk to the upper part of the vines and deposit eggs in positions similar to those selected by the winged form. This peculiar phase of development would assist in explaining some of the peculiarities regarding the continued prolificacy of the species in California where the true male and female appear so rarely, if at all. They may mingle with the common form which is so often found in considerable numbers two or more inches above the ground.

There is generally a marked distinction between the appearance of the young larvæ which are to develop either into the winged form, or are to become mother insects upon the roots. The latter being decidedly dull in habit, and pear shaped, are quite easily distinguishable; the former are not so easily recognized until the wing-pads begin to appear, but by this time they are already so far developed that they become less active, and in bodily form answer more nearly to the description of the wingless type. But then there has been noticed on some of our specimens among these larvæ, another form, which in activity and outward appearance closely resembles the undeveloped winged insect. It is of a very bright color, apparently smooth, and seems to separate from the remainder of the generation as soon as it is capable of moving. It is in fact never found in clusters, and mostly upon portions of the roots which do not show signs of having been attacked. These insects seem to be the explorers for the more sturdy productive ones which follow them. Their peculiarities place them undoubtedly upon the side of the winged form, and as there is presumed to exist a similar line of development, save the formation of wings, we may justly conjecture that this is the form corresponding in the biological series to the winged form, though never developing wings.

Hibernating Forms.—The hibernating larva is the final form of the year's development, upon which the future multiplication of the insect is dependent. This, and the winter eggs, serves to carry the insect through the winter. It seems, according to our observations, that this special precaution is not necessary, and is therefore not apparent in the California climate. Our winters are so mild that merely a cessation of work is noticeable, and not an extermination of the common forms. The young larva of the common egg-laying insect acts as hibernants without any apparent special preparation, and it seems to brave our winter without any trouble. The mother insect can also be found, although with difficulty. The larvæ themselves, in some cases, seem to have assumed some of the qualities of the true hibernants, for they are strong, and usually darker in color, often almost black.

In connection with the habits of the phylloxera during hibernation, an instructive sample of infested root was preserved this year, in an open vessel, filled with moist earth. The root was protected from the earth and placed so that it could be watched through the sides of the vessel without being disturbed. Scarcely any change has been noticed since October fifteenth, when the specimen was prepared. Although the conditions have been quite similar to that of ordinary vine growth, except somewhat drier, there has been no movement to other parts of the root corresponding to the supposed movement of the phylloxera to lower roots when winter comes on. The insects have become somewhat darker, well developed young larvæ, with no appearance of the adult larvæ form. Up to February, 1886, there has been no appearance of reviving or moving about, still the extremities of the insect are extended and can be plainly seen as in their natural condition in summer. It is to be hoped that interesting facts may be gathered regarding moulting, and change of form, when they revive later in the spring.

In previous cases, where no soil was used and the temperature of the laboratory influenced them, eggs have been produced in mid-winter, and production continued until the root had decayed.

The soil of the above sample was moistened in December, and a good supply of grass roots and shoots started, but have since dried up.

It has never before been shown that the winter habits in California differed in the least from eastern countries. The winter of 1884–85 has shown that California climate is specially favorable to the life of the phylloxera. A period of three months will almost include the total time of inactivity, for we find active insects on the last of November, and newly-laid eggs on the first of March.

Moulting of Hibernants.—It is usually supposed that a certain number of moultings is necessary before the hibernants assume the mother state. This, I think, is only partially true here, and applies, if at all, to the youngest insects which pass as hibernants, and which were not fully developed when winter came on.

Numerous specimens have been carefully watched during the proper period, and no movement whatever was noticed until the insect began laying eggs. It was further observed that the abundance of young larvæ found at the close of the season in November were in about the same position, and apparently not changed in the spring when egg-laying began.

Sterile Winged Form.—The table speaks of two different appearances of the pupa and winged form. Undoubtedly this means the fertile and sterile kinds; the former alone has been produced during our experiments, although

it was through the latter that the winged form was first found in California. These were observed in 1879, by Dr. Hyde of Santa Rosa, and were identified by Professor Hilgard to be of the infertile variety. These are the only individuals of the sterile variety found thus far, and they came from rather large-sized woody roots, such as are usually found near the surface in ordinary California summers. May we not reasonably conjecture that the unusual summer rains of 1884, causing an unusual abundance of white surface roots, have also been instrumental in developing exceptionally the normal fertile winged form?

Mode of Attack on Different Vines.—There is one point worthy of note as throwing some light upon the resisting power of vines; it is the manner of the insects' attack. In the common *vinifera* even, they show preference for particular spots on the roots, selecting those places where the bark is softest, usually near a crack. From this they extend upward and downward along the line where the tissue is continuous from that spot; and scarcely ever do we find them working at right angles from this line. When the sap begins to ooze out and rotting sets in, they precede it closely, always leaving a number of insects to continue the destruction until the spot becomes completely rotted and gives out no more sap. Large numbers of insects will often be found feeding upon such spots, apparently reluctant to leave them as long as any sustenance can be derived therefrom. So carefully is this mode of working followed, that on many old Mission vines they will be found only on a single spot, while the remainder of the root is free from them. A root covered with a furzy bark is noticeably objectionable to them, a harder one with cracked or loosened bark is preferred.

Upon a thoroughly resistant stock the insects act quite differently. They are usually scattered about apparently at a loss to know just where to begin operations. Their first piercings are made, and instead of a deep rotting which completely kills the bark to the woody tissue, a slight, thin blackening of the bark takes place, which does not extend further, and, if made on the finer rootlets, will often peel off, leaving the root perfectly smooth.

REPRESSION OF THE PHYLLOXERA.

The grave problem of the repression and, if possible, extirpation of the phylloxera, evidently continues to form an attractive subject of reflection to many persons. Unfortunately, the desire to discover an available remedy is but rarely accompanied by such thorough knowledge of the habits of the insect as would enable the inventor to foresee the difficulties which may lie in the way of success; and thus the list of bootless propositions in the premises is still suffering a steady increase. Seven or eight such propositions have, in the course of the past two years, been made to this department, sometimes accompanied by a clear statement of the plan proposed, at others simply desiring to have the proposed remedy applied and tested in the University vineyard plot. Some of these remedies are still under trial, having apparently produced a favorable change; but nothing thus far brought forward has seemed to give any reasonable promise of success in curing vines once infested, although heavy fertilizing may for the time invigorate them. The most promising of all thus far—the mercurial treatment proposed by Mr. J. A. Bauer, of San Francisco—is more elaborately considered below; but for the benefit of those who are still wrestling with the

problem, the substance of Bulletin No. 3, of the Agricultural Experiment Station, issued in January, 1884, is here reproduced:

BULLETIN No. 3.

REMEDIES FOR THE PHYLLOXERA.

In answer to numerous inquiries received regarding the possible efficacy of various insecticide remedies against the phylloxera, and particularly with reference to the one lately suggested in France by M. Cramoisy, the following summary of the main points is abstracted from a bulletin published by this department in 1880:

"It is not difficult to find a great variety of substances that will kill the insect without materially injuring the root of the vine. The difficulty lies in their economically practicable application. Any such remedial agent, in order to be effective, must, in the case of a bearing vineyard, reach not only the entire surface, but must penetrate the soil to a depth not less than three, and frequently as much as eight feet in open soils. It is quite useless to propose to 'bare the roots of the vine' for any insecticide application on the large scale. In a bearing vineyard the roots and rootlets form one matted mass all through the soil over the entire field, and it is at the remote ends that the insect forms its largest and most flourishing colonies. To bare all these is practically impossible, and would in any case involve an amount of labor incompatible with the profitable maintenance of the vineyard; especially if, in addition, the insecticide is to be carefully applied to all, and soaked in with water, as is mostly suggested by the proposers of such impracticable schemes.

"There are obviously only two practicable modes of giving the insecticide agent the wide distribution called for. One is to apply it in solution in water; the other, to make it penetrate the soil in a gaseous form.

"Water alone, if applied continuously for from thirty to forty days during winter, by flooding, accomplishes the object to the extent to which it seems feasible where the phylloxera has once obtained possession; that is, to so far decrease its numbers as to render it harmless for one or two seasons. Where flooding is impracticable, and a quantity of water sufficient to saturate so large a mass of soil has to be put on the ground by artificial means, and at the same time charged with a more or less expensive insecticide, the cost readily becomes such as to exceed the value of the vineyard. This is largely due to the fact that the soil is a powerful absorbent of almost all substances soluble in water, thereby rendering them inactive toward animal life for the time being. The same disinfecting property of soil that enables it to purify the foulest water filtered through it, without itself becoming offensive, also serves to render ineffectual a large proportion of any poison that may be introduced in watery solution. It is only after the soil has become saturated with it to a certain (very variable) extent, that a remaining portion can become effective. Hence, the amount needed of any insecticide, when used in the soil, is very much greater than that which would be required if water were to be applied to the insect directly. A solution of carbolic acid, or a tea of the 'Persian insect powder,' that would be instant death to an insect sprinkled with it, becomes inodorous and harmless when filtered through a few inches of soil; and the same is more or less true of all kinds of poisons. It is, therefore, clear that only such as combine cheapness with a high degree of efficiency, even in a very dilute form, can be thought of for any practical purposes.

"The same relations that exist between earth and substances dissolved in water apply more or less to gases. Some of these that might otherwise be available are so strongly absorbed by the soil as to render any effort to send them to the depth required, practically useless. This is true, for instance, of the gas from burning sulphur, the use of which against the phylloxera is continually re-invented by persons unacquainted with the practical difficulties.

"Of all insecticide vapors that are promptly fatal to the insect, while comparatively innocuous to the vine, and at the same time but very slightly absorbed by the soil, that of carbon bisulphide stands foremost. Whether injected in substance or introduced in solution in the form of 'sulpho-carbonates,' it is, beyond comparison, the most thoroughly effectual at the least expense. That it is difficult even through its agency to extirpate the insect completely in certain soils, only strengthens the argument against the possible efficiency of methods lacking similar advantages.

"That vineyards consisting of valuable varieties can be profitably maintained against the phylloxera by the aid of carbon bisulphide has been sufficiently proven. But to deliberately establish new vineyards of vines unprotected by grafting or resistant stock in infested localities where flooding is not available, and with the hope of holding the insect in abeyance by insecticides, is from a financial point of view almost inexcusable. For at least the same expense will then have to be incurred annually, which, once incurred by grafting on resistant stock, would make the vineyard safe forever after."

As a sequel to the above, the following discussion of the "mercurial remedy" was published in Bulletin No. 18, in October, 1884:

MR. J. A. BAUER'S PHYLLOXERA REMEDY.

As a general answer to numerous inquiries concerning the probable efficacy of the phylloxera remedy devised by Mr. J. A. Bauer, of San Francisco (viz.: the introduction of finely divided quicksilver into the earth around the stock), regarding which several articles have lately appeared in the public press, the following points, based upon the known and observed habits of the insect, are here given in advance of the experiments which it is hoped will be extensively made during the coming season:

There can be no question as to the efficacy of metallic mercury finely diffused through the soil in killing the phylloxera, or any other small insect remaining within its reach for any length of time. Apart from the experience long had in this respect in the means used for the preservation of various articles, insect collections, etc., from the attacks of small insect depredators, the direct experiments of Mr. Bauer on earth and roots infested with the phylloxera have been entirely conclusive as to the inability of the latter to live more than a few hours in the atmosphere created in a close space, or in earth, at the ordinary temperature, by finely divided mercury. The conclusion that a soil column of six or eight inches depth, impregnated with the mercurial vapor by intermixture with "blue mass," will effectually prevent the passage through it of the slow-going insect is, therefore, fully justified. Many other substances might be used to act similarly in this respect, *e. g.*, gas lime; but none others thus far suggested possess the permanency of the mercurial preparation, and the entire innocuousness toward even the most delicate rootlets, unless, perhaps, in the case of the direct contact of the globules themselves. On this point, certainly, Mr. Bauer's inspiration has been a most happy one, and while the introduction of mercury into boreholes made in the stem of the vine has long been suggested and found to be useless, his suggestion is, so far as known, altogether new, and certainly original.

Were it feasible to impregnate the *entire* soil of a vineyard with the mercurial preparation, the phylloxera, being unable to ascend to the surface, would probably in a few generations be compelled to succumb, as the "winged form" could not then perform its functions toward the renewal of the tribal vigor by sexual reproduction. Since, however, so extended a use of even this very dilute insecticide is hardly practicable on the large scale, it remains to be determined to what extent its use *immediately around the trunk of the vine*, in the manner proposed by Mr. Bauer, will be likely to serve the purposes of prevention and repression.

The interposition of obstacles to the passage of the insect along the stock was among the early suggestions of aspirants to the great prize offered by the French Government for the discovery of an effectual remedy. We have among the inventions aiming in that direction, even a proposition to encase the stock in a plaster jacket of several inches thickness. It will be surmised that the sagacious insect was not long in discovering a convenient path outside of the lump of plaster toward the coveted roots.

In the case of Mr. Bauer's plan, however, the descending or ascending insect innocently crawls into a well laid trap, which gives no outward sign even by an obnoxious odor. According to the experience had thus far, it seems quite likely that the unwary travelers would find themselves ensnared before they had any intimation of danger; and as there can be no doubt that the great bulk of the ingress and egress ordinarily takes place along the trunk of the vines, after the egg laid by some wanderer on the leaves or branches has hatched, it can hardly be doubted that a considerable repressive influence would be exerted by Mr. Bauer's remedy, even where the phylloxera already exists, and that it would also act as a fairly effectual preventive of infection for many uninfested vineyards.

Its *universal* efficacy is, however, limited by the fact that (as has been observed in Europe, and quite lately and very prominently in this State), not only the winged form of the insect, but even the young larval one, will ascend abundantly to the surface of the ground from shallow outlying rootlets, and will from thence progress slowly but surely over the surface to neighboring vines. Direct proofs of this fact have been had here within the last few weeks, and will be published in connection with other new observations, in a subsequent bulletin. It follows that when such shallow rootlets are abundant (as they are in some soils), the obstacle or trap placed along the stock may affect the welfare and diffusion of the insect only in a slight degree. It is still true that even in this case, great numbers of the wanderers will perish without reaching the safe harbor of a root, since most of them will try the route along the stock and will there succumb to the mercurial trap. Still, some will be likely to find their way *down* to the superficial rootlets, as the multitude found its way *up* from them; and this will be the more surely the case, the more the soil is liable to be summer-cracked, or the coarser its tilth. In close, sandy, and in well tilled soils, on the contrary, the chances of stray insects descending by chance to such rootlets would be exceedingly slight, in case the stocks were all protected by the mercurialized earth. How great is the difficulty interposed to the progress of the insect on a sandy surface, can only be appreciated by those who have watched the ludicrous antics it exhibits under such circumstances. The incessant tumblings and backslidings soon exhaust its energies, and show good reason why, notoriously, the phylloxera is comparatively harmless in very sandy, and correlatively in very well tilled soils.

From the foregoing considerations, those interested may readily infer how far in their particular cases the ingenious device invented by Mr. Bauer is likely to prove efficacious;

and while still it will undoubtedly be far better to plant resistant stock and graft, those favorably situated, or those who have already planted the non-resistant vine, will do well to take the proposed remedy under careful consideration.

BERKELEY, October 1, 1884.

The sequel of the matter is given summarily in Bulletin No. 48, about a year later:

BULLETIN No. 48.

INVESTIGATIONS UPON THE MERCURIAL PHYLLOXERA REMEDY.

About a year ago much interest was excited by the publication of a statement that finely divided ("deadened") quicksilver mingled with the soil around a vine would effectually prevent the access of the phylloxera to the roots, and would thus prove a certain preventive of infection, if not a cure for vines already infested

In response to numerous inquiries addressed to me on the subject at the time, I stated (see Bulletin No. 18, October 1, 1884,) that past experience, as well as direct experiments, had shown the inability of the phylloxera to live more than a few hours in the atmosphere created by finely divided mercury in a closed space, or in earth, at the ordinary temperature; and that "the conclusion that a soil column of six or eight inches depth, impregnated with mercurial vapor by intermixture with 'blue mass,' will effectually prevent the passage through it of the slow-going insect, is therefore fully justified."

It appears that soon after the publication of the above facts and conclusions, there arose a considerable demand for the preparation of finely divided mercury, from persons who desired to thus protect their vines. Mr. Bauer, the inventor, not having intended to engage in the business, was unprepared to supply the material; but upon being pressed, finally agreed to prepare some of the clay and mercury mixture on a larger scale. It was thus supplied to a number of persons in the infested districts of Sonoma and Napa; a number of experiments were inaugurated under the auspices of the Viticultural Commission, and some twelve vines in the experimental plot of the University were also treated under Mr. Bauer's directions. These were, to incorporate a package of the mixture, containing about half an ounce of mercury, with about a peck of soil taken up from around the vine, baring its upper roots, then replacing the mercurialized earth.

The failure of at least a large proportion of the applications thus made to produce the expected effect within the time it was looked for, is a matter of public notoriety, it having been diligently heralded both at home and abroad, in advance of any reasonable examination into the facts and the causes of the discrepant results.

The subject was immediately taken in hand by me upon the opening of the University session, and the investigation is now so far advanced that both the causes of failure, and the means to be used in making the remedy effective on the large, as it was on the small scale, can be definitely stated. A detailed account of the experiments will be given in the annual report of the department.

As to the first point alluded to above, it should be kept in mind that my prediction of the efficacy of the application was based upon the condition that (as quoted above) the soil must be *impregnated with mercurial vapor;* that vapor, and not the liquid mercury, being the effective agent. If from any cause that vapor failed to form, the quicksilver would remain inactive.

On testing in this respect the mixture furnished us by Mr. Bauer, which consisted of equal weights of mercury and clay or chalk, it was found that only the merest trace of mercurial vapor could be detected in or around it by the most delicate tests; while the same tests showed an abundance of vapor in the mixture prepared in the same proportions by ourselves. A corresponding difference manifested itself in the effects on phylloxerated roots, on which the insects were rapidly killed when immersed in our mixture, while in Mr. Bauer's they only showed signs of discomfort and moved off.

This puzzling difference was finally traced to two circumstances which tend to diminish materially the evaporation of the mercury. One is that the metal used was rather strongly contaminated with *lead*, which is known to retard evaporation in a remarkable degree. The second is that in the preparation of the mixture some *oil* was used, in order to facilitate the subdivision of the quicksilver, as is frequently done in working on a large scale. Thus *each globule was coated with a film of oil*, which farther interfered with evaporation—an effect which, though easily intelligible on physical principles, it was not easy to foresee. And it is quite evident that if even the pure mixture acted but feebly on the insects, its intermixture with many times its bulk of soil would be still more inert.

It was found, however, that in a number of cases in which neither oil nor the impure mercury had been used, the results had also been unsatisfactory, while in others the effect of the same mixture had been prompt, as in the small scale experiments. Evidently there must have been some other factor concerned in the failures.

I had, from the outset, conjectured that the absorption of the mercurial vapor by the soil itself (analogous to its well known disinfecting action in other cases) might be an impediment to the action of the mercury that would vary in different soils. In the case of vapor of water, the amounts taken up by various soils vary from less than one to over twenty per cent of the weight of the soils. If, then, similar differences exist in the case of mercurial vapor, some soils—sandy ones—might allow the vapor to act within a very short time, being quickly saturated; while in the case of loam and clay soils, with high absorp-

tive powers, the slow process of evaporation and saturation might occupy a long time, during which no free vapor would be available for action upon the insects.

The subject being one that has never been investigated, it was necessary to feel the way with numerous tentative determinations and experiments, of which at present some sixty are on record and many more under way. The results, however, have fully verified the correctness of the above conjecture, and have also shown the way to make the mercurial application practically effective *for the protection of uninfested vines.*

Thus, when the finely divided quicksilver is mixed with pure sand in the proportion of about two per cent, the effect on the insects becomes obvious within less than twenty-four hours after immersion; and after six hours more all are dead, or so badly poisoned that they will die even when withdrawn from the sand. But when, instead of the sand, a clayey soil is used, having a power of absorption about twelve times greater than the sand, no decided effect is perceived, even after several days.

When that same soil, however, after its mixture with the mercury, has been subjected for a few hours to the temperature of boiling water, it acts upon the phylloxera as quickly as the sand mixture, and that not only in the laboratory, but also in the vineyard, as repeated tests have shown. It was also noted that in the latter case the effect did not extend into the natural soil beyond, even to the extent of an inch, in the course of a week; but insects crawling within reach would, of course, perish.

These facts having been demonstrated by numerous repetitions of the experiments under varied circumstances, it now remains to apply them to a large-scale practice in the vineyard. This part of the subject is still under investigation, so far as the means of readily impregnating large quantities of clayey soil are concerned; but it is even now obvious that Mr. Bauer's original proposition (viz., to *protect young vineyards from invasion*) is perfectly feasible and conducive to its end, provided *sand* is used around the stock or cutting instead of soil, when the latter is at all of a clayey nature. In sandy *soils* more or less time will elapse before the vapor becomes effective; but it will, nevertheless, be likely to afford protection the same season, even without other preparation than intimate intermixture. But in the case of even moderately clayey soils, a *previous preparation, to insure saturation with the metallic vapor,* appears to be necessary in order to insure immunity from attack during the season in which a cutting has been planted. Even in the prevalently clayey soils, in which the applications in Napa and Sonoma have mostly been made during the past season, the protective effect will doubtless be felt to a greater or less extent as the oil film decays away and the earth becomes gradually saturated.

But, while there is every reason to believe that an application once made will remain effective during the life of the vine, so far as the ingress of the insect from *above* is concerned, it is also clear that the spreading of the mercury will probably be too slow to afford immunity to outlying roots that may be infected from *below.* In other words, the mercurial remedy will probably not, as has been supposed, avail for the protection of cuttings planted on infested ground, nor for the cure of old infested stocks; unless, perhaps, in very sandy soils.

In regard to the practical method for preparing saturated earth in the vineyard, the experiments now in progress seem to show that it can be done by exposing the dry, fine soil, after intermixture with the quicksilver, to hot sunshine such as will maintain its temperature at 110 degrees for from 20 to 30 hours in the aggregate (say three to five midsummer days); the above temperature being the one found to be usually assumed by raisins in sun-drying, and hence has been adopted as the standard in our best driers. There are but few parts of California where these conditions can not be amply fulfilled during some part of the year, and the soil so prepared could then be used at any time when wanted.

It is probable that almost any soil might be saturated so as to be available for use in the spring planting, if after mixing in the mercury thoroughly at the beginning of summer, it were left in low piles, protected from the moisture of the ground and air, but accessible to the summer temperature. It should be fully understood that the presence of moisture interferes materially with the absorption of the vapor by the soil, and therefore with its saturation; although when once saturated, its action on the phylloxera is scarcely interfered with by moderate wetness.

It would, of course, be perfectly practicable, in regions where extended planting operations are progressing, to prepare the mercurialized earth more quickly by subjecting the mixture to steam heat while it is agitated by mechanical means; for instance, by a revolving, spirally-acting agitator within a steam-jacketed, sheet iron cylinder, which with the needful small boiler could be mounted on a wagon truck so as to move about as required. With this, or similar appliances that can readily be devised, attention to the avoidance of mercurial poisoning would, of course, be very essential.

As to the amount of mercurial vapor actually absorbed and rendered inert by ordinary loam and clay soils, the assays of soils subjected to the action of *vapor only* show that it amounts to from 121 to 129 grains per cubic foot; a relatively large quantity, which, considered together with the extremely slow evaporation of the metal at the ordinary temperatures, amply accounts for the observed failures of the remedy as applied heretofore. It is, presumably, only the excess over that amount that can produce effective vapor. But as the fourth part of a cubic foot, say 6×6×12 inches, or better, 7×7×9 inches, would perhaps constitute an adequate application to one cutting, the 30 or 40 grains of metal thus rendered inert bear but a small proportion to the permanent value of the protected vine. On the whole, the half-ounce doses of mercury thus far used by Dr. Bauer, when well mixed in, is probably ample.

Experiments on these points, as well as on the effect of vapor-saturated soil on the tender rootlets of seedlings, are still in progress, and will be reported in due time.

In view of a late discussion concerning the propriety of exterminating the phylloxera on the University vineyard plot, as demanded by the State Viticultural Commission, it is not irrelevant to state that the determination of the above questions would have been altogether impracticable until next season, had not the infested plot afforded the needful material for the numerous experiments, and opportunity for daily and hourly observation.

BERKELEY, November 12, 1885.

The details of this investigation, and some farther results as well as experiments now under way, are given in the subjoined report by Mr. F. W. Morse, of the work done by him in this connection, under my direction, together with the conclusions which, in my opinion, are legitimately deducible therefrom:

2. REPORT OF EXPERIMENTS UPON MERCURY VAPOR AS A REMEDY AGAINST THE PHYLLOXERA.

For many years there has been a diligent search for some means of combatting the phylloxera by applying an insecticide around the roots of the vine in such a manner as to eventually permeate the whole soil to the full depth at which the insect can live on the roots, varying according to the perviousness of the soil from three to as much as seven feet. Such an insecticide must be either very powerful, so as to act at once on all forms of the insect wherever lodged, or it must be permanent and act slowly and continuously. It will readily be seen that to fulfill all the requirements, the remedy, if applied in solution, must be extremely cheap, and the means of applying very simple. The use even of water alone to reach all the lowest rootlets becomes almost impracticable in most cases, and when used as a carrier of an expensive remedy, requiring more than one treatment, would prove too costly to be generally practicable. It is, above all, desirable that the remedy shall be permanently and continuously effective, so that one treatment shall suffice once for all. Large numbers of remedies have been proposed and applied, and have, for a time, produced apparently excellent results, but have not prevented subsequent invasions of the few insects which escaped the first treatment by being far out on the lowest rootlets of the vine. The various applications in the truly liquid form have not been successful, because not widely distributed to all the far-reaching roots. The use of a solution bearing a substance capable of generating a gas or vapor in the soil, some time after the application is made, such as the sulpho-carbonates, etc., approaches nearer the desired results, but those thus far suggested carry with them the objection of the want of permanency, and the same is true of the bisulphide of carbon itself. Hence the need of several successive treatments, or annual to triennial ones, during the life of the vineyard.

It is the predicable permanency of mercury vapor which has led many to look to it as a possible remedy. The action and value of this agent is based upon two facts, namely: that metallic mercury, at the ordinary temperature, is continually giving off a vapor which acts as a deadly poison to all insect life; and that the volatilization of the mercury is so slow in its natural metallic state that it becomes practically permanent, and that its effect would presumably last during the life of a vineyard. Upon these presumptions a method has been devised by Mr. Bauer, whereby the mercury may be so finely diffused through the soil as to hasten greatly its vaporization, in order to give immediate relief to the infested vines. It was supposed that all vines, when properly treated according to this plan, would

soon be rid of the majority of the insects on the main roots, and that the remaining ones would succumb as the vapor extended to the outer rootlets. In the meantime, the vine, relieved of the drain of the insects, would begin to revive.

The application of the same remedy as a preventive against the infection of new vineyards, by planting the young vine in soil impregnated with the mercurial mixture, followed naturally enough. Such soil applied around the cutting would prevent the descent of the insect by way of the trunk during the early growth of the vine, and the subsequent gradual spread of the vapor would prevent infection through surface roots which would be produced later.

MR. BAUER'S MERCURIAL MIXTURE AND ITS APPLICATION.

The Bauer mercurial mixture is prepared by triturating equal parts of metallic mercury of commerce with powdered chalk or clay until it is so thoroughly divided that it can be readily transported and mixed with the soil of the vineyard without danger of the reuniting of the particles of mercury. A small amount of oil was sometimes added to facilitate the division of the mercury. The following directions were given for the application of the mixture:

For New Vines.—Dig a hole a foot in diameter and fifteen to eighteen inches deep; throw the soil from the hole into an open wooden box; distribute an ounce of the mixture well through it with a shovel, and plant the vine in this prepared soil, packed down as usual.

For Old Vines.—Dig out the soil carefully six inches around the main stem of the old vine, on which the side roots are still healthy and living, to a depth of eighteen inches; prepare the soil thus taken out by distributing through it an ounce and a half of the mixture, and replace, pressing down well.

MR. BAUER'S EXPERIMENTS.

Mr. J. A. Bauer, the originator of this remedy, has earnestly and diligently experimented with it for many years, using the mercury in various forms, and in various degrees of strength, until the minimum amount was reached; and he tested alike its poisonous effect upon insects, and its possible injury to tender plants. He has thus become convinced that it produces no injurious effect upon the plant's growth, which came under his observation in pot specimens used for experiment. He is further convinced of its harmlessness, from his experience in a vineyard of his own, where many thousand cuttings were planted in the mixture, under his direction. All have produced most flattering results.

His experiments upon the phylloxera were conducted mostly in San Francisco. The phylloxera specimens were obtained from infested country vineyards, and placed in a light sandy soil, such as prevails in that city. His line of experiments has been to ascertain the minimum amount of quicksilver to be used to be effective; also, to determine the time required to kill the insect. How far the experiments have been carried since, we are not aware; but they were reported as having been highly successful and satisfactory. It will be seen, later on, that he was very fortunate in the selection of material with which he worked, and that, had conditions been otherwise, less flattering results would have been obtained.

OTHER EXPERIMENTS.

The report from the State Viticultural Commission on experiments, under their direction, to test the efficacy of the remedy, has already become a

matter of public note. Their line of tests, continued since March, 1885, embraces many experiments relating to the manner of application to its use as a preventive in the case of young vines planted over old infected stocks, and also to its efficacy as a preventive against invasion of young vineyards or cuttings planted also over infested roots. No decided or favorable effect was reported in any case, whether on old infested vines or on young vines planted in the holes from which the former had been taken, or in uninfested ground planted with healthy vines that were thereafter purposely infected.

Several vineyardists have also experimented with it, but in no case was positive relief reported. Their tests, also, were usually made upon vineyards or plots where old vines had been destroyed and new ones replanted, or upon old infested stocks. The results all pointed to the conclusion that the remedy is too slow to be effectual in the case of old infested stocks, or new vines which have replaced those killed by the pest.

UNIVERSITY FIELD EXPERIMENTS.

On November 21, 1884, ten vines of the University vineyard plot were treated with the mixture furnished by Mr. Bauer, and applied under his directions, using his prescribed dose of one half an ounce of metallic mercury (or one ounce of the mixture) to each vine. The preparation was carefully mixed with a peck or more of loose earth, and then placed upon and surrounding the roots to such a depth as the mixture could be practically applied, after reaching to ten inches depth, and sometimes extending out one foot from the vine. They were allowed to remain until March of the following year before an examination was made. Different representatives of the lot were examined in March, April, May, June, and September, with quite unsatisfactory results.

It should be remembered that these vines are very old, and have been infested so long that all the older roots are badly corroded, and even rotten, so that it would be difficult to find the phylloxera upon them in the early spring, even though no remedy had been applied. The time, and the year, was most favorable for an abundant production of the insects; and, as the records show, for the most complete growth of small rootlets, which were then nearly matured and badly infested. During the winter season, 1884–5, the insects were naturally diminished in numbers, and, at the time of first inspection in the spring, scarcely any were found upon the old roots, while upon the healthier and smaller roots no appreciable change was noticeable.

Upon four of the vines that were examined, no phylloxera was found during the summer; these vines also had no small roots. Upon all the others the insects were found at different times in numbers varying directly with the condition of the roots; small roots bearing them almost invariably. Some vines were reported at different times as being not infested; the reason for this being that it was considered advisable not to molest them to such an extent as to injure them, but to leave them for future examination of parts which could not then be conveniently reached. One vine treated in November, for example, bore the usual forms in March, received an additional treatment in April, at which time no change from the normal condition was noticeable; in June and on September twelfth, no insects were found, and the roots were reported as poor. A more complete examination on September twenty-second, showed the majority of old roots to be free from insects, except those lying near to fresh or fibrous roots, where the pest was abundant.

Another vine, which received an ounce treatment of mercury on April twenty-first, was found to be free from the insect on May eleventh.

A fibrous root, apparently in a fresh condition, although covered with nodosities, was not infested. Numerous small globules of mercury were found lying upon the larger horizontal roots. The old roots still remained free in September: but phylloxera was seen in abundance upon some white "tuberous" rootlets which were growing luxuriantly about eight inches from the main stock, and still within the limit of the mercurialized earth.

A third vine, which received the early treatment, was the only one upon which both phylloxera and eggs were noticed. These were found in March upon small rootlets four inches below the surface of the ground, near the central part of the impregnated earth.

As a counter-check upon the examinations of the treated vines, others which had received no treatment were examined from time to time. They gave similar results, some bearing no phylloxera, some with better adapted roots bearing a few; with the growth of new tuberous rootlets they were found in abundance. All witnessed alike the comparative freedom of the old roots from the pest.

Very little could therefore be said in favor of the effects of these two first treatments. They had furnished no positive evidence of good results, the insect continuing to live even though surrounded by the mixture, whenever the roots were favorable to their existence.

The almost absolute freedom of the old roots from the pest suggests a possible effect upon them by these applications, but the supposition is not borne out by the experience of observers elsewhere.

It is due to the originator of the remedy to state here that the strength of the mixture used in the early treatment was not up to the supposed standard. The causes for its failure of effect will be explained later.

EXPERIMENTS IN THE LABORATORY.

From the field experiments, noted above, it appears that the remedy, as first applied, gave but little encouragement for its future success. This want of decisive favorable results may be accounted for, in general, by one of two causes:

First—An improper preparation of the mixture.

Second—An absorption and retention of the vapor by the soil.

The object of the following experiments was to show how far each of these objections may have influenced the efficacy of the remedy, and to point out, if possible, some means for overcoming the difficulties.

Methods and Reagents Used.—Before discussing the separate experiments relating to the preparation, absorption, and diffusion of the mercury vapor, it will be necessary to speak of methods used for the different tests for the vapor, and also of the manner of treating of the roots under observation.

During the first part of the experimental work an attempt was made to use gold foil as an indicator of the presence of mercurial vapor; the formation of the gray amalgam being very characteristic. This test, however, proved far too slow in its action, and was put aside to be used only where comparative results and long standing would be required. In its place, iodine vapor, previously suggested and used in his investigations by Brame, was adopted as on the whole the best indicator, although for some purposes it is open to the opposite criticism, since the slightest trace of mercury vapor is indicated immediately by the distinct and characteristic deposit of yel-

low or red iodide of mercury. Finely powdered iodine is placed in the apparatus so that its vapor, which forms immediately at ordinary temperatures, comes in contact with the mercury vapor drawn by a current of air from the material to be tested.

A somewhat slower indicator was found in the solution of ammoniated nitrate of silver, but this was not used to any extent.

In some of the experiments on the absorption of mercury vapor by soil, the point of super-saturation was shown by a deposit of metallic mercury collecting upon a properly arranged condenser above the soil, leaving no doubts of the completeness of the operation.

Whenever it was practicable the chemical tests were supplemented by counter-tests upon the insects themselves. A portion of the soil or mixture under examination was put in a glass vessel and a piece of infested root inserted in such a manner that the insects, without being touched by the soil, could be seen through the glass, and frequent observations were taken. When a more accurate examination was had the root specimen was carefully taken out and the microscope brought into requisition. In order to protect the specimen as much as possible from the soil, a piece of porous cloth (cheese cloth) was placed over it on the earth side, giving ample opportunity for the vapor to pass freely about the root and its inhabitants.

"*Standard Mixture.*"—Most of our experiments were made with a mixture prepared by ourselves* from mercury purified with ferric chloride, which at the same time reduces it to a state of fine division. The gray mass, while still wet, was poured upon the soil and allowed to dry until it could be rubbed up with a soft pestle without recombining the globules of mercury. Although this plan was not a perfect success, owing to the tendency of the mercury to rëunite, it has answered the purpose.

Mr. Bauer's Mercurial Mixtures.—We have received from Mr. Bauer three different samples of his mercurial mixtures. The first, which, in part, was applied to the vines in the University vineyard plot, was dark colored, and was supposed to contain one ounce of mercury to each package of two ounces of the mixture. It forms a very plastic mass when wetted, clay having evidently been used in its preparation. From chalk mixture the mercury can readily be rubbed out, when slightly wet, and rëunited; but with this mixture it was almost impossible to do so. It also contained a considerable amount of oil, which, in its examination, was extracted with caustic soda. After washing out, and again drying, mercury globules were obtained, although in small quantities, and still quite finely divided. They were bright, and apparently free from lead.

The second mixture, consisting of equal parts of chalk and mercury, and a little oil, yields the mercury readily when rubbed while wet. A very large percentage of lead, used for the same purpose as oil, namely, to facilitate the dividing of the mercury, forms a crystalline mass, surrounded by the liquid mercury, which was only in small amount.

The third sample, of chalk-and-mercury mixture, supposed to be free from lead and oil, still contains sufficient lead to form a film completely enveloping the mercury globules, and of sufficient thickness to produce a visible effect on their surface as they move about. It is stated to be "commercial quicksilver."

As the efficacy of the remedy is entirely dependent upon the rapidity of the formation of vapor, it will readily be seen that any cause which tends to prevent this rapid action will be adverse to the efficacy of the mixture.

*This mixture is hereinafter designated simply as standard mixture.

And it follows, with equal certainty, that if, instead of the clear surface of pure mercury, one covered with a jacket or film of any kind is presented, just in proportion to the thickness and nature of the film will the rapidity of vaporization be hindered. There can be no doubt that the benefit of using oil and lead, in dividing the mercury, is due to the film formed about the globules, which, however, defeats the primary object aimed at in the division.

It is, however, a well ascertained fact that any considerable amount of lead in quicksilver materially diminishes its evaporation in any case.

In the first mixture, mentioned above, a very large amount of oil was used, and probably no lead, as the mercury obtained seems quite pure, at least there is not sufficient lead to form a film. Any lack of action, such as was indicated in the field, would, probably, be due to the presence of the oil. The second mixture contained only a small amount of oil, but a large amount of lead, and is also slow in action, as indicated by the experiments on the insects. The comparative tests of this sample with the standard mixture, both with the same amount of mercury, and applied under similar conditions, show the Bauer mixture to be very much slower, hence points to a defect in the *rapidity* of vaporization.

In the third mixture, containing no oil, the effect was more decided than in the preceding ones, and yet the experiments with the latter indicate less deadly action than in comparative experiments with the standard mixture. This difference, also, is probably to be accounted for by the fact that the mercury used in our standard mixture was chemically pure, while that even of mixture No. 3 of Mr. Bauer did, as stated before, contain lead enough to form a very perceptible film on the surface of the globules. This contamination, perhaps unavoidable in commercial quicksilver, is at all events, preferable to the oil which, as will be seen, causes the insects to move away instead of being killed where they are.

It is manifest that neither oil, nor lead, nor any other material which, although favoring division, coats the globules and retards vaporization, should be used in the preparation of these mixtures. So far as is known, those which have been used elsewhere for field work were all prepared in the above manner; and thus, no better results could be looked for.

Soils used in the Experiments.—The soils used in the experiments were on the one hand the stony yellow adobe of the University vineyard plot, in which the use of Mr. Bauer's mixture had entirely failed of success during the past season, on the other, washed sand from the sea beach was used as the extreme representative of sandy soils; subsequently, a dark-colored semi-adobe from General Bidwell's ranch, near Chico, was also brought in as the representative of the highly absorptive humus soils. The composition of the above soils is as follows:

	No. 4. "Adobe" Ridge Subsoil.	No. 8. Dark Loam Soil.
Mechanical Analysis.		
Weight of gravel over 1.2 mm. diameter	13.23	.40
Weight of gravel between 1.2 and 1 mm.	4.61	1.61
Weight of gravel between 1 and 0.6 mm.		
Fine earth	82.16	97.99
Mechanical Analysis of Fine Earth.		
Clay	18.92	20.8
Sediment of <0.25 mm hydraulic value	17.25	32.0
Sediment of 0.25 mm	4.87	3.3
Sediment of 0.5 mm	6.79	6.6
Sediment of 1.0 mm	6.42	5.6
Sediment of 2.0 mm	6.64	7.3
Sediment of 4.0 mm	3.69	7.5
Sediment of 8.0 mm	7.45	5.7
Sediment of 16.0 mm	11.03	4.8
Sediment of 32.0 mm	9.49	1.5
Sediment of 64.0 mm	3.42	1.2
	95.97	96.4

		No. 561. Black Loam Soil, Bidwell's.
Insoluble matter	86.002	59.144
Soluble silica		3.160 62.304
Potash	.189	.305
Soda	.154	.221
Lime	.484	2.909
Magnesia	4.52	1.042
Br. oxide of manganese	.038	.025
Peroxide of iron	4.013	9.342
Alumina	5.532	13.038
Phosphoric acid	.057	.095
Sulphuric acid	.021	.068
Carbonic acid		
Water and organic matter	4.051	10.149
Totals	100.993	99.498
Humus	Trace.	3.00
Available inorganic		.59
Hygroscop. moisture	6.13	13.980
Absorbed at 13° C.		

Soil No. 8, from near Stockton, of which the mechanical analysis is given above, is altogether similar in character to the Bidwell soil, which has not as yet been mechanically analyzed. It will be seen that as regards the finer ingredients, which are chiefly concerned in the absorptive power, the difference between the two soils used in our experiments lies mainly in the finest sediments, while clay is nearly alike in both. It will be noted that they differ widely in their chemical composition, while presumably not far apart in their mechanical nature. The great difference in their absorptive power for water, which is of especial interest in this connection, arises evidently very largely from the considerable proportion of humus present in the Bidwell soil, while the other contains probably less than one half per cent. The sand used in these experiments was taken from the sea beach, and carefully washed. It showed, in comparison with the soils, a moisture absorption of only .53 per cent.

Experiments Regarding the Continued Life of the Phylloxera on Detached Root Fragments.—In order to be assured that the roots used in the experiments would continue to support the life of the phylloxera in natural soil, a root fragment about four inches long, taken from the lot that served for the other tests, was placed in a vessel with air-dried soil and watched like those being treated with mercurialized earth. This specimen has been frequently examined, since October fifteenth, when it was prepared, and has not only proven that the insect will live, but has also furnished an opportunity for watching it during its hibernating season. It will be of great interest to watch the anticipated revival in the spring. The insects seem to have remained in exactly the same position as they were when put away, but are plump, and have the usual color of hibernants. The soil was noted as quite dry one week after the experiment began, but it was not moistened until December tenth, and then only slight. Small grass roots and shoots soon penetrated the whole soil, but have since dried up.

The fact that many times other specimens had been kept in bottles about the laboratory, without any precautions being taken to preserve them, would be quite evidence enough to prove that the death of the insects in our experiments was due to the direct effect of the poisonous vapor.

Action of Mercury Vapor upon the Phylloxera.—Comparing the result of the preceding experiment with those in which mercurialized earth was used, we can readily note the poisonous effect of the vapor. A badly infested root was suspended half an inch above a layer of mercury, in a glass-stoppered cylinder, about fourteen inches high. A slight effect on the lowest portion was noticed on the third day, and upon the fourth, some of the old insects were blackened and dead, the eggs were drying up, and the general effect had reached to the height of three or four inches. On the following day blackened and dead insects were found to the height of six or eight inches; the eggs were darkened and shriveled. Upon the seventh day none were healthy looking, and on the ninth no live insects could be found. The root, which was still quite fresh, was transferred to an open tube to determine whether any would survive, but none ever appeared.

It will be seen that it took from four to seven days to produce a decided effect upon the insects when placed close to the mercury before vapor had had time to form to any extent. Some five months later, a badly infested root was placed in the same cylinder, two inches above the mercury. In sixteen hours the effect was very apparent; some old insects were browned and apparently dead; about one third of the larvæ moved briskly about when warmed. At the end of twenty-four hours many were moving about, and showing signs of distress. At the end of thirty-nine hours none were alive; large numbers that had died had fallen to the mercury below, while others still remained fastened to the root. Some still retained a light color, showing they had only just died.

The rapid effect in the second experiment was manifestly due to the fact that the vessel was then already filled with the mercury vapor, while before it had still to be formed, and only very gradually rose in the cylinder.

Experiments showing Formation of Vapor with Different Mixtures.—In one experiment (No. 5), a body of dry soil mixed with an excess of Bauer's mixture, was placed in a vessel and gold-foil was inserted upon the inside of the glass. At the end of seven weeks the edges were amalgamated, but the central part remained unaffected as seen from the outside.

No. 6. A portion of Bauer's mixture alone was put between two watch

glasses and foil inserted as in above experiment. The result was about the same in both cases and showed a reaction more from actual contact of the globules of mercury themselves than from the formation of vapor.

No. 7. In order to avoid the actual contact of the foil and mercury globules, a glass tube containing the foil was inserted into the soil mixture of the first experiment, and allowed to remain from May, 1885, until February, 1886, but it showed no signs of amalgamation.

No. 9. An attempt was made to show the relative rapidity of vapor formation from metallic mercury on the one hand, and from Bauer's mixture on the other. The substances were placed upon three-inch watch-glasses, conveniently well filled, and suspended in upright, well covered glass funnels, leaving ample room for the passage of the heavy vapor between the watch-glasses and the sides of the funnels to a glass vessel placed beneath. Close to the opening of the funnel beak, and on the bottom of the receiver, was placed the foil to serve as an indicator. No visible effect had been produced at the end of five months. Possibly a weighing of the foil might have shown an increase in weight due to amalgamation, which could not be detected by its appearance. At this time a little iodine was placed near the beak of the funnel, where it gave a faint tinge of mercuric iodide; but as the iodine vapor passed up between the glass and the funnel a distinct red ring was formed upon the latter, near the edge of the watch-glasses, showing the formation of mercury vapor there. No noticeable difference in the results could be deduced from these experiments.

Experiments 41, 42, and 43 were to show the comparative rapidity of action of metallic mercury, standard mixture, and Bauer's mixture No. 1. The materials were placed in covered glass dishes, with iodine placed upon watch-glasses resting upon the mixtures. In two days the iodine had vaporized, leaving an iodized atmosphere within. A heavy deposit of red iodide soon covered the surface of the metallic mercury. Upon the standard mixture the whole surface was more or less covered with the iodide, and a very bright color lined the higher, rough points of the mixture. The Bauer mixture showed no red color; only a darkening had taken place in the lowest parts of the surface. As was to be expected, the action was most decided on the free mercury; of the two, the standard mixture was much more active than Bauer's. In the latter, the action of the iodine ceased to increase visibly only after long standing. The inference would be that the globules were surrounded by some material (presumably oil) which prevented the access of the iodine to the mercury, and also the formation of vapor.

Alongside of the three preceding experiments may be put Nos. 11, 12, 13, 14, and 68, which were intended to determine the relative rapidity of vapor-formation and rise of vapor in cylinders. The materials used were metallic mercury, standard mixture, Bauer's mixtures (with and without oil), and soot containing free mercury. A small quantity of each was put in tall, narrow cylinders, and glass tubes having gold-foil adhering to the outside were suspended just above the substances. They were prepared on September twenty-fifth, except No. 68—Bauer's mixture, consisting of equal parts of chalk and mercury without oil. In fifty-one days the foil in the mercury cylinder was heavily amalgamated from one to two inches above the mercury. The cylinder containing the standard mixture had formed an amalgam to about the same height. Neither the Bauer mixture nor the soot had given any indication of amalgamation up to February first; but by the twenty-fourth a distinct change was noticeable in the foil in the soot cylinder, and a doubtful trace in the Bauer mixture cylinder. The

slowness of the latter may be due to tarry matter which may prevent vaporization in a similar manner to that of the oil of the Bauer mixture.

Into another cylinder, containing metallic mercury, and which had served for the experiments of Nos. 2, 3, and 4, was suspended a glass tube a foot long, arranged similar to the preceding experiments. Five months later it was found that the foil was completely amalgamated to the height of six inches, and that the effect had reached, in a less degree, to the height of nine inches, to the limit of the foil.

These experiments, with the preceding ones, exhibit very characteristically the manner in which mercurial vapor forms and diffuses in air. In the experiments with long roots covered with phylloxera and suspended in a tall cylinder with mercury at the bottom, the first effects on the insects nearest the surface of the mercury freshly put in, were observed at the end of three days, and after nine days all insects were dead, the effect progressing visibly from below upward. In a subsequent experiment, in the same cylinder, after the mercury had remained in it for several months, the effect on the insects nearest the metal (two inches above its surface) became obvious in sixteen hours, and after the lapse of thirty-nine hours all were dead. In this case the air of the entire cylinder contained more or less vapor, but it was evidently much more dense, and therefore produced the quickest effect, near the bottom. Precisely the same results were reached in the above experiments with gold foil, only the foil, being much less sensitive than the insects, required much more time to show the effect. All these observations corroborate the soundness of the rule noted by the workmen in mirror factories, viz.: that those whose work obliges them to stoop or otherwise be near the floor, are most quickly and severely affected by salivation.

Experiments on the Effects of Immersion of Infested Roots in the Mixtures Alone, or with Sand or Soil, at the Ordinary Temperatures.—The experiments recorded below give the results obtained by treating phylloxerated roots in mercury mixtures, both alone and with varying quantities of soil:

Substance Used.	Numb'r of Hours.	Condition of Insects.
1. Bauer's mixture, No. 1	24	Many moved away, some are moving.
	72	All dead, color of some still good.
61. Bauer's mixture, No. 3, prepared without oil	18	Slight effect.
	24	Some dead, majority in good condition.
	42	All dead.
51. Bauer's mixture, No. 1	49	Form of some still quite good, slightly shriveled.
	24	Nearly all had moved away, two or three dead ones remaining.
54. Bauer's mixture, No. 1	7	Good condition.
	24	Some killed, mostly moved away.
	48	All gone.
5. Bauer's mixture, No. 1, with moist earth	24	No effect.
	48	Old insects black and dead, larvæ looking healthy.
	96	Still in good condition, finally moved away.
54. Bauer's mixture, No. 1, with dry earth	17	Considerable motion.
	26	Larvæ moving freely about.
	60	All moved away.
29. Standard mixture and wet sand	22	No effect.
	30	Slight effect.
	47	No signs of rapid death, many healthy.
	78	Only one in good condition, others browned and blackened.
27. Standard mixture and dry sand	22	No effect.
	30	A number dead, some moving.
	46	All dead and dried up.
28. Bauer's mixture, No. 1, and dry sand	23	No effect.
	31	Some slightly brown, most all moving.
	47	Nearly all remaining ones are dead; many left the root; some have good color and move.
50. Standard mixture and soil	21	No effect.
	45	Some dead.
	53	Quite a number dead.
	76	Nearly all dead, color of some is good.
	93	Color of some is good.

Experiments 1, 61, 51, and 54, were treatments of infested roots with simple mixtures alone. Considerable difficulty was experienced in keeping the roots or insects free from actual contact with the mixture in cases where the vapor alone was expected to act.

It will be seen that it required about twenty-four hours to cause death in the most favorable cases, and that forty-two hours were the least in which *all* were killed. This occurred in a newly prepared mixture of equal parts of mercury and chalk, without oil. A slight effect was noticed in eighteen hours, although fatal results occurred only at twenty-four hours, and the shape of the insects still remained good until some time later. In the first experiment, with "old mixture" No. 1, the color remained good for seventy-two hours, although the majority of the insects had left before fatal results were produced. The most noticeable feature in the case of this mixture is, that the insects become disturbed and move about before poisoning takes place. Doubtless the disagreeable atmosphere produced by the oil used in the preparation hastens their departure, since the moving-about occurs notably in the Bauer mixtures, as will be seen further on. It is, however, noted in poisoning other pests by means of gases, that if the poison works slowly, a general activity or disturbance will be noticed before death takes

place. In the present cases nearly all of the insects moved away from the root, leaving only a few dead ones behind. Doubtless the actual contact of the mixture produced more fatal results than the vapor alone.

Nos. 5 and 5½ were treatments made with one and the same soil mixture, differing only in the one being moist and the other dry. The moist soil seems to have been most effective, requiring forty-eight hours to kill the old insects; the larvæ escaped before death overtook them. At the end of the fourth day one insect still had sufficient life to move away. Some eggs upon the root retained good color to the end. The dry soil treatment did not seem to kill the insects, in full accord with the negative results of the field experiments with the same mixture.

In Nos. 29 and 27 we have fifteen grammes of standard mixture with eight hundred grammes of coarse, washed sand. The former was perfectly saturated with water, which evidently retarded the action of the mercury vapor. We find only a slight effect at the end of thirty hours, and some insects still in good condition at the end of seventy-eight hours. In the dry mixture, on the contrary, large numbers were dead in thirty hours, and lying in confused positions, showing the deadly work of the vapor. In less than forty-six hours it had proven fatal to all and the bodies were dried up. The effect of moisture seems to be reversed in this case, as compared with the dry soil and Bauer mixture in experiments 5 and 5½. In the former case the soil was but just moist, in the latter so wet that the water stood in the bottom of the vessel.

No. 28 shows the slower effect of Bauer's original mixture in dry sand, as compared with No. 27, in which our standard mixture was used in the same proportion. The tendency to leave the root was again shown here in the case of the former. It also gave the appearance of greater poisonous effect, as in both cases at forty-seven hours nearly all the insects were reported as being dead. In fact, only the weaker ones remained to be killed, the stronger ones having left before poisoning took place in the Bauer mixture. For the first twenty-four hours there was no noticeable effect in either case. The rapid effect in No. 27 at the end of thirty-one hours was shown by the confused positions of the dead insects.

In No. 50 we have the mercury mixture in somewhat larger proportion, 15 grammes of mixture to 550 grammes of dry earth. It required about forty-five hours to produce death, being a trifle slower in action than sand and Bauer's mixture, and much slower than mercury mixture in sand. Its action is not so decided later on, a slower rate of death taking place from the forty-fifth to the seventy-sixth hour. This points to an absorption of the vapor by the soil. It is remarkable that in this case the Bauer's mixture with soil was nearly as effective as the same mixture alone (No. 51).

The general outcome of the above experiments may be stated to be that the effects of Bauer's mixture, both alone and when mingled with soil, were decidedly slower than those of the mixture prepared by ourselves, in the same general proportions; thus pointing to extraneous causes for its inefficacy. That these were the presence of oil and of a considerable contamination of lead in the quicksilver used by Mr. Bauer, has already been alluded to.

Some irregularity in the results obtained in different experiments is, however, to be expected, since it is next to impossible to make the conditions exactly alike at different times. This is especially true of the condition of the soil used, both as to the moisture it contains and the degree of fineness to which it has been brought. The latter especially, as will be seen later, affects materially the rapidity and continuity of action.

ABSORPTION OF MERCURIAL VAPOR BY THE SOIL.

Upon the supposition, that in addition to the causes above discussed, the failure of the mercury remedy might be partially due to an absorption of the mercurial vapor by the soil itself, numerous experiments were made with a view to testing this point. If the supposition were correct, it would follow that in a soil mixed with finely divided mercury the effect on the insects would be delayed in proportion to the amount of vapor which would first be consumed in saturating the soil. It would follow that in a clay soil, having a high absorptive power, this delay might be very great, while in a sandy soil, of low absorptive power, it would be relatively prompt. This presumption was strengthened by the fact that Mr. Bauer's successful experiments had been made with the sandy soil of the City of San Francisco.

In order to insure saturation, so as to render the soil incapable of further condensing the vapor formed at the ordinary temperature, it was obviously best to heat it after intermixture with the mercurial mixture, thus forming an abundance of vapor, which, on cooling, could not fail to leave the soil fully impregnated, so that any excess present would be sure to be free to act on the insect.

For practical purposes, the lowest temperature at which such saturation could be effected within reasonable limits of time, was evidently of capital importance, since it would largely determine the cost of application of saturated soil in the vineyard. This, therefore, was one of the objective points in all our experiments concerning saturation, which are recorded below.

Comparative Saturation of Soil and Sand, Experiments Nos. 14 and 15.— In these experiments clean washed beach sand and soil from the University vineyard plot were the materials used for comparison.

About 3,500 grams (eight pounds) of soil were mixed with twenty-two grams of standard mercury mixture and placed in a glass vessel, which was immersed in a water-bath. In each a glass tube, 1x7 inches, was inserted, having both ends open, and supposed to admit of free access of vapor generated from the soil mixture. These tubes are referred to in experiments Nos. 18, 20, and 22. Within them were placed smaller glass tubes, covered with gold foil. The water-bath was kept at 120° F., for about twenty-three hours, then raised to 180°, finally reaching 212° at the thirty-ninth hour. The soil experiment showed a slight amalgamation of the gold-foil after ten hours, a very decided one at thirty-six, which was seen three inches up the tubes. The effect did not appear higher at the twenty-ninth hour, nor was it more extended when the temperature reached 212° F., although globules had formed in the tube while the temperature was at 180° F. It was too hot for the condensation of the mercury in the tubes, but the passing vapor seemed not to act completely on the foil.

In the sand experiment a slight effect was noticeable at the sixteenth hour, and at the twenty-third a decided amalgam had formed, which reached up the tube six inches. At the twenty-eighth hour a slight effect was noticed to the top of the tube; and, at the thirty-ninth hour, mercury had condensed in the upper end of the tube. The effect upon the foil was much more general than in the soil. A porcelain dish placed over the sand condensed the escaping vapor in appreciable quantities.

The general conclusion is that the vapor escaped much more quickly in the case of the sand, indicating that less was absorbed; but no close estimate of the relative amounts could be made.

Effect of Saturated Soil upon the Phylloxera.

The table below shows the effect of soils and sand, saturated as above stated, upon the insect:

Material Used.	Time after Beginning of Experiment.	Condition of Insects.
18. Saturated dry soil	23 hours	No effect.
	30 hours	Moving about.
	46 hours	Larvæ dropped off, dead.
22. Saturated dry soil	24 hours	Majority in good condition, some brown, some dead.
	32 hours	Nearly all dead.
	49 hours	All dead.
19. Saturated dry soil	22 hours	No decided effect.
	30 hours	Normal and moving.
	46 hours	No motion, dead.
25. Saturated dry soil	16 hours	Normal.
	24 hours	Badly affected, not positively dead.
	41 hours	Mostly dead, some alive.
20. Saturated dry sand	7 hours	No effect.
	23 hours	Normal, but moving.
	30 hours	Moving about confusedly.
	47 hours	Root dry.
21. Saturated dry sand	7 hours	Normal.
	23 hours	Tuberous root was dry, insects left it, adult larvæ dead.
23. Saturated dry sand	16 hours	Normal.
	24 hours	All dead.
24. Saturated sand, wetted	17 hours	Normal.
	25 hours	Decided effect.
	41 hours	Nearly all dead, some moved.
	66 hours	Color of some good.
26. Saturated soil, wet and re-dried	23 hours	Slight effect.
	31 hours	None alive.
	47 hours	All gone.

Three of the above experiments, Nos. 20, 18, and 22, were made by placing pieces of infested roots in open tubes surrounded by the mercurialized soil. This space might be supposed to be quite as well saturated as the soil mixture itself, there being ample room at the lower end for the flowing in of the vapor. Two have, however, produced less effective results, and in the case of the sand very little, if any, effect could be noticed. No. 22, a duplicate of No. 18, seems to have produced good results, proving fatal to some of the insects in twenty-four hours, and killing nearly all in thirty-two hours; which equals the effect produced on roots placed in the soils themselves, outside of the tubes. In the latter experiments forty hours were required to kill all the phylloxera; while the sand is more active, requiring only twenty-four hours to kill all. The effect was decided in No. 23, as the insects did not move from their first position. The specimens were all tested within a few days of the preparation of the saturated soil.

Some of the impregnated sand was wetted to test the effect of moisture upon the action of the vapor (No. 24). We still get a decided action at the twenty-fourth hour and find the insects nearly all dead at the forty-first. Their peculiar positions show the characteristic effect; even at this hour

some still had motion. At sixty-six hours nearly all were brown; one or two still retained yellow color, but their legs were incurved and they were undoubtedly dead. At eighty-nine hours one was still in good external shape. This experiment shows that some individuals, in protected places, may survive some time after the effect has proved fatal to those most exposed.

In No. 22 three insects were in a mass, the top one was black to brown, the second lighter, and the bottom one apparently in good condition.

Three of the root samples had eggs on them; on one the eggs remained eighty hours before becoming darkened, and only at one hundred and four hours were brown and shriveled, showing them to be very much more slowly affected than the insects themselves, but that under continual action they will finally die.

No. 26 refers to a soil sample that had become very wet during the saturation. It was dried at ordinary temperature in the course of about ten days. The insects placed in it were active at the twenty-third hour, but were strewn all about and none alive at the thirty-first hour, and by the forty-seventh all had disappeared. The wetting seems, therefore, to have produced no effect upon the permanent efficacy of the mercurialized soil; proving that the natural alternations of the same kind, in the vineyard, will not naturally influence the practical application of the remedy.

Experiments on the Least Time Required for Saturation, at 110° F.—These experiments were made with a view of finding the least time required for the saturation of a soil with mercurial vapor at 110° F., the temperature ordinarily available under a summer sun in California.

Nine samples of soil were prepared by mixing 15 grammes of standard mixture with 550 grammes of slightly moist soil; one sample was left unheated, and two each of the remaining samples were heated to 110° F. for three, six, twelve, and twenty-four hours respectively. Another larger sample, of two gallons, similarly prepared, was subjected to the same temperature for three days, when the iodine test showed excess of mercury vapor. The table below shows the results obtained in the exposure of infested roots to the action of the several soil samples, in the same manner as before described:

TABLE

Showing Effect of Time in Saturation of Soils.

MATERIAL USED.	Time, Hours.	CONDITION OF INSECTS.
50. Soil and standard mixture, not heated	21	No effect.
	45	Some apparently dead.
	33	Quite a number dead.
	76	About all dead; color of some was good.
	93	Color of some still good.
37. Soil and standard mixture, heated three hours	24	No effect.
	40	Large number dead.
	65	All dead; one had good color.
49. Soil and standard mixture, heated three hours	21	No effect.
	28	No apparent effect.
	45	Nearly all dead.
	52	All dead.
	69	Shriveled up.
38. Soil and standard mixture, heated six hours	24	No effect.
	40	Badly affected and browned.
	48	Majority are dead; some good color.
	65	One still alive.
48. Soil and standard mixture, heated six hours	24	No effect.
	47	Large number dead.
	54	All dead.
	71	Some retain shape and color.
39. Soil and standard mixture, heated twelve hours	24	Slight browning; insects active.
	40	Nearly all dead.
	48	All probably dead; not shriveled.
	69	Eggs shriveled.
47. Soil and standard mixture, heated twelve hours	23	No appreciable change.
	47	Some dead.
	55	Quite a large number dead; some perfect.
	79	All dead.
44. Soil and standard mixture, heated twenty-four hours	24	A few badly affected and brown.
	40	Nearly all dead.
	48	All dead; medium color; not shriveled.
56. Soil and standard mixture, heated twenty-four hours	24	No appreciable effect.
	31	Some apparently dead.
	48	Some dead; many moving.
	72	All dead.
	79	Two or three retained good shape.
35. Soil and standard mixture, heated seventy-two hours	23	No effect.
	31	Some injured; some evidently dead.
	47	All apparently dead.
59. Soil and standard mixture, heated seventy-two hours	18	No effect.
	25	Some dead.
	42	Only a few have good form.

From the above record it appears that the soil not heated at all is slow in its action, as it required at least forty-five hours to produce apparent death in some, and seventy-six hours to kill all the insects.

Of the rest, the soils treated respectively twelve and twenty-four hours, and three days, produced a visible effect within twenty-four hours after the immersion of the phylloxerated roots. The majority of the insects were killed at the fortieth to forty-eighth hours.

As regards No. 50, it will also be seen that as the delay of fatal effect is increased, there is a chance for many of the insects to escape, for small cracks, or pieces of bark lying loosely over them, protect them for the time, and they come out after all the more exposed individuals are dead. In nearly all these nine experiments, straggling individuals appeared sixty or seventy hours after treatment, and many were found, having good shape and color, even after the eightieth hour. They did not shrivel rapidly, even when dead, as happens when the action is quick. The eggs seemed to be but little affected.

Upon No. 35 the insects were scattered about, and one or two survived the forty-seventh hour. An old one laid eggs at the fifty-fifth hour, and was in fair shape at the seventy-first hour, but eight hours later was dried and shriveled, as was also the egg.

It thus seems that twenty-four hours, at 110 degrees, is sufficient to saturate the soil to such extent as to insure rapid and satisfactory results. But it nevertheless appears, from a close discussion of the former tables, that in the case of soils mercurialized at a high temperature, or by long treatment at a lower one, the action in the later stages (after the fortieth hour, or thereabouts) is more complete and thorough, the insects losing shape and shriveling very soon after death.

VAPOR-SATURATION OF SOILS.

In order to determine definitely the amount of mercurial vapor which a soil will absorb ("occlude"), an apparatus was devised in which the soil could be exposed to such vapor at the desired temperature; the vapor, formed below, passing through the soil until saturation was complete. The first appliance used was simply a flask, on the bottom of which was placed standard mixture scattered through asbestus. The soil was placed upon this, and a tube reaching through the soil and asbestus to the bottom of the flask was connected with a drying-tube. An aspirator exhausts the air from above the surface of the soil, so as to suck dry air through the open tube and the heated asbestus and soil. Experiments 31 and 45 were conducted in this apparatus. It was, however, soon replaced by a more convenient one. A small glass percolator replaced the flask; the layer of asbestus and mercury mixture was increased to $1\frac{3}{4}$ inches in thickness, and was covered with two fine wire gauzes, to prevent intermixture of the soil above with the layer below. The soil fills the space to the top of the vessel, $3\frac{1}{2}$ inches. An air-tight cover is luted to the upper end of the percolator, with an exit tube connecting with a gauge bottle and aspirator. At the lower end of the percolator vessel is fitted a piece of rubber tubing, which passes up on the outside and is connected with a drying-tube. The whole, thus arranged, is sunk, up to the cover, into a water bath, which is kept at 110° F. In the exit tube is placed some iodine, which vaporizes quickly and indicates the passing over of any mercury vapor. The aspiration is kept at the rate of about 8.9 litres per hour, which, with a 7-mm tube, gives a velocity of 64 millimeters per second, and which is just rapid enough to keep the iodine vapor from passing more than one half an inch toward the soil. At this point, whenever mercurial vapor comes over, a distinct, bright red ring forms diagonally around the inside of the tube.

At varying times samples were taken out for assays. It was first attempted to distil a definite quantity of saturated soil, and determine the amount of mercury in the distillate, but a large amount of tarry matter

coming over with the vapor rendered it quite difficult to obtain accurate results, so a wet method was substituted.

Fifty grams of soil were treated with strong nitric acid, and, after standing some time, was filtered, evaporated, and dried, treated with hydrochloric acid and the mercury precipitated with sulphydric gas, collected, and the weight determined.

The table below gives in one column the amount as determined; hours aspirated; amount of air passed through; and the calculated amount of mercury per cubic foot of soil:

	Number of Hours Aspirated.	Volume of Air Aspirated. (Litres.)	Mercury in 50 Grams of Soil. (Grams.)	Mercury in 1 cu. ft. of Soil. (Grains.)
31. Vapor-saturation of dry University soil, in flask	54	480.6	.0070	*78.538
Vapor-saturation of dry University soil, in flask	54	480.6	.0115	129.025
45. Vapor-saturation of dry University soil, in flask	51	453.9	----------	----------
55. Vapor-saturation of dry University soil, in special apparatus	94	836.6	.0073	81.779
64. Vapor-saturation of dry University soil, in special apparatus	144	1281.6	.0108	121.171
53. Vapor-saturation of dry Bidwell's black adobe soil, in special apparatus	46	409.4	.0069	77.412
60. Vapor-saturation of dry Bidwell's black adobe soil, in special apparatus	144	1281.6	.0077	86.392

* Determined by distillation, yielding too low a result; the next by extraction with nitric acid, as are all the rest.

The table shows that the largest quantity of mercurial vapor taken up by the soil amounts to only 129 grains per cubic foot. This includes the amount actually absorbed, and supposed to have no effect upon the insect, besides a part which, as will be seen, remains as an effective vapor. Just what proportion of this total amount is really inert has not been determined, and, without doubt, varies considerably, if we may judge by the effect produced upon the insect; for an increased amount of mercury found in the soil does not seem to produce a proportionately increased effect.

The relative amount absorbed by the two soils does not bear out the supposition that the absorption of mercury vapor follows the general law for the absorption of water vapor by the soil. The Bidwell soil has a high power of moisture absorption, is high in humus, and contains a large amount of clay, all tending to a higher absorptive power than the University soil. But this does not hold good for the mercury vapor, except for the soil aspirated during a shorter time, where it exceeds the University soil in absorption, owing probably to its greater fineness. It is not obvious from these determinations, and the analysis of the soils, what the chemical nature of the soil should be to absorb mercurial vapor readily. Its physical condition may largely influence the absorption.

Effects of Vapor-Saturated Soils on the Phylloxera.

For the purpose of comparison, the specimens of soils which were vapor-saturated were also tested as to their action on the phylloxera. The results obtained are given in the following table, in which, for comparison, numbers 35 and 59 of the last table are reinserted:

TABLE

Showing the effects on the Phylloxera of Soils Saturated with Mercurial Vapor at 110 degrees.

MATERIAL USED.	No. of Hours.	CONDITION OF INSECTS.
35. Saturated University soil, with excess of standard mixture	23	No effect.
	31	Some injured; some dead.
	47	All apparently dead.
59. Saturated University soil, with excess of standard mixture	18	No effect.
	25	Some dead.
	42	Only a few have good form.
36. Vapor-saturated University soil, slightly moistened, aspirated 54 hours in flask	21	No effect.
	45	Look disturbed.
	69	All are dead.
	93	Some eggs good color.
40. Vapor-saturated University soil, dry, aspirated 54 hours in flask	6	No effect.
	22	Some apparently dead.
	30	Some good condition; many left the root.
	46	One in good condition.
58. Vapor-saturated University soil, aspirated 51 hours in apparatus	18	Quite decided effect; some dead.
	25	All are dead.
	42	Shriveled up.
62. Vapor-saturated University soil, aspirated 144 hours in apparatus	22	Large number dead; many in perfect condition.
	30	All apparently dead.
	46	Shriveled up.
63. Vapor-saturated University soil, moistened, 144 hours in apparatus	22	Very slight effect.
	71	Those most exposed are dead; many are perfect.
	75	Some moving about.
	102	Nearly all have left the root.
57. Vapor-saturated Bidwell soil, moistened, aspirated 46 hours in apparatus	18	Quite decided effect; some apparently dead; some moving.
	25	About all gone; some quite good condition.
65. Vapor-saturated Bidwell soil, moistened, aspirated 144 hours in apparatus	18	Majority dead and shriveled; few in perfect condition.
	25	All dead and shriveled.

It will be noted that the dry soil (No. 40) acts more readily than the one treated like it in all respects except moisture (No. 36). The effect was decided even after twenty-two hours, but the effects did not increase to the forty-fifth hour, as was anticipated; a slow fatality lasting until the sixty-second hour, when all were dead, and nothing living was left by the seventieth hour.

The remaining experiments, conducted in the new apparatus, where more complete saturation could be attained, have given better results than the preceding. All, except No. 63, have produced fatal results in eighteen hours, and have been fatal to nearly all the insects in twenty-five to thirty hours, and by the forty-sixth hour, as the outer limit, all have been shriveled.

In Nos. 58 and 62, similar soils, the latter treated longer than the former, there is no noticeable gain by the longer treatment. The action was prompt and decisive in both cases. In Nos. 57 and 65 a wider difference is noticeable between the two treatments, and the action is even more prompt than in the preceding numbers. An eighteen-hour treatment produced a fatal

effect in both cases; but in the former more insects were moving, and in better condition. In the latter there was but little motion, the insects dying upon the spot where first located. The former left some in quite good condition at twenty-five hours; the latter none with distinct form. This would indicate a decided influence in favor of a longer treatment during vapor saturation.

A comparison of Nos. 58 and 57, the former treated a little longer than the latter, show them to be nearly equal in effect, the former being a trifle more effective.

A peculiar discrepancy presents itself in comparing these results. It will be seen that a longer aspiration, with the same soil, invariably produces more decided results; but not in the same ratio that the soil becomes charged with mercury. The assays, therefore, do not accurately foreshadow the effect the saturated soil will have when tested with the insects. For instance, the Bidwell soil and University soil, of one hundred and forty-four-hour treatments, give to the University soil the higher mercury contents, but to the Bidwell soil the most decided poisoning effect. Evidently the outcome is materially influenced by some peculiarities inherent in the soils themselves, which it will take further investigation to identify.

Effects of Moistening.—The very marked effect of wetting on the efficacy of a vapor-saturated soil, is shown in comparing Nos. 63 and 36. Even the slight moistening of 36 has very decidedly retarded its action (from twenty-two to forty-five hours) in producing fatal results, and to sixty-nine in killing all of the insects. At ninety-three hours one still moved, although reddened; some eggs had good color.

In No. 63, a moistened duplicate sample of 62, the action is very slow, almost none. At twenty-three hours only a very slight effect was noticeable, while at the same hour a large number were killed in No. 62. At seventy-two hours some of those most exposed were killed, many were perfect and moved about and were able to leave the root by the one hundred and second hour.

Influence of the Degree of Division of the Soil on its Vapor-Saturation.—From the preceding experiments, showing the rapid action of soils saturated with mercurial vapor on the phylloxera, it is evident that the amounts of the metal found by the assays do not represent only the portion really rendered inert by absorption or occlusion, but include a certain excess, which, being present in an extremely fine or perhaps even vaporous condition, acts with extraordinary energy upon the insects; *at least* as much so as in the case of the soil saturated by heating with mercury finely diffused through it.

It is evidently only by long exposure of the vapor-saturated soil to the air, insuring the escape of all evaporable surplus, that the real minimum of occluded metal can be ultimately determined. For this determination, however, sufficient time has not yet elapsed.

It has, however, been definitely ascertained that vapor-saturated soil rapidly decreases in its efficacy in the course of time, and the same decrease has been noted even in the case of some samples in which the mercurial globules had been actually intermixed with the soil.

There is no difficulty in accounting for this decrease in the former case. The soil used is not uniformly fine, but consists of little clods ranging from the size of dust particles to that of large sand grains, say .02 of an inch in diameter. The dust particles are quickly saturated throughout; with the

larger particles, the vapor requires time to penetrate the whole mass and saturate it. As this absorption into the interior of the clods progresses, the free vapor of the air pores will be consumed thereby, and thus the efficacy of its action on the phylloxera is materially diminished. After a time, of course, when all is thoroughly saturated, a condition of equilibrium will be established, to be disturbed only by the introduction of fresh, unsaturated earth.

In the vineyard, where the clods will usually be larger than in our experiments, it will also take a longer time to establish the condition of thorough saturation and permanent equilibrium. On the other hand, our experiments represent minimal results in this, that in order to allow of continuous observation, the insects were protected from all immediate contact with the mercurialized earth by the interposed screen of cheese cloth. Considering the localization, and especially the sinking-down of the mercurial vapor shown in the experiments with tall cylinders, this constitutes a serious impediment to the action of the mercury. All things considered, there is reason to believe that when soil properly prepared is used in the vineyard, the effect will be at least as prompt as in our experiments. Some observations bearing on this point are given below.

The season having advanced so far that phylloxerated roots suitable for direct experimentation could no longer be obtained, the following experiments were made with a view to the approximate solution of the above questions.

Detection of Free Vapor in Mercurial Mixtures and Mercurialized Soils.— In order to determine approximately the relative proportion of free vapor in mixtures after standing for some time, a portion of each was placed in tubes about five eighths inches in diameter by fourteen inches long. The lower end is drawn out to a small point and connected with a drying tube. The soil was placed upon a thick layer of asbestus, and its upper surface covered with cotton, of sufficient thickness to prevent particles of the substance being carried over when aspiration begins. Iodine was placed in the exit tube connecting with the gauge-bottle and aspirator. The vapor passed through the five-milimeter tube at the rate of thirty-two milimeters per second.

TABLE

Showing Action of Mercurialized Soils in Yielding Vapor.

	Date of Preparation.	Date of Testing.	
76. Saturated University soil, from experiment No. 14	Oct. 2	Nov. 21	Faint red ring in ten minutes, quite distinct in fifteen minutes; duplicate gave a more decided reaction.
60. Saturated University soil, from experiment No. 14	Oct. 2	Nov. 17	Very distinct yellow color formed in twenty-five minutes; later, red became very distinct.
69. Saturated sand, from experiment No. 15	Oct. 7	Nov. 18	Very distinct yellow color formed in twenty-five minutes; distinct characteristic red color in three hours and twenty minutes.
70. Sand with standard mixture, not heated	Oct. 9	Nov. 19	Slight yellowing in ten minutes, slight reddening in fifteen minutes.
75. Sand and Bauer's mixture	Oct. 9	Nov. 20	Quite characteristic rings in five minutes; ten minutes, quite red.
78. Bauer's old mixture, No. 1	April 20	Nov. 24	Slight yellowing, not characteristic, formed in a short time; distinct red ring in four hours and fifty minutes.
77. Bauer's new mixture, No. 3	Nov. 16	Feb. 4	A yellow ring formed almost immediately; eight minutes, red.
71. Vapor saturated University soil (dry)	Nov. 13	Feb. 19	Thirty-five minutes slight yellowing, not characteristic; nine hours and ten minutes, faint red color.
67. Vapor saturated University soil	Oct. 28	Feb. 17	Three hours and forty-five minutes quite distinct yellow color; four hours and thirty minutes very characteristic color, strong in five hours.
72. Vapor saturated Bidwell soil	Nov. 10	Feb. 20	Eight minutes, slight yellow; twenty minutes, distinct yellow with red tinge.
79. Soil mixture, not heated	Nov. 24	Feb. 24	Five minutes, distinct red ring.
80. Soil mixture, not heated	Nov. 24	Feb. 30	Five minutes, distinct red ring, became very bright after standing.

A prompt and decided reaction is here shown in the saturated University soils which have been heated and have since stood six weeks. But the sand similarly treated, and remaining nearly the same length of time, is very much slower, requiring three hours, against fifteen to twenty minutes in the soil similarly treated. No. 70, which was similarly composed but not saturated by heat, exceeds the preceding one, and equals the soils which *were* heated.

A surprising result comes from No. 75—Bauer's mixture, and sand not heated—even exceeding No. 70, similarly treated, and standard mixture used. It would thus seem that the mixtures *not* heated hold more vapor at the end of six weeks than those that *were* heated.

In Nos. 78 and 77, we have a comparison of Bauer's two mixtures—the former, the old one, with lead and oil, and the latter, the new one, free from both. A very decided difference appears here, but in later experiments, February, 1886, the two give reaction with nearly equal promptness.

The vapor-saturated soils give a very wide difference in amounts of vapor. That of the Bidwell soil aspirated one hundred and forty-four hours, had kept its saturation to the full extent.

The remaining soil, prepared for use in the field, 1 part of mercury to 714 of soil, gave a rapid and decisive reaction as soon as it was prepared.

Further experiments are needed to explain some of these divergent results.

Lateral Diffusion of the Mercurial Vapor.—In order to test the rapidity of the sidewise diffusion of mercurial vapor through the soil, a box 6x6x23 inches inner dimensions was made, care being taken to make close fitting joints. At one end was placed a column of mercurialized soil, 714 parts to 1 of mercury; being approximately the proportion directed by Mr. Bauer to be used in practice, in planting a new vineyard with the remedy. The remaining portion of the box is filled with dried soil of uniform fineness throughout, separated by a partition of cheese cloth from the mercurialized soil. The whole is covered with a close fitting cover. Upon one side are holes, stopped with movable plugs, at intervals of 1, 1, 2, 3, 4, and 8 inches, through which the soil can be taken and tested to note the progress of the vapor.

At the end of one month the soil, at a distance of one inch from the mixture, gave a characteristic test for mercury with iodine in about twenty minutes, showing a very slight amount, and slow diffusion. Further tests will be made, from month to month, or as fast as the indications may seem to require them.

VINEYARD EXPERIMENTS WITH MERCURIALIZED SOIL.

In order to test, in the field, the results obtained in the laboratory experiments above detailed, about three gallons of vineyard soil was mixed with the usual amount of standard mixture, and heated in a water bath at a boiling temperature about four days, until the mercury vapor condensed upon a dish placed above the mouth of the jar in which the soil was heated. We were thus assured of complete saturation of the soil with mercurial vapor. One third of the soil so treated was placed near a vine, carefully covering, but not completely surrounding, some roots which were badly infested. The mercurialized soil was covered with paper and the original soil replaced above it. On the fifth day no living insects could be found upon the upper side of the roots, within the limit of the treated soil. On the sixth day, the insects on the lower side of the roots were still alive, although some were affected. On the ninth day, no insects could be found within the treated portion, above or below, but very numerous and apparently unaffected colonies just outside its limit. The effect had apparently not extended even half an inch outside of the mercurialized earth.

Another portion of mercurialized soil was prepared by mixing 250 grams of standard mixture with two gallons of soil. It was heated to 110° F. for three days, and then one and one half gallons placed around the roots of a badly infested vine. The large roots were completely surrounded by it, and the surface of the replaced natural soil moistened with water. At the end of five days no insects could be found where the prepared soil had reached, but just outside of this limit was an abundant supply. We are assured of the presence of the vapor in the mixture by its effect upon insects in the laboratory, and are also certain that its limit could not have been extended to any distance beyond, as the insects near by were unharmed. Of course, only a slight diffusion at best could have been expected in so short a time as five days, and it would, therefore, be of little service to a vine with far-reaching roots, within any similarly short time.

GENERAL CONCLUSIONS.

The causes of the failure of the field experiments of the last season having now been successfully traced, it remains to be shown whether the needful saturation of soils with mercurial vapor can be accomplished in some manner that will render the method practically available to grape-growers, whether for the prevention or for the cure of the phylloxera invasion. In what manner, and at what temperature, can this impregnation be accomplished cheaply on the large scale, at or near the vineyards to be treated, and without endangering the health of the operators?

It is obvious that in the case of sandy soils preliminary preparation may be dispensed with; and that the mode of application used by Mr. Bauer will still be satisfactory, provided that the mixture was made with mercury free from lead, and without oil.

In the case of heavier soils, in which preliminary impregnation is necessary in order to insure prompt action, we have determined how long an exposure to the temperature usually acquired in the sundrying of raisins, and which has been adopted as the desirable temperature in the best fruit driers, viz.: 110°, will suffice to effect the saturation. From our experiments it appears that exposure to this temperature during *twelve* hours makes the dry earth nearly as effectual in destroying the phylloxera, as any longer period of exposure; but for safety's sake a longer heating should be used in practice, where soils will not be in as fine a condition as in our experiments.

This suggests that in order to prepare the impregnated earth on a large scale, it might first be made fine by harrowing and rolling; then taken up by means of scoops and spread on a drying floor placed on a warm exposure in the vineyard, in such manner that after full drying and raking into it the proper proportion of the mercurial chalk or clay mixture, a three or four days' exposure to sunshine would fulfill the minimum condition of a twelve hours' heating to 110°. The earth would then be ready to be placed around the vines or cuttings to be protected against infection in such quantities as continued experience shall show to be necessary. A minimum of one quarter cubic foot has been suggested above (see Bulletin No. 48), but it may be desirable to allow a wider margin of safety, and use the full amount originally suggested by Mr. Bauer—half an ounce of mercury, or one ounce of his mixture—for each vine. With about a cubic foot of earth—filling a hole say a foot across and twelve inches deep—the earth would contain nearly twice the amount of mercury required for its full saturation, and would thus be very likely to be fully effective. That, however, saturation at steam heat would be more certain to insure the maximum effectiveness, is rendered probable by several experiments described above. A suggestion of devices to accomplish this in the field is given in Bulletin No. 48.

The effect of earth thus impregnated upon fine rootlets, the differences created by differences of soil, the spread of the mercurial vapor sideways and downward, and many other points suggested in the course of this work, are still under investigation, and their determination will take some time.

THE PHYLLOXERA AT BERKELEY.

At a meeting held May 11, 1885, the following resolution was passed by the Board of State Viticultural Commissioners:

COPY OF RESOLUTION.

Resolved, That the Committee on Vine Pests and Diseases of the Vine be instructed to ascertain whether the phylloxera still continues to infest the vines at the University grounds, Berkeley, and, if so, to enter into communication with the proper officers of the University, and request that the infested vines be destroyed as soon as possible, so that the pest may be completely exterminated before the season of prevailing summer winds shall cause further danger of the spread of disease into healthy districts.

A copy of this resolution was communicated to the Secretary of the University on June fifth, and during the recess of the Board of Regents a memorandum containing a reply to the same, and giving reasons why the request of the Viticultural Commission should not be complied with, was prepared by Professor Hilgard. At a meeting of the Regents held on August fourteenth, the above resolution, together with the memorandum mentioned, was read, and by the Board referred to the Committee on Viticulture for report at a future meeting. Shortly after, a communication signed by the Chairman of the Committee on Vine Pests of the Viticultural Commission, and purporting to answer the statements of the above memorandum, was sent to the Secretary of the University, and simultaneously published in certain periodicals. A rejoinder to the latter communication was presented by Professor Hilgard to the Chairman of the Regents' Viticultural Committee, and at a meeting of the Regents held September first, the following report and recommendation concerning the subject was made by that committee, and unanimously adopted by the Board of Regents:

Second—We recommend the continuation of the study of the phylloxera on the University grounds, believing it to be without the slightest danger of infecting other parts of the State, on account of the extreme care taken by Professor Hilgard; and we believe it will probably result in obtaining a knowledge of the habits and life of this insect, which will be of great value to vine-growers. We think that Professor Hilgard should be requested to make a full report of the controversy.

Respectfully,

GEORGE J. AINSWORTH.
J. WEST MARTIN.

In pursuance of this action of the Board of Regents, the following presentation of the points involved is made by Professor Hilgard:

UNIVERSITY OF CALIFORNIA, COLLEGE OF AGRICULTURE,
BERKELEY, September 5, 1885.

George J. Ainsworth, Esq., Chairman Viticultural Conference Committee:

DEAR SIR: In accordance with the recommendation of your committee, adopted by the Board of Regents at their late meeting, I respectfully submit the following summary statement:

When, some five years ago, the orchard, vineyard, and propagating houses of the University were placed in my charge, and some time afterward it was discovered that the vines were infested by the phylloxera, I made immediate preparations to apply to the whole plot the "death treatment" with bisulphide of carbon. A French "injector" was loaned for the purpose by Mr. John H. Wheeler, from whom also a supply of the bisulphide was obtained. Unfortunately the stony nature of the ground rendered

operations very difficult, the injector being broken several times; after which the ground became too hard, and the matter had to be left in abeyance for the season of 1881.

During the legislative session of 1880, an Act was passed creating legal machinery for the repression of insect pests, action in respect to the phylloxera being specially delegated to the State Viticultural Commission. During the year a vigorous stand was made for the enforcement of these laws by the fruit growers, and with excellent results, until finally, in a test case brought before the Supreme Court, the Act was declared unconstitutional in some respects, and its enforcement had to be abandoned. No serious attempt to enforce the provisions relating to the repression of the phylloxera was, during that interval, made by the Viticultural Commission, owing in part, perhaps, to the opposition of vineyard proprietors in the infested districts to measures that would declare the existence of the pest in their neighborhood. The Commission, conjointly with the University, proceeded to the ascertainment and outlining of the infested areas, and made recommendations regarding disinfection, resistant vines, etc., based on the action previously taken in France. It omitted, however, any reasonably adequate provision for the observation of the life-habits of the phylloxera, a knowledge of which was, nevertheless, of great practical importance in estimating its probable advance within the State, as well as in making the best choice of means for its repression. Such provision was among the first measures adopted by European Governments, and our preliminary work had rendered it obvious that a material difference, in several respects, must exist as the cause of the relatively slow progress of the pest in this State, when compared with France and the East.

In view of these facts and of the remoteness of the University grounds from any serious vineyard enterprise in the direction of the winds that steadily prevail during the season when there might be danger of infection being carried to some distance, I reconsidered the determination to extirpate, immediately, the phylloxera in the University plot; the more, as the latter is so located with reference to the rest of the grounds (viz.: at their northeastern extremity), that in view of the trade winds steadily prevailing during summer, with proper precautions, even the infection of other portions of the grounds where vines might be planted, was only a remote possibility. So long as cuttings and grape boxes from infested districts continued to circulate freely in all directions, it seemed to me of much greater importance to have under my own observation and control, a plot on which exact experiments and observations could be made at all times by practiced observers, and with the aid of the best appliances, than to remove so infinitesimal a chance of infection as is here afforded, provided reasonable care be exercised.

It has been claimed by the Chairman of the Committee on Vine Pests, that "such observations could be better made on a large scale within the infected districts," and that the repeated excursions made by my assistant, Mr. Morse, under the auspices of the Commission, to these regions, are adequate for the purposes in view. But this idea is based on a misapprehension of what constitutes valid experimentation and observation. Neither of these can be carried out to conclusive results by occasional tours of inspection. It is necessary to place competent observers where, whether for experiment or for the study of its life-habits, *the insect can be under daily and hourly observation;* and this, as stated, has been done by all European Governments that have acted in the premises. The omission of this necessary part of intelligent action, by the Viticultural Commission, alone

amply justifies the maintenance of the infested plot at Berkeley, so long as it can be done without serious danger to vine-growing districts. The latter is the only point about which there can be any discussion; and on this point the observations made at the University have shed very essential light.

It is now generally understood that, apart from the transportation of infested soil and vineyard materials or appliances, the chief danger of infection arises from the existence of the "winged form" of the phylloxera, which, during a certain period, usually of from four to six weeks in July and August, issues from the ground around the infested vine during the warm hours of the day, and may be carried to a distance, even of several miles, by violent winds in level regions. The fly, however, has very limited powers of flight, does not rise high in the air, and depends mainly on the wind for its locomotion. Hence, bodies of forest, and high steep ridges unoccupied by vineyards that would form way stations, have been elsewhere as well as here found to be impediments, or, as the case may be, effectual barriers to the progress of the insect, provided effectual quarantine is maintained.

Until within the last year, the nearest serious vineyard enterprises under the wind from the Berkeley vineyard plot, were some fifteen miles away, near Martinez, across many ranges of high hills; the highest being directly back of the experimental grounds, which, moreover, lie in the "dead angle" under the range, and are screened by trees on all sides. It is doubtful that more than one out of a thousand of the winged insects would usually be carried even beyond the limits of the University grounds by the trade winds; and the chance of that one for getting beyond the first high, steep range would be but a dismal one. When it comes to traversing several more ranges covering the remainder of the distance, its prospects would be desperate indeed.

To this view of the matter the representative of the Commission has objected "that the Napa Valley, south of Yountville, has apparently been invaded by the winged female, which has been blown across the high mountain ridge which divides the region from Sonoma." There is nothing to support or justify any such conclusion. The first phylloxerated spot within the Napa Valley was observed by me in 1877, close to the stage road and public highway leading directly from the worst infested portion of Sonoma, and on which vineyard material was and is constantly being hauled back and forth. It is plainly from this highway and its infested wagon-loads, that the insect has spread in the Napa Valley; probably quite as much through this direct transportation of infested material as through the agency of the winged insect itself.

There are, however, circumstances apparently peculiar to California, whereby the supposed danger referred to by the Commission is reduced to a minimum. One is the now well established rarity of the winged form of the phylloxera in ordinary seasons,* that (as long ago suggested by me) largely explains the relatively slow progress of the pest in California. Among the vines in the University plot Mr. Morse has found only one vine that has furnished the winged insect every season, the rest varying in this respect in different years, but mostly showing few or none.

In addition, the observations at the University have demonstrated the fact, that an unusually large proportion of the winged insects is sterile, and hence unable to carry infection; further, that of about one hundred and

*To this rule there was a notable exception during the wet Summer of 1884, and to this my remarks before the Viticultural Convention held that year, directly referred.

sixty eggs from winged insects, kept under observation in 1884, not a single one hatched into the sexual forms, which alone, as a rule, produce the "winter egg;" and further, that in the whole course of Mr. Morse's extensive investigations, he has found only two cases which pointed to the production of the winter egg, while the most diligent search thus far has failed to find the latter itself. However important in France, the "winter egg" seems, therefore, to play a very insignificant part in California, and the suggested carrying of infection anywhere through the distribution of other plants upon which it might have been accidentally deposited, is thus reduced to an improbability represented by figures beyond the usual range of our ideas.

Whatever may be the precise cause of these deviations from the habits observed in other countries, they are obviously of no mean importance, for they imply that with us the communication of infection is much more easily avoided than elsewhere, and that a rigorous system of disinfection, enforced by law, would have been of great efficacy in preventing the spread of the pest. It is the more to be regretted that the strong influences brought to bear so successfully on other viticultural matters at the last session of the Legislature, should have omitted to place such provisions on the statute books. Of all noxious insects, the phylloxera is now, in this State, the only one of which the repression can only be attempted through the influence of moral suasion. It is thus that the focus of infection known to exist for several years past, in the neighborhood of San José, in the very center of one of the most important viticultural districts of the State, remains *in statu quo* to-day, although incomparably more dangerous to the Santa Clara Valley, and even to that of Livermore (now free from the pest), than the well guarded plot at Berkeley can be to any of the vineyards of Contra Costa.

It should be understood that the infested plot at the University (representing a square of about 70x75 feet and containing only about forty infested stocks besides a number of resistants planted for experiment's sake), is and has been used exclusively for the purposes of experiment and study, such as testing the resistance of different grape varieties to the phylloxera, the efficacy of various proposed remedies, and the study of the life-habits of the insect; the latter part being under the special charge of Mr. Morse, whose second report thereon is now in course of preparation. Nothing whatever, in any shape, has ever gone out from the infested plot, even to infested districts.

The grape cuttings and seedlings distributed from the University have all been grown at the garden of economic plants, a quarter of a mile away, *above the wind;* and all have been carefully disinfected before packing. But the closest scrutiny of the vines growing in that garden (at the western extremity of the grounds), of which many are non-resistants, has failed to show a trace of the phylloxera.

At the present time, many experiments are in progress that illustrate well the desirableness of maintaining this plot as it is. Among them are several in relation to the unlooked-for failure, thus far, of the mercurial remedy suggested and furnished to us by Mr. J. A. Bauer. The insecticide power of mercurial vapor formed at the ordinary temperatures is well known and established by the experience of centuries. It is also shown promptly whenever the insect is exposed to air confined over metallic mercury. From some cause this vapor is not formed, or is rendered inactive for a time at least, in earth treated with Mr. Bauer's preparation; and the chief executive viticultural officer has somewhat hastily inferred its entire

failure, in advance of further examination into the possible causes of this unexpected result, and a possible overcoming of the difficulty. I am now investigating this subject experimentally, a thing which it would be impossible to do unless the living infested vines were under my immediate observation and control.

In conclusion I would say, that while the demonstrations and experiments now under way in the University vineyard plot are, in my opinion, too valuable to be sacrificed in the manner suggested by the Commission, to an unfounded apprehension, it is feasible to do away with even the remote possibility suggested by the (to me thus far unknown) existence of a new vineyard within five miles of the University in the direction of Martinez, by covering the ground around the infested vines with a dressing of gas lime, which will completely cut off the exit of the winged insects.

Respectfully,

E. W. HILGARD,
Professor of Agriculture.

The matter prepared for this report, on the subject of "resistant vines," is unavoidably omitted from the present publication for want of time for proper arrangement and discussion. It is proper, however, that at least a general statement concerning this subject, and the bearings of the preceding investigations thereon, should be made.

The observations of Mr. Morse seem to show clearly that the cause of the observed slow spread of the phylloxera in California, is to be found in the scarcity of the winged form of the insect, as long ago suggested by the writer; and that this rarity is due to the absence of summer rains, and of surface fertilization, both militating against the formation of the white rootlets near the surface, that appear to be the special breeding-ground of the winged form. If this be true, then quarantine regulations providing against the accidental spread of the wingless forms, should be of exceptional efficacy in this State and can not too soon be established. But however well guarded in this way, the vineyards of uninfested districts must remain in constant jeopardy from accidents and carelessness, so long as the actual extirpation of the pest in the infested regions is not compassed. The latest reports of French experience in this respect, and of the inefficacy of the "culture treatment" of infested vineyards for their permanent maintenance in profitable productiveness, are not encouraging in this respect. The American resistant stocks will therefore, hereafter as heretofore, constitute practically the only resource of infested regions.

For uninfested regions, the three measures to be resorted to are, first, "eternal vigilance;" second, the planting of resistant stocks, whether for direct fruiting or for grafting with *vinifera* varieties; third, the preventive use of the "mercurial remedy" during or after planting, under the conditions which have been found necessary to insure its efficacy. How far the favorable results obtained with that remedy on the small scale can be realized in large practice, must yet be determined; but the outlook for its success as a preventive is certainly hopeful.

As regards the choice of resistant grafting stock, it is certain that it will have to be carefully guided by farther experience. It is coming to be more and more fully understood that while our vigorous native stock, the *Cali-*

fornica, succeeds excellently on rich, heavy, and especially deep soils, it is not satisfactory where soils of lower quality and comparatively shallow depth prevail: in these, the *Riparia* and *Æstivalis*, and perhaps the *Rupestris*, are preferable. Under favorable conditions, however, the most vigorous growth and earliest bearing are recorded for the *Californica*.

In the work on resistant vines lately issued by Prof. Millardet, the resisting power of the *Californica* in France is placed no higher than that of the Eastern Fox or *Labrusca* varieties, which are commonly rated in this respect but little above the *viniferas* themselves. As Prof. Millardet's experience can not be older than ours, we must still incline to regard what we have seen here, ourselves, as better authority in the premises, so far as California is concerned. It is, in fact, quite possible that under the combined influence of summer rains and fertilization, the root habits of the Californian vine are changed to the injury of its resisting powers, in the direction of the formation of delicate surface roots, instead of the tough and deep-going, though relatively soft, tendon-like ones, that characterize it in its native home, and in which the bite of the phylloxera produces only little ring-like swellings, that nowise interfere with the health of the root or vine. Any one of the "resistant stocks" can be placed under conditions that will make it succumb to the attack of the phylloxera; hence the importance of carefully co-adapting soils and stocks in this case as well as when we plant *viniferas* for direct bearing.

Details, in respect to these several points, will be given in a future report.