

REPORT

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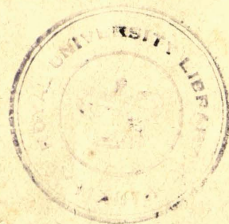
VINE AND POTATO DISEASES IN MALTA

AND

TREATMENT THEREOF

BY

Prof. F. DEBONO, M.D.



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Argotti Botanic Gardens,
Floriana, 3rd June, 1898.

Sir,

In compliance with instructions received from you "to prepare, for the information of His Excellency the Governor, a report suggesting the steps which, in my opinion, might be taken for the treatment of the Vine and Potato diseases;" I have the honour to transmit herewith enclosed:

————— A "Report on the Vine and Potato diseases in Malta, and
————— treatment thereof"; together with an Appendix on "Injury from
————— Frost, and methods of prevention"; and an Abstract of recommenda-
tions detailed in the Report and Appendix.

I have the honour to be,

Sir,

Your obedient servant,

F. DEBONO, M.D.

Director, Argotti Botanic Gardens.

The Director of Education.

The Honourable
The Chief Secretary to Government.

Forwarded.

N. TAGLIAFERRO,
Director of Education.

8th June, 1898.

REPORT on the Vine and Potato Diseases in Malta, and treatment thereof.

Preliminary Remarks.

The Potato and Vine plants have, of late, been respectively attacked, to a dangerous degree, by an allied fungous disease which calls for nearly the same treatment.

The Potato Blight and the Vine Downy Mildew are both caused by *Peronosporæ*; that attacking the Potato and causing the "late blight" is the *Phytophthora* (*Peronospora*) *infestans*, De Bary, the other, taking hold of the Vine, is the *Plasmopora* (*Peronospora*) *viticola*, Berk.

A Government Commission, of which I was a member, was appointed on the 23rd July 1892, to inquire into the nature of the disease, then raging amongst the Vines, and to suggest means to stamp it out. The Commission gave their report on the subject, which was published in the Government Gazette of the 10th September 1892.

The same Commission having been, afterwards, entrusted with the carrying out of their recommendations prepared an estimate for a vote of expenditure of upwards of £ 300 towards the cost of labour and the acquisition of instruments and chemicals. The vote was passed by the Council of Government, and early in the spring of the following year spraying the Vines with "Bordeaux mixture" was commenced.

In 1894, the Potato crop suffered, in an unprecedented degree, from blight, and the same Commission was requested to include in their work the Potato disease also. That year had been a very bad one for the Potato crop all over the continent and the United Kingdom, but more especially so, in the North and West of Ireland, whence the great bulk of the Potato seed is imported every year. On this account, on the recommendations of the Board of Health, the importation of the tuber from every part of the United Kingdom was prohibited by Government Notice of the 9th November 1894, to protect the growers from purchasing diseased seed.

In consequence of the heavy loss—estimated at over £ 80,000—sustained by farmers and Potato dealers, through the failure of the spring crop of 1894, the Commission of Agriculture, Commerce and Industries unanimously passed an address to His Excellency, requesting a Government grant of £ 30 to enable the Società Economico Agraria to carry on experiments for the purpose of ascertaining what new varieties of disease-resisting seed could be selected instead of the Irish seed. The work was entrusted to a special Commission of the above named Society, and a preliminary report was published in the Society's annual report of last year.

Many other useful suggestions were made to Government, by the several Commissions, some of which call for legislative measures : such are ;

(a) The examination, before importation, of the tuber intended for seed, so as to secure exclusion of diseased seed ;

(b) The burning up, or burying deep into the soil, of the dried foliage left when the crop is dug ; and last but not least,

(c) The compulsory spraying of the Potato plants with the " Bordeaux mixture."

By far, the greatest obstacle which stands in the way of profitable Potato growing in Malta, is not one of the nature of a disease, but injury from " Frost" which is generally experienced towards the middle of February. I propose to deal separately with " Frost" in an appendix to the present Report.

The Vine Disease.

The existing regulations in Government Notice, guard against the most terrible of the Vine diseases, the *Phylloxera devastatrix* ; inasmuch as, no vine, vine-shoots &c., whatever be their origin, are allowed to be imported, and no other plants coming from any port in the Mediterranean are admitted, unless accompanied by an anti-phyllloxeric certificate.

For the further development, however, of the local vine-growing and wine-producing industries, those regulations require to be revised, as will be seen later on.

The disease, the vine growers have principally to contend with, is the " Vine Downy Mildew," whose germs exist with us. The life history of the fungus causing it, is such that favourable atmospheric conditions being given, we are sure to have the disease. To cope with this enemy at home, our energies must be directed towards combating it in its dormant stage, as well as when it is in full activity.

Scraping the dried bark of vines, followed by painting with a strong cupro-calcic solution, has proved very beneficial, as it is known that the bark harbours thousands of the spores of the disease which only await proper season and favourable atmospheric conditions to sprout.

As a preventive, and even as a means of combating the fungus in its active stage, spraying of the whole plants with Bordeaux mixture is generally recommended, and practised elsewhere.

The Mildew of the vine caused by the fungus *Uncinella spiralis*, B. & C. whose conidial stage, until lately, was known as the *Oidium Tuckeri*, Berk., is easily accessible to treatment by means of dusting with sulphur. Prepared sulphur, that is, sulphur containing 3 % of impalpably powdered sulphate of copper, is preferred to simple sulphur, just to spare one application of the sulphate of copper in the liquid form. This treatment is generally carried out in all important vineyards in Malta, and more extensively in Gozo ; and in both islands the scourge is kept in abeyance.

In the interest, however, of the wine-producing industry, the treatment ought to be carried out in a more systematic manner. If the dusting is short of the quantity required, there may be disease present to such a limited extent as to escape notice ; and notwithstanding the wine produced may turn to be non resistant, owing to deficiency of such compounds that are necessary for the keeping of wines. If the dusting is excessive, or applied somewhat late in the season, some of the sulphur may find its way to the wine, and give the disagreeable smell and taste of sulphuretted hydrogen.

The sulphur need only be applied twice, and in very bad years a third time. The best times for dusting are :

1st, previous to the flowering stage when the shoots are nearly 4 inches long. At this time, one need not be afraid of giving too much sulphur.

2nd, when the grapes begin to swell, and are of the size of pepper-berries. The dusting is, then, to be more evenly done, and preference to be given to the bellows. When the 3rd dusting is necessary, it should be done at least a month before the time of gathering the grapes.

The "Erinosi" is quite an innocent disease and need not give rise to any apprehension as to evil effects.

Our line of defence as regards the vine diseases can be summarized as follows:

I. To revise the actual restriction on the importation of the vine and other plants.

II. To encourage "scraping the bark" of old vines during the winter time.

III. To facilitate and afford the means for "spraying" vine plants with Bordeaux mixture.

IV. To furnish at cost-price the prepared sulphur for dusting the plants to prevent Mildew.

No. I has reference to the Board of Health and, as a member thereof, I venture to propose: (a), that the restriction on the importation of the vine or parts of the vine should be limited to ports in the Mediterranean; (b), that the American vine used as stock in grafting wine-producing varieties of vine, as well as shoots of the latter varieties, not already existing in Malta, should be allowed to be imported, provided the precautions detailed in my report of November 1895 be scrupulously observed.

No. II.—Legislative measures to insure the "scraping of bark" (*Décorchement*) was resorted to by the French and other Governments; we only need follow their example.

No. III being common to the treatment of the Potato blight will be dealt with in treating of that disease.

No. IV might easily be carried into effect by the Government entering into a contract with a local firm that should be called upon to furnish the prepared sulphur at a fixed price. The vine growers will apply for a "bonus," pay the amount and get the material from the contractor. The only drawback to this plan, is the uncertainty of the quantity the contractor should be called upon to supply.

The Potato Disease.

In my opinion, it is high time that the Government should interfere in some way or other to uphold the reputation of local Potatoes, which has been gradually going down, as may be seen from price-lists of English and continental markets, and from a publication that appeared in the Government Gazette of the 10th August 1896. The day is very far distant when the growers will be able to co-operate and unite themselves into a syndicate charged with the exportation of the Potato crop. For many years to come the merchant and middleman will be necessary factors in such transactions, and so far there is no hope of bettering the crop. The merchant and the grower, who by their respective callings, should strive shoulder to shoulder on the same side, are very often on opposite sides trying each, on his own account, to encroach upon the other's share of gain.

For the Potato crop, our aim must not only be to guard against disease, but also to take advantage, to the utmost extent, of the peculiarities of our soil and climate. It is a fact that the Maltese Potatoes command high prices in foreign markets when they do not enter into competition; but when they have to compete with Algerians, Jerseys, and the Canarians for instance, they are left far behind because of their comparatively inferior quality.

The following are the recommendations that, in my opinion, are sure to banish disease and at the same time to improve the produce.

- I. Select seed from the best stocks of disease-resisting varieties.
- II. Sow in the proper soil, at the proper season, and manure liberally.
- III. Never raise two successive crops on the same soil.
- IV. Cut the seed into large pieces.
- V. Avoid thick sowing, and when possible plant in rows in the direction of the sun's rays in order to give sunlight and ventilation to the plants.
- VI. Cultivate thoroughly and deeply.
- VII. Spray the plants *twice* with Bordeaux mixture, or other recognised fungicide, at the time the plants are making rapid growth.
- VIII. When the tuber is dug, do not leave diseased potatoes or foliage on the ground, nor put them on the manure heap; but burn them, or bury them deep in the ground.

Each of these recommendations needs closer examination.

As regards selection of seed, none is made in Malta. Potato seed is imported by thousands of bags from Belfast and Liverpool, the great bulk being sent on consignment and sold, or distributed to the growers on certain terms of agreement. Two varieties, the "Scotch Champion" and "Magnum Bonum" are principally imported. The importation is simply a matter of business. Firms abroad send their agents any quantity of potatoes at a very low price, sometimes only £ 1 per ton is paid. This means that only the refuse of saleable potatoes are sent here as seed. In bad years, when disease prevailed at the place of origin, many tubers were found to be infested with the mycelium of the fungus. (*Vide*, Government Gazette of the 12th January 1895). Even when this is not the case, nothing, as to the hereditary qualities of the seed, can be known.

The inevitable condition of importing seeds every year, places the local grower in a very bad position as to the selection of the same.

The enforced examination of seed before importation, and allowing only the sale of such tubers that are declared good for seed at one *Central Station*, say under the Verandahs at Porto Nuovo, might, however, be tried for a couple of years. Other tubers found unsatisfactory might be permitted to be landed and made use of to the best purposes by the owner. The object to be attained by this measure would be twofold. The firms abroad, knowing those precautionary measures, will be more careful as to the quality of seed they will supply; and the growers will be protected as to the quality applied for, inasmuch as only examined seed will be delivered under the Verandahs.

If this suggestion be acted upon, I have reason to believe that the second recommendation, viz: the selection of the proper soil, will be attended to. In some years the importation of seed amounts to 50,000 bags and more; and the consequence is, that half the quantity, at least, is grown on improper soil. The measure recommended above will tend to lessen the importation to within reasonable limits, and cause preference to be given to the *red light soil*.

With regard to the season of sowing, that depends mainly upon foreign markets, and need not be detailed here. Frost, treated of in the appendix to the report, is an obstacle to early sowing.

The question of manuring is engaging the serious attention of the Società Economico Agraria. From experiments made by myself on behalf of that Society, this can be said: On dry soils suffering from insufficient rainfall, and in a rather hot climate like ours, artificials should not be much recommended; on the contrary where there are means of irrigation the best results follow the use of fertilizers. With regard to the common manure, cow, stable, or mixed, it is generally known that the more liberal the supply the better will be the produce. The question involved is only a question of means.

The raising of two or more successive crops of Potatoes is contrary to the elementary principles of rotation. It adds, moreover, to the probability of disease, if the previous crop has been so attacked.

Generally in Malta the seed is cut into very small pieces, averaging in weight below 1 oz. Such seed give rise to very slender stems and the plants do not grow to the full extent. The small weight of the seed is imposed by the practice of thick sowing, without any regard to planting in rows especially in fields that are not irrigated. The total quantity of seed put into the ground corresponds to nearly 18 cwt. per acre, which, elsewhere, is the quantity productive of the best results. It may be, that the prevalence of high winds in Malta, makes it a necessary condition to have the plants close together for mutual defence.

Thick planting favours the development of disease, as it prevents ventilation among the plants; and when planting is not in rows in the direction of the sun's course, sunlight cannot penetrate among the plants and exert its beneficial influence. Another drawback in thick planting is, that the cultivation, for want of space, cannot be made deeply and thoroughly, nor can the earthing be effective.

Spraying is, however, the most important of the recommendations. The plants ought to be sprayed twice or oftener with Bordeaux mixture.

Sulphate of copper reduced by an alkali has been found by experience to be one of the most effective means of checking the development of fungoid life. In the form of Bordeaux mixture it has proved extremely useful as a preventive to both the *Peronosporæ* attacking the Vine and the Potato. The Government Commission of 1892 gave preference to the Bordeaux mixture, and the formula, as well as instructions, for compounding it, were given in their report.

Nowadays many other preparations are recommended, and used, as a substitute for the sulphate of copper. Their high price, however, is against their adoption on a large scale. One of the cheapest, and a very effective fungicide, is the "Strawsonite" which has been adopted by the Irish Land Commission. As the Government of Malta at present possesses a considerable quantity of sulphate of copper on hand, I do not recommend a change of the chemical, until the stock is fully exhausted. Strawsonite, nevertheless, might be procured in small quantity for the sake of comparative experiments.

Constant practical experience with the Bordeaux mixture since 1893 has convinced me that the formula suggested by the Commission is no more reliable. The proportion of the chemical prescribed (3 to 7 per thousand) forms too weak a solution. For spraying the Potato I have gradually increased the strength to 2% always with the same beneficial results.

As to compounding the mixture, the greatest difficulties were experienced in having the solutions properly prepared by the men engaged by the Commission. Many of them did not understand the importance of the mixing, and prepared solutions which, when applied to the plants, caused greater harm than that which they were intended to prevent. The same evils happened when the instruments and chemicals were left in the hands of the few growers who had applied for the treatment. Although the process of compounding was given in full detail by the Commission, very few, not conversant with elementary chemical manipulations, could prepare the mixture without special training. Tubs of the capacity of one sprayer, wherein to prepare the mixture, were furnished in 1893. This entailed much loss of time as the process of the preparation had to be repeated each time a sprayer was used. When spraying on my own account I made use of a 20 gallon tub to prepare the solution once, or twice daily.

The capacity of the tub being known, I reckon the proportion of the chemical thus: 1 lb. exactly of sulphate of copper and 1 lb. pound of slaked lime for every 5 gallons, or if the measure be given in Maltese "Barili," 1 Rt for every "Barile" of the solution.

To prepare the solution; fill about two thirds of the tub with water; put the sulphate of copper in an earthenware or wooden vessel, pour on boiling water sufficient



to dissolve it, pour the solution in the tub and mix. Put the lime in another vessel, add a small quantity of water, just enough to make a paste, dilute with water to the brim of the vessel, stir up and decant into the tub whilst agitating. Pour more water on the residue, mix and decant again; repeat the process till no more milk-lime is produced. If the mixture does not reach the mark on the tub, add water till it does so.

The solution is now ready and the sprayer can be filled and worked, care being taken to mix the whole, just before the sprayer is filled.

I lay great stress on the necessity of stirring the liquid, unless this be kept up the reduction of the copper salt is not effected and the mixture will not answer the purpose for which it is intended.

This operation is necessarily performed in the field. The appliances required, besides the sprayer, are : a large tub (20, or more gallons), a small wooden vessel, another vessel which can also be used as a bucket to draw water, and a fourth one in which to boil the water. With some rare exceptions, all these appliances cannot be procured by the growers. I have purposely entered into these details, as I am fully convinced, that the discarding of the same, has been the cause, and the only cause I dare say, of the farmers being sceptical to the treatment until now.

The mixture is distributed upon, and on the under surface of, the foliage of the plants by means of a spray producing machine. The sprayers imported in 1893, although of the best pattern at that time, are not now serviceable, the mechanism being rather complicated, and the parts wearing very easily.

Six years experience with these sprayers has led me to reject the pattern. I have never succeeded in working a whole day with these sprayers, although I had many of them to spare. This year I have been compelled to buy a new pattern, the "Candeo forceps sprayer" which has proved very successful, although it was somewhat hard to work with, the whole day. I inquired abroad as to the best specimen of sprayer and Messrs Stranson of 71A Queen Victoria Street, London, contractors to the Irish Land Commission, favoured me with an illustration of their model.

The same firm is organizing a plan to insure the spraying of the Irish Potato crop, this year. An appeal has been made by them to the Irish railway companies for the transport, free of charge, of instruments and chemicals intended for that purpose; and recent newspaper-notices are to the effect that the companies have favourably responded to that appeal.

Before giving the preference either to the Candeo, or Strawsometer I should like to have the latter tested. The Candeo without the knapsack could be delivered in Malta at £ 1 each, and the knapsacks of the old sprayers could be utilized with the new pattern. The Strawsometer costs 30/- in London and probably 35/- in Malta. At least, 12 machines will be required to begin with.

The spraying to be effective as a preventive measure must be applied at least *twice* to the Potato plants, and three times to the Vine. If a shower of rain follows its application the remedy is washed off and another application will be required. The spraying must reach every part of the plant, both the upper and under surface of the foliage, as the stomata through which the germs penetrate into the substance of the leaf, are found especially on the under surface.

Spraying with the Bordeaux mixture, in the Potato culture, besides acting as a preventive remedy, improves the quality and quantity of the produce, as it prolongs the period of vegetation and enables the foliage to continue green and growing, by which a great increase of sound tubers is obtained.

Spraying, therefore, must be resorted to, as a matter of routine even in seasons when disease is not very prevalent.

When the spraying was carried out by the Commission, the Islands of Malta and Gozo, were divided into Vine, and Potato growing districts; each district being under the immediate charge of one member of the Commission. The plan, in some of the districts, proved a failure and generally did not answer the purpose the Commission had in view when they framed it. The members of the Commission are not

expected to be out in the country for whole days during the spraying season ; and the distribution of instruments and chemicals, without supervision and care being taken of the same, has contributed largely towards their being damaged and put out of use.

The following is a practical plan, which in my opinion, will insure the spraying of the Vine and the Potato plants.

There should be one *Central Station* for the storage of instruments, appliances and chemicals, and 3 or 4 foremen trained in the management of the sprayers and the preparation of the mixture, to be paid 2/6 for every whole working day.

Hitherto the men employed by the Commission went round begging farmers to have their plants sprayed, and very often a whole morning, if not a whole day, was spent in finding a place to work in. In the plan, I have the honour to suggest, the farmer applies for treatment to the Central Station, he is given the instruments, appliances, and chemicals, every thing that is required ; and on the next day, or other appointed day the foreman will be on the spot to prepare the mixture, and direct the spraying.

One man, when everything goes right, can in one day spray from a half to a whole acre of potatoes or vines ; but if two men are employed more than double that amount can be done in one day. To encourage speediness of treatment the farmer might be charged six pence for every full day the instruments and appliances are kept by him. If he has a large piece of ground to spray, he, or other hands, may help the foreman and complete the work in a single day. Once the mixture is prepared by the foreman, and once directions how to spray are given, an unskilled hand can do the work. If one of the sprayers gets out of order, the foreman, being on the spot, will mend it, and the work will go on.

Besides the sixpence for the use of appliances etc., the farmer should be made to contribute one shilling towards the wages of the foreman. In this way the Government expenditure would be, one shilling per day for the foreman, while the expenditure of the farmer would be one shilling and sixpence. This is almost equivalent to treatment free of charge, as the farmer, besides the skill, will receive a day's work from the foreman at the price usually paid for unskilled labour.

The cost of applying two dressings with hand machines is put in the United Kingdom at 24/- per acre. In Malta, on the plan I am suggesting, it will only cost the farmer 6/-, or 75 % less.

The wages of foremen are fixed at 2/6, so as to secure good workmen, with sufficient skill for their work, and to obtain them at short notice when applied for. For Gozo the rate of wages being rather lower, I think 2/- ought to be a fair remuneration.

No foreman should be employed unless he has had a sufficient training in, and has mastered the details of, the work.

With regard to the last recommendation, viz: the burning of, or burying deep in the ground any diseased tuber or foliage, the importance of the measure is evinced from the following considerations.

It has been proved that the *Peronosporae*, besides their rapid propagation by means of *conidia*, have another mode of propagation by "*oospores*," or winter spores. The latter are very resistant and when on the ground, or on parts of the plant affected with the disease, are capable of maintaining life even for three years and then of developing the disease.

Diseased tubers and foliage ought therefore to be destroyed, as many of the winter spores cling to them ; they should not be put on the manure heap, as, by doing so, they will be returned to the soil, especially when a new potato crop is intended to be raised. They should not even be given to cattle, as the spores pass unaltered through the alimentary canal and find their way to the ground through the manure. The best way to dispose of diseased tubers and foliage is to destroy them by fire, or if their value as manure be disregarded to bury them 3 ft. or 4 ft. deep into the ground.

Argotti Botanic Gardens,
1st June, 1898.

F. DEBONO, M.D.

APPENDIX

Injury from "Frost," and methods of prevention.

As mentioned in the Report, frost stands in the way of raising an early Potato crop. Many growers, who are in a position to dispose of their Potatoes by the first week of April, when there are strong demands for new Potatoes on foreign markets, are prevented from sowing at the proper time, lest "frost" might destroy the crop wholly or partially. I have made a special inquiry, this year, and last, as to the extent of the damage caused by frost. Last year's frost occurred in the night between the 18th and the 19th February. Whole fields were destroyed and others suffered in part. I then estimated the damage to be equal to 30 % of the production expected to be ready by the first week of April.

This year, the occurrence of frost was a week earlier, the exact date, on which it came down, was the 12th February. It was not so severe, as last year's; but it was remarkable for its greater extension, nearly the whole of the Island suffered from it.

The effect of frost on the Potato crop is twofold ;

(a.) Actual loss ; from destruction of some of the plants and stoppage of growth in the others apparently spared ;

(b.) Preventive loss ; many farmers plant rather late in the season to avoid frost and sell their produce at reduced prices. *

Although frost is governed by atmospheric conditions, over which man has no control, or a very limited one, yet if we could only know, a few hours beforehand, when frost is to come down, we might do much to prevent the mischief caused by it. Science and meteorological observations enable us to foretell the occurrence of frost sufficiently long to guard against its effects.

Frost results from condensation of the water vapour in the surrounding air upon the foliage of the plant, which has been cooled below the freezing point by the radiation of heat. Dry air and a clear sky foster radiation. The watery vapour condenses in the form of *dew*, or *frost*, according as the *dew point* be above, or below the freezing point. The dew point varies with the amount of humidity, and not directly with the temperature of the air. Very dry air at 60° Fahr. may give frost, whereas humid air at 40° Fahr. may not.

The dew point being the index of the occurrence of frost, one might by the use of the wet and dry bulb thermometer, or better by the Psychrometer, foretell when frost is imminent ; and if by some means the warning could be spread to the growers, co-operative action might be taken by the latter to prevent, or diminish, the impending injury.

The fact that frost, in Malta, only causes considerable injury to the Potato plants and not to other co-existing crops, proves that the dew point but seldom falls below 31° Fahr., a degree which might easily be prevented if some remedy could be applied in time.

* This, and last year, proved an exception to the rule ; the late crop selling at prices equal, if not superior, to those of the early crop :

Methods of prevention.

The methods of prevention aim at :

- 1.) Diminishing the radiation of heat,
- 2.) Adding heat to the air,
- 3.) Mixing the air,
- 4.) Raising the dew point.

Starting of *smudge* fires, supplemented with irrigation, or spraying, or sprinkling water on the fire, answer very well for the whole of the principles just alluded to.

The fire warms and expands the air, at the same time, the production of smoke diminishes radiation. The addition of water, in whatever form, increases the humidity of the air and therefore tends to raise the dew point.

Practical plan to carry out the remedy.

Forecasts of the occurrence of the lowering of the dew point may be had by systematic meteorological observations. For the protection of the Potato crop, the observations need only be carried out during the month of February, or to be on the safe side from January to March.

To determine the dew point by means of the Psychrometer, it is sufficient to moisten the muslin on the wet bulb, and then whirl, or fan, the instrument, when the temperature will fall ; read the two thermometers, take the difference, and the dew point will be found in the table at the intersection of the two columns respectively headed, "temperature of air" and "difference of reading of dry and wet bulbs."

If in the afternoon, the dew point is near the critical temperature (32° Fahr.) arrangements should be made for protection if necessary. If at a later hour (say 10 p.m.) the dew point is constant, or lower, the sky clear or clearing, and the air calm, it is reasonable to expect that the temperature will fall to the dew point during the night and cause frost. This intimation should be spread all over the Potato growing districts, with as little delay as possible, by means of the telephone. And in each district the alarm again distributed to the whole village in some way or other. In Malta where the distances are not very great, the Church bells might be available for the purpose, provided there be co-operation on the part of the Church authorities, and no religious objection.

The warnings thus given, it would behove each grower to protect his crop by starting fires at the proper time (say between 3 a.m. and sun rise) at different spots of the field. Any old rubbish is suitable as fuel for the fires ; damp straw, tar, turpentine, tarred cord and old hay are preferable for the great amount of smoke they give in burning.

Arrangements to start fires at a very short notice should be made beforehand and so be ready at the moment of emergency. The fuel must be ready and close by. I recommend the use of the French "*boules*", or wood shavings dipped in melted resin and formed into a ball. To save the plants from direct injury by the fire, an ox muzzle attached to a short pole, or anything similar, wherein to place the fuel, might be used.

All the materials being ready at hand, time is only needed to distribute the same on the fields and to set fire to them at once. It is evident that a person attempting to protect his own field, will be protecting his neighbour's, therefore by co-operation, among the individuals of the same locality, the greatest protection may be provided at a trifling cost. Really, trouble and inconvenience are the only drawbacks, while the gain may amount, at times, to thousands of pounds sterling.

Nevertheless before putting this scheme into actual practice, it is well that its beneficial effects should be tested. I propose, if Government is prepared to provide for the outlay, to try the experiment in the fields now used by the Società Economico Agraria as the Model Farm. From last year's experience it is known that the

fields are very subject to injury from frost ; in fact nearly half the crop was at that time destroyed, and this year, to prevent injury from that source, the planting was delayed to the 15th of January, whereas it could have been done as early as the 1st of December in the previous year.

Argotti, Botanic Gardens,
1st June, 1898.

F. DEBONO, M.D.

ABSTRACT of recommendations detailed in the Report and Appendix.

Dealing with;	Suggestions;
1. Importation of Vines	Revision of Government Notice.
2. Examination of Potato seed before importation.	Introduction of provisions in Law to enable the Government to enforce the same.
3. Scraping the bark of old Vines.	
4. Burning, or burying deep into the ground, diseased tubers or foliage.	
5. Supply of "prepared sulphur".	
6. Acquisition of instruments and appliances.	Contract, for the
7. Wages, transport and other incidental expenses.	<i>Vide</i> , Estimate of Expenditure,
8. Meteorological observations.	Starting of.
9. Spreading warnings of imminent "frost".	Use of telephone, and Church bells.
10. Testing proposed treatment of "frost".	Grant of fields at Hamrun.
11. General suggestions as to cultivation and as to details in treatment.	Publication of leaflets in the vernacular.

ESTIMATE of Expenditure towards treatment of the Vine and Potato diseases.

	Recoverable	Not recoverable
Examination of the Potato seed before importation, at -/1 per bag; average number imported 30,000. Recoverable from the owner... ..	£ 125 0 0	
Supply of "Prepared Sulphur" by contract; 3 tons at £ 10 p. ton; recoverable from growers	30 0 0	
Acquisition of instruments and appliances, etc.		
1 Strawsometer at 35/-		£ 1 15 0
1 Psychrometer at 40/-		2 0 0
2 Cwts Strawsonite at £ 1 p. cwt.		2 0 0
12 Sprayers, Candeo's at 20/- or Strawson's at 35/-..		21 0 0
6 20 gallon tubs at 3/-		0 18 0
„ Small wooden vessels at 1/-		0 6 0
„ Petroleum tins at -/3		0 1 6
„ Buckets at 1/-		0 6 0
Wages; 4 foremen at 2/6, for 100 working days, 1/6; out of the 2/6 to be recovered from the growers... ..	30 0 0	20 0 0
Transport and petty expenses		5 0 0
Other incidental expenses (contingencies)		7 10 0
Expenses in connection with testing treatment of frost		2 10 0
	£ 185 0 0	£ 63 6 6

F. DEBONO, M.D.