

Pennsylvania Experiments in Fertilizing Orchards.

Experiments started in 1907-08 by Prof. J. P. Stewart, of the Pennsylvania State College Experiment Station, have shown that the plant-food needs of an orchard may be the most important check on its production. By variations in fertilization alone they obtained average differences in yield ranging from 50 to 460 bushels per acre annually for the past four or five years. At this rate and with a valuation of only fifty cents per bushel for the extra fruit, they have had, on certain orchards, average profits from fertilization running up to more than \$200 per acre annually. The differences in growth and general vigor have likewise been marked. The deductions presented below are derived more or less directly from the results of thirteen experiments, involving ten soil types, twelve locations, and 2,653 trees in the last five years. It is to be noted, however, as stated in one of the summarized conclusions, that, in one case no form of fertilization produced a profit, while in two others profitable response has come only from manure and mulches. It is evident, therefore, as the author observes, that the actual fertilization of a given orchard is still largely a local problem. Some of the many other important conclusions are as follows:

The total plant-food draft of a mature and active orchard is greater than that of a 25-bushel crop of wheat in every important constituent except phosphorus. It is practically inevitable, therefore, that sooner or later the output will be reduced or off seasons will be developed in any productive orchard because of a lack of sufficient plant food.

The mineral requirements of wood growth are comparatively low. This largely accounts for the fact that young trees usually do not make a profitable response to fertilizer applications, although they frequently respond well to manure or to other methods of conserving moisture.

The relative amounts of the various food elements required by the other parts of the apple plant are also of interest, but as a rule they are not especially reliable as bases for making fertilizer applications. The latter are best determined experimentally, as there seems to be very little relation between the response of the trees and their total chemical requirements.

Applications of nitrogen and phosphates and also of manure have been very beneficial in two of the experimental orchards. In those orchards potash has been of little or no service. These results are reversed at the present time in one of the other orchards, so far as yields are concerned.

The time required for results to appear has been surprisingly short in all cases where fertilization has proved to be really needed. In such cases, both the value of fertilization and the kinds needed were clearly evident by the middle of the second season, and no material changes have occurred since.

Neither acid phosphate nor "floats," when applied alone, have resulted in any important benefit. The fertilization of their plots is being "completed" by the addition of nitrogen and potash, in order to test further their relative values as carriers of phosphorus for trees. Basic slag was introduced into this comparison in 1912.

Lime also has failed in most cases, though it may have some value in aiding growth. In addition, it may have some indirect value in facilitating the growth of leguminous intercrops, and also in correcting a possible toxic action possessed by the basic radicals of a number of salts, some of which are present in commercial nutrients.

At present the high-grade sulphate in these experiments is showing no superiority over the muriate as a carrier of potash, but the reverse is usually true. The lower cost and easier handling of the latter, therefore, give it the preference. It is possible that the low-grade sulphate, or the 24 per cent. "double-manure salt," as it is often called commercially, may be superior on account of its magnesia content, but this has not yet been fully demonstrated.

The influence of proper fertilization is not transient. The gains from it have been greater in the sixth and last year of some of our experiments than at any time before. In one case, these gains have exceeded 1,100 bushels per acre. Where the crops of the full years are not too high, the yields usually have been greatly steadied by proper fertilization.

In all the experiments, the action of manure has proved to be practically identical with that of a commercial fertilizer rich in nitrogen and phosphorus. Their successes and failures have coincided with but two exceptions, and in those cases moisture rather than plant food was apparently the controlling factor. The commercial nitrates and blood have acted more quickly than the manure, and the potash in the latter has apparently been less effective than that in the commercial forms.

In general, the influences that have materially increased the yields have also increased the

growth. This is true generally, unless either occurs to an abnormal extent. The phosphates seem to be a partial exception to the rule, and mild injuries also may stimulate yield at the expense of growth.

Manure and potash are the only fertilizing materials that have shown a consistent benefit on the average size of fruit. This is doubtless associated with their favorable relations toward available moisture which is the chief determiner of fruit size. Above a rather indefinite point, however, the size of the crop on the tree becomes the dominant influence on fruit size. Proper thinning and moisture conservation, therefore, are the most important means of improving the average size of fruit.

The red color in apples can not be increased materially by any kind of fertilizer applications, though potash and possibly phosphates may be of some slight assistance. These colors are directly dependent upon sunlight and maturity, with the latter occurring preferably on the tree. Late picking, open pruning, light soils, sod culture, and mildly injurious sprays, therefore, tend to increase the reds in fruits, while opposite conditions decrease them.

The retarding influence of nitrogenous fertilizers or manure on color makes it advisable to use them less freely on some of the red varieties, especially those in which the color comes on rather tardily. On the lighter soils, or in localities with the longer growing seasons, this precaution is less important.

It is possible to indicate the more prominent characteristics of orchards that are in need of fertilization, and to formulate a general fertilizer, based on present experimental results, that may be used in such orchards until more definite local data can be secured.

Present evidence indicates that the nitrates, or other specially soluble plant foods, are best applied somewhat after the fruit has set. In addition to greater effectiveness, this delay enables the rate of application to be varied somewhat in accord with the amount of fruit set, making the applications heavier when the crop is heavy and vice versa. In the long run, this plan should steady the yields and get maximum benefits from the fertilization applied.

The general fertilizer that they are now recommending is a combination carrying about 30 pounds of actual nitrogen, 50 pounds of actual phosphoric acid (P2O5), and 25 to 50 pounds of actual potash (K2O). These are the amounts per acre for bearing trees. Suitable carriers and formulas for obtaining these materials are given in the article headed "A German Fertilizer for Apple Orchards."

This general fertilizer can be modified and directly adapted to the actual needs of any orchard, by following a local testing plan.

Ontario Fruit Growers' Association to have a Central Selling Agency.

Of fifty-two fruit growers' associations now operating in the Province of Ontario, twenty-four were represented at a meeting of the recently incorporated Co-operative Fruit Growers of Ontario, which was held in the Parliament Buildings, Toronto, June 17th.

Owing to the fact that competition is getting keener year after year, it was deemed advisable by a number of the leading growers in this Province to form a central agency for the purpose of selling the fruit, or at least part of the fruit of the various associations operating in Ontario. Accordingly meetings were called, and provisional directors appointed, and application made for incorporation, which has gone through, and the Central Association is at last a fact. On June 11th, a committee met, and instructed the secretary, P. W. Hodgetts, to send out a letter to each association, informing them that if a sufficient number of these associations will, before July 1st, 1913, guarantee 50,000 barrels of apples, or the equivalent in other fruits to the Co-operative Fruit Growers of Ontario, and will put up their notes for ten cents per barrel to enable the company to finance the selling agency until such time as returns begin to come in the company will immediately make the necessary arrangements for the employment of a competent manager and assistants for a period of three years, and will proceed with the sale of the fruit, and if the guaranteed quantity is not sufficient to warrant the above the company will still make the required arrangements to sell the fruit offered.

This circular letter was responded to by over thirty prominent growers, representing, as previously stated, twenty-four different associations. Elmer Lick, of Oshawa, Ontario, the president of the Association, was in the chair, and made out a strong case for this new central selling agency, pointing out that the growers in the western States, and in Western Canada, had organized such associations, and unless Ontario did likewise there would be a possibility of Ontario apples being practically driven out of the western market. At any rate competition promises to be

very keen this season, and in seasons to come, and it is necessary that Ontario growers be prepared to meet it in the best way possible. It was also shown that if a central agency were not established in all probability six or seven selling agents, representing different associations in Ontario, would be sent out west this fall and thus competition would be keen in Ontario fruit alone. A central association would do away with all this, and could be operated at smaller cost than if so many men were sent out. The Grain Growers' Association with its 1,200 branches was mentioned as a fine market for Ontario apples, and there seems to be no reason why these two associations could not get together with results satisfactory to all concerned.

P. W. Hodgetts, secretary of the association, read letters from representatives now in the west, showing that the western market prefers Ontario-grown fruit, provided it arrives in good condition, and is of a quality corresponding with the marks on the packages. Bad fruit has injured the market, and unless buyers out west are assured of good fruit Ontario is in danger of losing a large part of the trade.

A great deal of discussion arose over the method of obtaining the money to commence business, all the details of which are not as yet worked out, but the executive hopes to have everything in running order by July 1st. Mr. Lick proposed that each individual association taking stock in the central be allowed preferred selling on ten barrels of apples for every dollar of stock taken, or in other words, should take ten cents in stock for every barrel of apples consigned. That is, if an association guaranteed 2,000 barrels of apples to the central association the amount of stock it would be required to take would be \$200. This ten cents per barrel is, of course, a permanent investment, and is only needed to finance the undertaking until such time as returns for fruit sold begin to come in. It was estimated that about 25 cents per barrel would be needed for selling, but this figure cannot be determined exactly.

From the number of barrels offered by representatives present, it seems as though no difficulty will be experienced in getting the 50,000 barrels consigned. Over 30,000 barrels were practically promised at the meeting, and many of the representatives wished first to report to their associations when the number of barrels to be sent in by each could be ascertained. Fifteen of the associations represented put out last year 95,000 barrels of apples. If the crop this year averages only 50 per cent. of that of last year these fifteen alone could very nearly supply the required amount.

The officials are: President, Elmer Lick, Oshawa; Vice-President, Robt. Thompson, St. Catharines; Directors: C. W. Gurney, Paris; Adam Brown, Owen Sound; Roy A. Carey, Oakville; Sec.-Treas., P. W. Hodgetts, Toronto.

During the meeting reports upon the fruit crop prospects were received as follows: Robert Thompson, St. Catharines: an average crop in the Niagara Peninsula; apples uneven; about 60 per cent. of a full crop with Baldwins light; strawberries light; plums, a full crop, and cherries improving. Roy Carey, Oakville: Spies light; other varieties as good as last year; cherries heavy; small fruit good, excepting strawberries, which are light. T. A. Lampman, Arkona: Apples, 30 to 40 per cent. of last year's crop; strawberries scarce; peaches scarce; cherries and plums good. Alex. Jamieson, Forest: Apples about 50 per cent. of last year's heavy crop; just a fair crop with Baldwins light. W. H. Porter, Petrolia: Apples 50 per cent. of last year; peaches heavy; strawberries light; plums injured by frost. R. A. Thomas, Barrie: Early and late fruit good; not much spraying done. Adam Brown, Owen Sound: Apples about 50 per cent. of a full crop; Spies, Greening, and Kings well loaded; Baldwins and Russets light. Chas. F. Howard, Hagersville: Baldwins light; Spies a fair crop. Walter Palmer, Marshville: Baldwins and Spies set well; E. Clemons, Pelham: Apples 50 per cent. of a crop; small fruit light. C. W. Gurney, Paris: Baldwins and Spies light; plums and cherries heavy; peaches good. R. W. Grierson, Oshawa: Spies double last year; Baldwins light. W. J. Bragg, Bowmanville: Spies and Fallwaters good; about 75 per cent. average crop on the whole. Win. Oke, Port Hope: Spies setting well; Ben Davis average; Baldwins light; Greenings fair; all early varieties heavy. Baldwins light in Oxford county and Middlesex; early fruit good. Wentworth reports Spies light. Tomatoes were reported badly damaged by frost.

Ventilation for Fruits in Storage or Transit.

Several practical points bearing upon the keeping of fruit in storage are brought out in a recently issued Cornell bulletin on respiration of fruits.

The respiration of ripe fruits as well as that of green fruits is rapid.