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THE NATIVE FRUITS
of the
UNITED STATES
and
THEIR IMPROVEMENT.

A Graduation Thesis
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The awakening of the western races to the importance of fruit in our economy is giving to horticulture a new impetus. So many, varied, and interesting are the lines opening upon its broad domain that it is difficult to choose one to the exclusion of the others. In selecting for consideration the native fruit of the United States I followed an impulse that led me to believe that through them a great advance might be made in fruit production. It will be needless to say to one who glances over these pages that the impulse had a definite basis in fact.

In studying out the matter I have sought to add to my previous observation the conclusions of the most eminent horticulturists. First I endeavored to show in what way native are superior to naturalized species. Then in two series I take up the commoner and the less widely known native fruits

mentioning under each the varieties to be found, their qualities and peculiarities to some extent, and where I have discovered anything else regarding them that is germane to this subject I have also included that. Still it is not to be considered that each genus is treated exhaustively even under these heads. The last division is devoted intirely to the subject of improvement and though it might easily embody more than it does it, never-the-less, presents a few valuable ideas worked out by many heads.

I can claim but little originality for the work my own experience being limited. My thanks are due to professor Munson, F. A. Waugh and Bessey, to S. B. Heiges, C. W. H. Hideman and P. A. Rydberg, and in this institution to professors Popenoe and Mason for advice and information regarding various portions of the subject. Many horticultural works and reports of the various national and state

societies have been consulted with a view to ascertaining the opinions of the most reliable horticulturists of the century, and these I have sought to embody in the thesis that it might be as much an expression of the best ideas of the age as possible.

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W.H.

The subject of fruit will never cease to be of interest to mankind until that eventful day is reached of which the chemists speak, when they will be able to abstract the nutritive elements directly from the soil. That day, however, is far distant, and even when it does come it is doubtful whether men will give up the innocent pleasure of cultivating fruit and enjoying the delicious product.

A long period has elapsed since man subsisted upon acorns, and those who admire so greatly the golden age would, never the less, be unwilling to forego the pleasures that Pomona now offers them for the sake of indulging in the fruits of a time the only enchantment of which lies in its distance from us. The change is great, and in what does it consist? It is not so very long since the paucity of fruit, even on the very best tables, was serious. Mankind is only now growing into that free

use of fruit for which nature seems to have designed him - at least that is the case in the temperate zone. Because it was easier and the returns were sooner seen in raising a crop of wheat, for instance, fruit culture was long left in abeyance, except where here and there a few still worked at the problem of improvement. The monks and occasionally other land owners were deeply interested in fruit, and it is largely due to their efforts that in Europe a large fruit industry has been made possible during the last century and a half.

Whence came the original fruits, is a natural inquiry at this stage, but it is a somewhat difficult one to answer. In a number of cases botanists think they have traced out the original wild species from which the cultivated fruits have sprung, but with regard to others they are still in doubt. Horticulturists, however, are fairly unanimous in ascribing to wild varieties the

parentage of our popular fruits. The native plants which at first offer so little to the eye or the palate, are never-the-less the types of our garden varieties. — By slow degrees the sour and bitter crab expands into a Golden Pippin, the wild pear loses its thorn, the Almond is deprived of its bitterness, and the dry and flavorless peach is, at length, a tempting and delicious fruit.' [Downing].

All this has been by the continuous cultivation and selection age after age, and this will be found to be the history of the fruits of any temperate region where other circumstances have not interfered with the natural evolution.

A few words on the general importance of native species as compared with those brought from other regions. We hear a great deal now-a-days and meet with not a few who are great enthusiasts on the subject of introduction of fruits from latitudes and climates similar to their own, adducing as a reason that thus

they get fruit already brought to a high state of development by other hands. By these means they would immediately turn a new country into a garden containing the results of ages of care without going through the ordinary slow intermediate steps. Without attempting to detract in the least from the importance of this idea or saying aught against the principle they advance, I would, nevertheless, present the claims of native species unimproved though they be - not necessarily as competitors but rather as coöperators with varieties obtained in any other way.

Though we have not, in the native species, the result of petting or of careful training with reference to the qualities man most desires, yet we have what is quite as needful in successful fruit culture, health and vitality in no ordinary degree. Grown up in a constant struggle with circumstances the most adverse, learning to trust themselves

under whatever conditions they may be placed; foreign to all forms of meddling, no hand to place them in a choice spot, to provide nourishment or adjust temperature or surroundings: but, dropped by chance into some particular spot where they must conform as nearly as possible to the necessities of their environment if they would survive. They could not decide as some of the horticulturists' darlings do, that they must have things just so or else not grow. By no means! The impulse to preserve their race was too strong so by dint of giving way a little here and there and accommodating themselves to the varying conditions thus seizing the advantages that were presented from time to time, they have achieved a secure existence.

It is difficult to repress the idea of intelligent effort that comes to the mind in contemplating the gradual adjustment of a plant to its environment, the idea that causes

replacing their foreign allies. Though the foreign fruits have furnished the most of the product of the United States so far, yet they are so liable to disease that whenever a resistant variety has been improved to the requisite degree it has been adopted in lieu of the other. While the growers of imported varieties have been groaning over insects, mildew, rust, drouth etc., the producer of native fruits has, in the words of an enthusiast over American products, sighed for more abundant and active phylloxera, and curculio, and grasshoppers with more capacious digestive organs, to thin out to a more reasonable amount their overlaiden vineyards and orchards. Our plums, grapes, and small fruit in general have entered the lists against the past occupants of fruit gardens, and it seems only a question of time until species of every fruiting family in the states will de-

us, in describing their actions, to use terms that belong more properly to mental characteristics. They seem to convey the proper impression. Thus: by reason of the difficulties it has surmounted and the impediments overcome, we have the strong, hardy, self-reliant qualities that characterize our native plants, the resistant varieties that defy all insect or climatic agencies that seek to injure them.

It is scarcely necessary to contrast with these the infinite pains that must be taken with tender varieties to make them live and repay us for our outlay and prevent our work coming to naught in our hands. It is a work familiar to you all. It may be well, however to point out the relation indigenous fruit bears to introduced fruit today. The native species, where they have been developed to any extent so that the competition is not too one-sided are gradually

mand recognition at the hands of the fruit grower.

How, you ask, did this state of affairs arise. Why are not our indigenous fruits the cultivated fruits of this country? The query is readily answered. When the European reached this continent he found it inhabited by a race of savages that had not attained the fruit-growing stage and consequently had done nothing with the native fruits. What more natural, then, for the colonists to do than to bring over the fruits they were accustomed to in the old world. Having these, and being too busily engaged in opening up the new country to pay any attention to improvement of fruit which always comes at a later stage, especially when there is something else to temporarily take its place, nothing was done until there was more leisure for that kind of thing, and the various societies arose and urged that some-

thing be done.

That is the hopeful sign of the present. All over the land people are awakening to the possibilities of the original fruit of woods and prairies, and that excellent test, the current articles on the subject, show that the stock of the native fruit is rising and may soon be at a premium. Highly interesting and instructive articles are those which, like professor Asa Gray's, give an idea of what would be the fruit of the country had it gone through the regular development observed in other countries. There would have been not so great a variety but it would have been neither scanty nor poor. In grapes there would have been gains. There would have been no pear. Our apple would have been developed from *Pyrus Coronaria* and might have been less varied. *Crataegus Tomentosa*, service-berry and others would be on the list. Plums and cherries, the latter as well flavored but not so large; peaches

and figs would be replaced by persimmons and papaws. We would have lost nothing in strawberries, gooseberries and currants, and perhaps we would have gained. In blackberries and raspberries we would be better off.' Other descriptions which tally closely with this are given.

Of equal or more importance are those which speak of what will be. 'Within the lives of young men who hear my voice today,' said Watrous, 'the common and universally propagated varieties of apples thro' the great Northwest will be the descendants of the native crab-apples indigenous to the glades and thickets of the prairies.' And much the same thing has been said respecting other fruits.

To those who fear the process will be too long, we would say that modern methods of improving plants are far in advance of those of the inhabitants of the stone age, or of the savages that Darwin speaks

of. Moreover, as we find that other countries appreciate our native fruits we will take more interest in them ourselves. Professor Bailey thinks that it is due to judging new varieties by existing standards that their adoption has been prevented. One should remember, also, that just because a fruit does well in one locality is no reason why it should suit all places or do its best under any variety of treatments; so do not be too ready with praise or blame.

Is our curiosity now sufficiently aroused to enter upon an investigation of our wild fruits? 'No part of either temperate zone is so richly endowed by nature with wild fruit of such intrinsic value, yet so susceptible of improvement,' says Van Deman, and I feel sure that we will be amply repaid for an examination of them.

Even in this country we can commence our discussion as early as the tenth century when the Northmen first discovered it. As we exclude all tropical and sub-tropical varieties.

from this account we may as well begin with the species discovered by the vikings and then follow the order in which they appear in Gray's Manual.

Vitis.

According to early accounts the Northmen were so struck with the rich product of the land that thenceforth it became 'Vineland' to them. The New England region is still noted for its native grapes and in colonial days they transplanted them to their gardens. We read of the Pilgrim fathers finding grapes white, red and very strong.

But though this New England grape, *Vitis Labrusca*, is one of the best it is by no means the only grape of the United States. Professor F. V. Munson, than whom no one is better known in connection with American grapes, enumerates a list of those that have been used by him and others; *V. Solonis*, *V. Doaniana*, *V. bham-pini*, *V. candicans*, *V. Simpsonii*, *V. rotundifolia*, *V. Berlandieri*, *V. monticola*, *V. cor-*

difolia, *V. cinerea*, *V. rupestris*, and *V. Lincecumii* as well as *V. vinifera*, *V. Labrusca*, *V. vulpina* L. (*V. riparia*, Mx.) and *V. aestivalis*.

Those in Kansas, of which half a dozen species have been identified, are somewhat small though there is great variation between individual plants. The fox grape, *V. riparia*, found in the southern portion of the state is of respectable dimensions and would prove a valuable addition. That this great variety of grapes has been left so long without being tested is almost inexplicable. There are a number at work now, however, and in a few years we may see heralded in a new era in grapes.

Before any definite work can be done with them it is necessary to know much of their history, relations and morphology, and this probably keeps a number out who would otherwise endeavor to aid in the work.

After the vine comes the rose family which has furnished man so many valuable fruits.

PRUNUS.

First on the list are the plums, and few native fruits are their superiors. Scattered over the states are a number of varieties some of which are large and of good quality while others are of lesser value or at least still require to have their native qualities developed. One advantage they have is their resisting power when they have to combat disease and insects. The difficulty we have with the cultivated plum, *Prunus domestica*, will hasten the day when these varieties will be universally recognized. Already we have in our gardens a number of plums from the natives and they are becoming more and more popular.

It goes without saying that *Prunus americana*, *P. maritima*, (the Beach Plum), and *P. Chicasa* are worthy of attention for we are familiar with

them as garden fruit already. It is encouraging to know that active steps are being taken toward their improvement. There is no lack of varieties suitable to all regions. Plans have also been laid for further enhancing their value; a prominent horticulturist writes, 'Six or eight years ago Charles Downing suggested to me the possibility of obtaining a freestone plum by crossing some of the native varieties with the peach. The result was a real cross but a mule in reproduction. Since that I have approached a freestone variety pretty closely by using pollen from the German Prune upon the Richmond plum.'

Prunus pumila, especially a Nebraska variety, is thought to be a promising subject as is also the new Dwarf Rocky Mountain Cherry which, judged by the furore over it, appears to be quite an acquisition. Coming later than the ordinary cherry it helps to close a gap. The other cherry, the wild red, *P. Pennsylvanica*, may yield

from some varieties of its acid-not
astringent-fruit a strain worthy of
cultivation. This completes the um-
belled kinds; those with racemes
seem not to respond so readily, yet if
it is true that, 'The fruits which
have been carried to the greatest
perfection by the arts of the pomol-
ogist are those which in the wild
state were good for little'; then may
we not expect to do well by the choke-
cherry. Not that the fruit lacks in
size for there are fine looking vari-
eties, but the quality would stand
considerable amelioration. Besides *P.*
Virginiana two others to receive favor-
able mention are *P. serotina* and *P. de-*
missa. In both these professor Bessey
sees a valuable fruit for the future.

Rubus.

Next we consider the raspberries
and blackberries. The European, *Idaeus*,
varieties of the raspberry have proven
unsuitable to our climate, but with
R. strigosus and *R. occidentalis*, the
wild red and black raspberries, we

are not disimaged. Nature has dealt kindly with this genus and varieties can be found in the woods that are the equals of the garden varieties. *R. villosus*, the high blackberry, and *R. Canadensis*, the dewberry, and several other members of this section are deserving of more attention. In attempting to do anything with this order and the next, it should be our aim to retain unimpaired the flavor that is so noticable a characteristic of the uncultivated types. That increased size has too often been the only object in view is greatly to be deplored. We may expect a greater improvement in the raspberries than in the blackberries for the reason that they have not reached quite so high a development in the natural state.

Fragaria

What was said of the quality of the berries just mentioned applies with still greater force to the strawberries. No one who is familiar with them but has noticed that

with rare exceptions, the flavor is impaired by cultivation. Increase in size and productiveness we grant, but that the rank, misshapen fruits that are constantly offered are an improvement we fail to see.

We may select from a number of natural varieties or use them as parents of new races. Besides the common *F. Virginiana* well known east of the Rockies there is *F. chilensis* and *F. Californica* on the Pacific coast which are worthy of improvement. J. T. Lyon says regarding strawberries, 'Select those that more nearly approach the native type in character, and especially in hardness of their foliage' - since such could be expected to better withstand climatic rigour; but why not use the native varieties that are at hand instead of running the risk of experimenting with imported kinds. It was the consideration of this fruit that suggested to Bailey that irrigation might be overcome by selecting and hybridizing those varieties which

grow naturally in the dryest localities.
Pyrus.

Perhaps we need not say much here with reference to the apple. The improved species have acclimated to such an extent and multiplied so freely that kinds can be found to suit all localities. If, however, our orchards do not resist disease better than they have done during the last decade, we may be compelled to turn to the natives for assistance. The Eastern, Prairie and Southern varieties of *P. coronaria* will then be permitted to exhibit their possibilities.
Ribes.

The goose berries and currants complete the list of well known fruits. No particular success has been attainable with European varieties so that most of the cultivated goose berries, at least, are descendants of natives. They seldom fail to yield a bountiful crop, and though not of the best quality nor of the largest size, they may yet yield

something better.' The size of *R. Cynosbati* would recommend it if there are prospects of improvement in other directions. *R. gracile* is too well known to require description. *R. rotundifolia* is engaging the attention of some improvers, and *R. oxycanthoides*, the smooth-fruited gooseberry of the north may yet be the progenitor of a numerous race.

The currants worth mentioning are *R. rubrum* (red currant) which is cultivated, and *R. aureum* (Missouri currant) which so far has been cultivated for little else than ornament. The present interest displayed in the 'Crandall' currant will have served a good purpose if it turns the eyes of horticulturists toward our native plants. The nursery varieties offered at present are by no means of a fixed type and it is too early to say what will be the ultimate position they will command.

There are a number of distinct wild varieties. P. A. Rydberg who

has studied them in Nebraska enumerates three forms of *R. aureum*:

- (1) with small spherical black berries.
- (2) with large ellipsoid black berries (rare).
- (3) with yellow spherical berries.

The last two I think are well worthy of cultivation; number 2 on account of its large size of fruit which even in a wild state becomes as large as a small cherry; number 3 on account of the quality of the fruit.' If attempts at improving are made I think the yellow variety is the most promising. In this the smell and flavor peculiar to the black currant is nearly lost. The taste is somewhat like the red currant but much sweeter—scarcely sour at all.'

The kinds of fruit mentioned thus far are those known to the veriest tyro in horticulture and are by no means all that are indigenous to this country. Those already discussed belong to well known genera that have been under culti-

vation for centuries and have attained a momentum that tends to throw off any new fruits that strive to enter the race. We will now consider a few of these lesser known ones beginning this series in the same order as the former and introducing a few which though long known have received but little attention.

Asimina.

Asimina triloba, our papaw, a member of the custard apple family, is valuable for its extremely rich fruit which is unusually large for a wildling. In favorable situations it is very productive and becomes a fair sized tree. Professor Gray gives it special mention and seems to have exalted ideas of the future of this and of the persimmon. The seed which occupies a disproportionate part of the interior of the fruit has probably been the most serious obstacle to its adoption into our gardens, but it is only because good seed is the prin

ciple object of the wild plants stirrings that it is so large. There is nothing to prevent us breeding out this trait.

The papaw according to various authorities is not naturally as variable as some other wild fruits; *A. triloba* is the only extra-tropical species. It would thus take a longer time to produce desirable kinds, but cultivation would encourage variation and so would crossing the varieties already known. Fuller has suggested that some of the tropical members of the family might be made available to improve the flavor. (The susceptibility of pollen to preservation with undiminished vitality through varying periods, some extending to months, is not generally known.)

Amelanchier.

With this next in the series more seems to have been said and less done than with almost any other on the list. The service-berry, June-berry, shad-bush, has been but

recently introduced to any extent and its permanent position does not seem to be fully assured. Van Deman's 'Success' which was placed on the market a few years ago marks an era in the progress of the species. *R. Canadensis*, var. *oblongifolia*, seems the most promising native type, and Professor Van Deman who has done most toward their development in this state finds them, 'abundant, bears, extremely hardy, and never troubled with fungous. The 'Success' especially has a fine flavor. Professor Bessey believes *R. alnifolia*, a more northern species, to be no doubt worthy of cultivation'.

Fuller thinks the service-berry deserves more care and attention. To improve the dwarf forms, among which he finds the largest fruit and most productive plants, he suggests selection of seedlings of the largest and best and continued planting of these through several generations. The size of the berries may be increased

by grafting the dwarf varieties on strong healthy stalks of the tree form, or on crab-apple stalks.'

This is another of the plants that has won professor Gray's good opinion. Dr. Darlington in the earlier half of the century thus describes them: 'The berries are pear-shaped about the size of a common gooseberry and of a pleasant flavor and the plant is greatly improved by cultivation!'

The partiality which birds show for the berries seems to be quite a drawback but it is not an unusual one and sometimes we have need of birds in the orchard.

Vaciniace.

With respect to the various forms of this group which includes the blueberries, the cranberries and the huckleberries, which are merely the most inclusive of a dozen names, there exists a wide difference of opinion. It is the belief of many that they are too exacting as to conditions to do well in ordinary soils and under ordinary cul-

tivation. But though in some hands they have failed in garden and field culture, in others they have been fairly successful. Fuller found the huckleberry, 'as readily and safely transplanted as hard-wooded trees and shrubs, and require no more care than the currant.' In burnt pastures east of the Mississippi and on the Pacific slope they often spring up abundantly and become loaded with fruit.

Of over twenty varieties none is better known or of more value than the bush-cranberry the fruit of which is now a staple article on the market. Little in the way of improvement has been attempted, but that is a state of things not unusual with native fruits that are naturally of good size. As it is easier to breed in sweetness than acidity. [Gray] there should be no doubt as to its possible future.

The blueberry which has been long esteemed was introduced to the trade

about '86. Though the varieties at present cultivated are excellent yet among the many wild varieties there may be those that would make a still better starting point in developing something better. Directions given in one catalogue state that side grafting near the crown of the root secured plants without suckers. It goes without saying that the scions should be chosen from the best plants.

Diospyros.

Now for a fruit which Fuller would have placed at the head of the list. As professor Gray says, anyone who knows any thing of the Japanese persimmon can readily see the possibilities of our own. That a little work with the native varieties would develop as good if not a better and certainly a hardier fruit than the Japanese is sure; the foreign kinds, however might be used to hasten their progress.

The wild sorts are already very variable and probably careful search

would reveal just the type we would desire to cultivate. Reports from Oklahoma woods and other regions south of us, in Texas, etc., would indicate that there extremely good natural varieties. The 'Chapate' or black persimmon of Texas is sweeter and less astringent than others but it is objected to on account of its property of staining fingers and lips a deep black, much worse than our choke-cherries or wild grapes do, yet it might be used to impart its good qualities to others.

Certainly as good a wild fruit as *Diospyros Virginiana* should be raised to the dignity of a cultivated variety as soon as possible. Accounts of successful culture do occasionally reach us and further attempts should be no longer delayed.

Shepherdia.

A few varieties of *Shepherdia argentea*, the buffalo-berry, are known varying more or less in size taste and color of the berries. A sort having bright amber yellow berries (Nebraska)

appears to professor Bessey to be more promising for cultivation than the ordinary red ones. Its occurrence in our state is unusual but we cannot afford to disregard a hardy fruit so common throughout the Northwest. Its future also remains to be seen.

Morus.

The mulberry has long been known but has not taken a high position as a fruit tree. Its uneven ripening and stalky fruit are against it for many purposes, and yet much of this could be changed. Here-to-fore almost the only attention bestowed upon it has been for the purpose of raising silk-worm food or for shade trees; once admit its possibilities as a fruit tree then by selection and cultivation its development could be turned into another direction. It would not take much effort to bring some of the American varieties up to the standard of the European mulberry.

Travelers in the West have testi-

fid to the value of *Morus Rubra* as a fruit; the Indians made liberal use of it, and few country children but know the location of some particular tree. Its qualities are merely overshadowed by some other fruits and though at present it is only considered an excellent tree to keep birds about the orchard that they may wage their beneficent war against our insect enemies yet sometime it may take a higher place.

This completes my list; there are still *Crataegus tomentosa*, *Berberis Canadensis*, and others that might have been mentioned but we have taken up the most likely ones. The southern genera which as I stated at the beginning would be excluded from this paper would prove very interesting to those that care to examine them. They were left out because I was writing especially for this region. The ardent believers in acclimatization in all its fullness might confer an everlasting benefit upon us if they brought some of them north.

Having completed the list of native fruits the next point will be to consider more definitely the modes of improvement. First we study how the present cultivated fruits reached their perfection and then consider whether this is the best way to follow or shall we find a better.

In these days of evolution we gain a slight insight into nature's workings and by studying these we may learn how to carry out our projects by 'moving things' so they may be in the current of progress. We merely adapt what we are handling to the course of nature and thus take advantage of the power that exists. Applied to fruit culture it means to make use of all we have learned in centuries of experience of nature's ways of improving, and then to assist Pomona by directing her course, relieving her of useless encumbrances, and providing wherever possible for her wants. In this method we know we are working with nature and thus waste no energy.

Now what shall be the methods employed? Professor Bussey suggests to me regarding a certain fruit, planting, planting continuously from the best seed with the variation of grafting the seedling tops upon standard trees that they might bear and be tested sooner. The first part of this is essentially the Van Mons system and has, it must be admitted, done much for the advance of horticulture. But is not this omitting an important factor that should be brought to our aid. It is said now of Van Mons results that most of his success was probably due to the natural cross-fertilization of the pears in his orchard. This explanation is the more plausible as we see the difference between planting a lot of ordinary seedlings and planting well chosen crosses. Shall we not learn a lesson, then, from this and see how far we can by artificial means, so-called, replace the haphazard methods of trusting wholly to winds and insects? The next question is what to hybrid-

ize. Where nothing has already been done with a variety it will be necessary to scour the woods, as professor Munson has done, to see what is the best nature has to offer. By inquiring in localities where certain fruits are known to be naturally well developed is often possible to discover phenomenally good varieties, and at least we can find the best that are to be had.

These may either be removed to where they can receive more attention, or the seeds may be collected for planting. It is surprising what an improvement even this moving into cultivated soil will make in wild plants. It has been found especially true of flowers that protecting them from the stronger plants that would kill them out in the wild state makes a wonderful difference. Fruits are much the same. Relieve them of the necessity of fighting for every step of their progress they can grow more luxuriantly in every way. But this is wasteful! We indeed grow better fruit, but

we could reap a still greater advantage if, instead of developing all parts proportionately, a greater percent of the improvement went into the fruit. This again requires us to exercise care in selection. The farmer in choosing his seed corn does not select the ears from a rank stalk the size of his wrist, and with a great big ear thickly set with grains but of which the cob forms a disproportionate part. No more would we chose a fruit for seed on account of the size of the bush or tree, the amount of foliage, or the development of the seed in the berry.

In selecting we must have an eye for the points that will render the fruit of more value to us. No point of size, productiveness, quality, etc., must be omitted in judging. Selection goes still further in that we should recognize qualities that will make a plant better suited to certain localities. Drouth-resisting qualities, for instance, are the desideratum in arid regions while in others we seek plants that

will triumph over mildew. So one might go on enumerating down to the smallest details but if I make it plain enough so that the principle is grasped it is sufficient.

For our selected varieties we must be sure to supply abundant nourishment, both to secure and to retain their qualities the ground must be enriched so that the necessary chemical elements will be present. We must not lose our advantage but remember Virgil,
 'I've seen the largest seed, tho' viewed with care
 Degenerate, unless the industrious hand
 Did yearly cull the largest.'
 Keep these two always in view if continued success is desired.

But selection is not all. We soon find the law of diminishing returns working; our selection has reached a certain stage and variation has become painfully slow, we are almost at a standstill. Then it is that hybridization comes to the rescue. We discover that by crossing two related plants and planting the seed the offspring

differs from the parents. It may be very like one or the other or it may be like neither. What the actual laws are that govern the variation we do not yet know. First one and then another has volunteered an explanation but they have not stood the test of practice. It is in a state described by C.W.H. Heideman, (Minn.), 'I can say that the pollen plant may controll size, quality and color of fruit, and the mother, or seed plant, may controll constitutional hardiness, vigor, form, and habit of leaf and plant; but I can also say exactly the reverse'. Such being the case we still have to work more or less in the dark, but some one must do the experimenting or we shall never get sufficient data upon which to base our laws. There are at present a number of workers engaged in this line and sooner or later we shall reap the benefit of their labors.

But let us consider what the ob-

ject of crossing is. Do we expect by crossing two varieties of valuable qualities to get from the resulting seed a hybrid combining the merits of the two? Not exactly. There exists in this seed great possibilities so we plant and grow them, whereupon selection must be again brought into play. When the fruiting stage is reached, (and we hasten it by every means known to the horticulturist), we take the seeds of those plants whose fruit approaches the nearest to the qualities we had in view. This we keep up as far as it will go until the possibilities are practically exhausted.

Moreover when plants are judiciously crossed a new vigor is imparted to the offspring. Munson in his grape experiments found an increase of vitality in the progeny of most of his grapes when the cross was by a different variety of the same species. These grape experiments are also an illustration

of the refining power of hybridization and are worthy of considerable study. A better variety of wild grape is also found where it has been possible for different wild varieties to mix.

We must not omit to mention the danger arising from crossing at random. In spite of the tendency of nature to eliminate poor qualities and establish the good, if we cross with weak varieties we are more likely to breed a lack of vitality into the strain.

Thos. Inman has said, "We can get new races by hybridization, but it is of little value to us as an improving element, but in the originating of new species it is invaluable. Once we have a new race we must look to the selection of seedlings for the improvement we desire." This is not going quite so far as some do, his statement is probably called out by witnessing the results of ill-considered

crosses. It is the practice of some to make use of all crosses whether they promise well or not but this is hardly warranted by reason. Most workers use only those which show definite advance upon previous generations.

I do not intend to go exhaustively into hybridization but this subject can not well be considered without at least this much reference to it. Many of the well known factors in successful crossing have been mentioned yet many of the obscurer points have been omitted. That the possibilities of this method of improvement are by no means limited is seen by the reports made from time to time of extension in some new line. Luther Burbank of California has shown that not only can the black and red raspberry be hybridized but they can be intermingled with the blackberry and make in some cases fruitful offspring. So it is in other cases where one would

expect infertile seed, and this widens considerably.

I have generally mentioned under the various fruits the varieties that might be called upon in this way to assist in the improvement and it will not be necessary to repeat them. In almost every case there are varieties either native or foreign the pollen of which may be used upon others, and this is undoubtedly the way to success.

As we approach our conclusion I would make an appeal for the improvement of the various fruits. It is really exceptional to have a variety that combines a number of excellent qualities in its fruit with great vitality in the plant; this is surely due to the fact that our success in those cases is due not so much to intelligent effort as it is to good luck, or there would be no reason why their number could not be largely increased. Breeding in fruit occupies

by no means the advanced position that is held by breeding in livestock or even in farm and garden crops. Take the cereals. Our wheat growers will undertake to produce whatever kind of wheat the market may demand. They alter the nutrient proportions at will. In Australia definite work is being done in the line of disease-proof varieties. Even in grains of lesser importance improvement is the rule. Then look at the high scientific methods that have been perfected in Europe for the improvement of the sugar-beet and are gradually obtaining in other products.

Why, then, should horticulture be so backward when nature has done so much for it? Let the word go forth to employ all means of improvement to the fruits we already have and fill every niche which a new fruit may occupy by improved forms from among our many wild ones. It should not be said that we already have enough delicious fruits.

The field of the horticulturist is to develop to the utmost all wholesome fruit that can please the palate and until he has done this his labor is not completed,' so says the veteran horticulturist E. S. Goff and we must all agree with him.

This provides no end of work for the experimenter for with all our discussion of acclimatization no species can so well suit any locality as that one developed there. Each climatic locality must work out its own salvation in the matter of improving its native fruitplants, says Heiderman. It has also been said 'If the races we start find themselves in a suitable atmosphere they will develop, if not they will succumb or remain weak and unprofitable. It will thus be a simple matter to tell the desirable kinds and once their position is secured it will be time enough to relax our efforts in the direction of fruit improvement and seek another outlet for our energy.