Bee Breeding

BEE-BREEDING

A Little Monograph on a Neglected Subject

By

STEPHEN N. GREEN

PREFACE.

The honey-bee has not been improved in a systematic way. New methods of handling, new kinds of hives, appliances, etc., by the score, but as yet there is very little effort toward a better bee. New races, it is true, have been introduced, but these do not fill the requirements. What we desire is a bee highly and scientifically developed to meet specific needs.

Bee-keepers are surely behind the times in this phase of the development of their industry. Animal breeding to-day is an exact science. Plant-breeding within the past ten years has made marvelous advances. With the results of researches of the kingdoms of life above and below that of the bee, before us, bee-breeding simply demands intelligence and time to advance to a state of perfection hardly dreamed of to-day.

Bee-breeding is not bee or queen-rearing; hence I am not to take up the discussion of many of the new or old methods of culture. It's not a question of more bees alone, but better bees.

Science is progressive. This little work is not perfect or complete. It is merely a start in the right direction.

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THE IDEAL BEE.

We cannot all agree as to the qualities of this bee. Every bee-keeper has his own ideal. He has in mind his own particular needs, and the bee that meets these requirements is to him the standard.

To know exactly what you want, and then proceed with this ideal in view, is the first requirement of successful breeding.

However, to make the most rapid progress as a whole, bee-keepers need a "standard of excellence." This standard may be a "scale of points," or a "pedigree"—a registry, or record of performance.

In constructing a scale of points it is impossible to please every one; for, as we have said, ideals vary so that there would be almost as many scales as there are bee-keepers. We must have in mind the most

general requirements, and build with these in view.

The use of a scale of points is mainly for the beginner. It is to train his judgment. When he has once a clear ideal of the requirements of an ideal bee he can, like the veteran, lay the scale aside. Also in awarding prizes, when there is a number of a certain class in competition, a scale of points is necessary for a fair treatment of all—that is, there must be some known standard to judge by.

Below is a suggestion, revised and modified by a number of authorities, which meets fairly well the requirements for a strain of bees adapted to the production of extracted honey:

Prolificness	30 points
Non-Swarming	10 points
Gentleness	10 points
Working abilities	15 points
Size of bee	15 points
Comb-building	5 points
Hardiness	15 points
The perfect bee	100 points

For a bee desired for the exclusive production of comb honey we must change our scale to meet these different requirements. For instance, as the control of swarming is

more difficult when running for comb honey, the better bee is the one least inclined to swarm.

Here is a suggested scale:

Prolificness	25 points
Non-swarming	15 points
Gentleness	10 points
Working abilities	20 points
Size of bee	5 points
Comb-building	10 points
Hardiness	10 points
Color	5 points
The perfect bee	100 points

Now, when we proceed to judge a colony of bees—for instance, one run for comb honey—we start in with prolificness. Assuming that the colony under observation is very strong, but still there is room for improvement, we will credit them with 20 points out of the possible thirty. Taking up the next and then the next requirement until we reach the end, we add the figures. Suppose the sum is 80 points, our strain needs improvement until the 100 points are reached.

The systems of registry amony cattle-breeders is familiar with all having a slight knowledge of this subject. These same registries are maintained to a greater or less

degree among all live-stock breeders. In time bee-keepers will find it profitable, possibly, to establish among themselves like records. However, so much preliminary work is to be done before this point is reached, it is hardly necessary to enter into the discussion of this subject now, so we must hasten to the next.

THE PROBLEM.

The reader has certain rights; and among them is the privilege of summing up the case. If I happen to be wrong—why, put me straight.

It is self-evident that the life of the bee is governed by the same biological laws as is all life, whether it be in the plant or animal kingdom. There can be no difference in purely fundamental principles. Unfortunately the limited space of this book forbids going into details regarding the many wonderful and beautiful examples and illustrations of these laws, only to define briefly some of the main ones directly affecting bee-breeding.

Many consider one force primarily accountable for all forms of life. We call it environment. Another section of this law,

seemingly different, we call heredity. With these as fundamental, man with his reasoning powers uses another force which we will call selection; then progresses further in controlling mating, which we call hybridizing, or crossing. To further his ideals still more, he regulates nutrition and uses to his advantage correlation. These are the main factors we shall deal with in the progress of this book.

There is a very large amount of purely scientific and technical work to be accomplished before bee-breeding reaches the perfection possible, and is placed in the forefront with plant and animal breeding. It is, for instance, well known that the bee itself varies greatly; but before we can use these differences to advantage we must have before us the tabulated results of many researches.

Every careful bee-keeper has noted the remarkable lack of uniformity of yield between his various colonies, even when they are of the same apparent strength. This may be from two or more reasons or a combination of them. First, the colony may lack enough bees of the right age for gathering; or, second, it may be in the nature of the bee itself. As the first reason deals

in the management of the colony to the greatest extent, we cannot discuss it here. The second reason, however, deserves our serious attention. From stastitics, which may be as representative as we can now obtain, I have found the variations averaging over 50 per cent. between the ten highest and the ten lowest yields of apiaries in the same State. We need more reliable figures along this line; and when bee-keepers will fully realize the difference of stock, the question of breeding will receive nearly as much attention as management does now.

It is hardly necessary to argue why the bee should be scientifically bred. Nature will hardly develop a better bee, for she has altogether different aims from man. Most of us wish a more profitable bee. We all know that, of each colony reached the high standard sometimes reached by a single colony, the honey crop would often be doubled. Careful breeding will accomplish this, and with it reduce in proportion the cost of all management, and this means better profits.

There are many points to breed for. One is color. Color may not be necessary, but let us have beautiful bees if possible. Beauty is a stimulant to best endeavors; so,

breed for beautiful bees, but combine it with endurance and industry. We can do it.

When we are breeding for certain points we will often run against traits that are almost a part of the bee itself; and to change then nearly means nearly making the bee over. For example, let us take the swarming impulse or the desire to increase. We can remove many of the conditions that tend to produce swarming, and by presistent breeding reduce this tendency to as low a point as is desirable.

As the queen is the foundation of the colony, we must have better queens. Cheap queens are a detrimental factor. As long as consumers insist on paying a low price for their stock, so long must they be content with the result of queens reared without proper care. There is too much tendency now to see how many queens can be raised, rather than how good queens. A good queen should command a good price, and a dollar is not enough.

We are all familiar with the fabulous prices paid for prize-winning trotting horses. Similar prices are paid for beef and milk cattle. Coming down to an industry which is often thought of in connection

with bees—poultry. Single specimens have sold more than once for over $1000. Choice breeding stock always commands a very high price; but with bees the prices paid for the best breeders rarely exceed $25.00, with a common level of $10.00 for the best specimens our breeders can produce.

This is all out of proportion to value of queens.

We can see how horses can earn large sums and be worth the prices paid, and horses and cattle are limited in their reproductive powers. The same way with poultry. Now, aside from breeding purposes a hen can very rarely exceed 200 eggs a year; and these, at the average price of 1 1-2 cents each, amount only to $3.00, and from this amount you must deduct the heavy expenses.

We will now consider a good queen-bee. From her eggs you could rear an immense number of other queens in a year. But in common practice you are doing well in rearing 1000; and these queens, at the low price of 50cts. each, will be worth $500. Again, to place the queen beside the hen in productive value, comparing eggs with honey. This queen at the head of a colony will produce 100 to 300 pounds of honey; this,

valued at 10cts. per pound, would bring $10.00 to $30.00, which is 10 per cent. interest on $100 to $300. And the life of the queen is as long as the hen's in usefulness. Yet we are willing to pay only $1.00 to $10.00 for a queen capable of such value.

It is small wonder that, with so many years of what we call modern culture behind them, American bees have made little or no marked advance. In animal and plants, enormous strides have been made, and we must advance the bee.

ENVIRONMENT.

Before going further into this subject I may as well explain that my views are Neo-Lamarckian. Though this theory is nearly a century old, a remarkable revival of it has occurred within the past five years. Our most advanced scientists believe this to be the most reasonable theory of the subject. Of course, there are many other theories, but we can not stop here to deal with them. If you are interested there are many books which will argue one way or another.

From the first simple cells to the present multitude of complex forms of life there is an immense span. Yet one force is responsible for all this change, to which all life eternally adapts itself—environment. We

use this word often, but do not half comprehend its full meaning.

This law of environment grinds slow, but grinds exceedingly fine. Its results are most certain. Hence in bee-breeding we can not afford to overlook it.

We can not expect the highest development of the bee unless the conditions and culture are the best. The environment must be the most favorable to the change we desire.

Just what effect climate has on the habits of the bee, we can not tell, as we have no data; but it must be along the same lines as with other life. My own experience with strains of honey-bees long bred in warm climates show, that, as a rule, they are inclined to be less vigorous workers, and very irritable, while strains bred in cooler climes seem to be more gentle and industrious.

Gentleness may depend on handling. If you maltreat an animal, for instance a dog, you will soon have a vicious beast. Again, if you are kind, a savage one may be made docile. While the bee is of a lower order, and thus not so easily affected, right handling must tend to produce a more gentle bee. It's a point worth considering.

Small hives or brood-nests restricted in any way tend to produce a less prolific queen

by retarding development; and this, in turn, affects her offspring. Just to what extent this is injurious we can not say; but doubtless the tendency of present conditions of the hive is unfavorable. The queen must be allowed sufficient amount of comb space if we are to profit by the law of environment to produce better and more polific queens.

It is true that many contend that acquired characteristics are not transmitted to offsprings, and still others contend that they are the only ones that are. As this point as well as others leads only to an endless discussion of various theories, we will stop here.

Environment, in another sense, play, a part in the mating of the queen, which is so important a matter. Since we can not yet absolutely control this matter, we can, for instance, restrict the flight of drones by island or prairie apiaries. As we take up this subject a little further on we need only mention it here.

In brief, environment, the effect of forces within and without, are as constant as gravitation, and surely influence the individual, and, by the law, we next take up the offspring directly.

HEREDITY.

All life is but the continuation of life which gave it birth. We call heredity that force which has to do with the transmission of certain qualities from parent to offspring. It has been put in other words, "heredity is the sum of all past environment."

As we have said before, heredity is so closely connected with environment it is impossible to separate it fully. Hence it is doubtless true that all qualities that are inherited have once been acquired. With this in view we can see how important this law is to practical bee-breeding.

The importance of the ancestry of the stock from which the bee-keeper desires to breed are of greatest consequence, and must not be overlooked. Bees, like other forms of life, are inclined to certain traits; and if these are desirable they should be en-

couraged; and if undesirable they must be suppressed. One characteristic seems to be inherited entire, independent of another, making things uncertain; but every point must be taken advantage of by the skillful breeder.

The constitution of various strains of bees varies greatly; and as this is a vital point the wise breeder will always have it in view. A good constitution insures long life, and swiftness and strength of wing,—little consequence in the individual bee, but of great importance in the final results of the work of the colony.

All qualities may be inherited, whether good or bad—color, size, disposition, etc.

One question yet uninvestigated in bees is the part heredity plays in the transmission or resistance of disease. In animal life this subject is widely discussed. In plant life, breeding for disease resistance is common. Coming still closer to bees, with insects, the silkworm, for instance, is known to transmit through her eggs disease which is fatal. With this question answered, some preplexing problems will be solved for the bee-breeder.

Nearly fifty years ago a monk in Austria, Mendal by name, discovered a law by which

he could predict the results of crossing two distinct varieties. This law he worked out in a most remarkable manner, and to the minutest details. His discovery created no stir until recent years, when it was rediscovered by others.

If Mendal's law be true, we may regard all animal and plant organisms as made up of a number of unit characters—10, 100, 1000, etc.; and these units behave somewhat like chemical reactions. The subject is very technical and complex in nature, and hard to explain to anybody not having considerable knowledge of special nature.

This law is fully worked out in plant-life, and recently applied to animal. It now remains for the bee-keeper to apply it to the bee. It doubtless can be done, and the subject will be given the great attention it deserves, for the subject of heredity is a vital one.

At best the problem of heredity is very complex, and difficult to solve. A volume would hardly be enough to explain its working, and cite examples. However, bee-breeders should be familiar with at least its first principles, so as to understand otherwise unreasonable and discouraging occurrences that are sure to come.

SELECTION.

Variation is the only constant force in life. Acknowledging this fact the bee-keeper should always be on the alert to improve his stock by the selection of the desirable qualities of this stock as they appear, and make them a part of this strain. Natural selection fits only for natural environment, and can never be depended upon to produce a bee adapted to the artificial needs of the bee-keeper.

Variations occur in every colony of bees. These variations, of course, are less marked in a strain of bees less carefully bred than in one carelessly maintained. The truth is, there can never be two colonies exactly alike. It is necessary to produce the best results in your apiary that every queen rear

bees near a uniform excellence, and the higher this standard, the better.

As we have seen, variations are constantly occurring. You have seen bees cap their cells to perfection while another does not. If you are running for fancy, other things being equal, breed from the former queen and drones. Colonies of bees differ in pollen-gathering and propolizing. They vary in their hours of laboring and the manner of ripening honey. They differ in cold and heat resisting, as well as resisting disease. The prolificness of queens is often marked, as well as the tendency to swarm. In judging these points we must bear in mind any artificial conditions that may interfere with the natural course of things.

All of these points, and many we have not named, though they appear very minute, must be kept in mind by the breeder, as they afford basis for the improvement of this stock.

An example of selection with bees which has been attempted in a spasmodic way is selecting for long tongues. Doubtless we can create a bee having a much longer tongue than the one we now have. Plant and animal breeding abound in examples of results gained that are far more difficult than has been attempted in bee-breeding. The

tongue-reach of the bees is important, and breeding for this point should not be abandoned by any means.

Another example is the "yellow-from-tip-to-tip" bees. This plainly illustrates what can be done in the color line when proper care is taken.

To begin the work of selection you should have the best possible stock for foundation. It is foolish to start with inferior bees when better can be obtained, even though this stock should come high. The time and labor lost in working with inferior bees more than repays any first cost. Final results are often half gained or entirely ruined in making the start. Breed from the very best of a very large number.

One quality is often gained at the expense of another. This should be kept in mind, and the colony averaging the highest number of points should be the one to breed from, in the majority of cases.

It is a splendid ideal, if not almost necessary, for the bee-keeper to keep a profit-and-loss account of every colony of bees under trial for selection. This will aid in determining which colony excels in reality and not from a personal view.

Variation, while bringing to light qualities, also exposes bad ones. Eternal vigilance is the price of a superior strain of bees.

CROSSING.

From a scientific standpoint it is to be regretted that the mating of the queen can not be controlled absolutely. From a practical view it is not so necessary, and prevents certain abuses. Still we can mate queens to a reasonable certainty. The more the radius of the flight of the queen becomes known, the less it grows, and especially so when drones are abundant. By rearing many drones within the apiary, from select hives we can expect a high percentage of our queens to mate with desired drones.

When more than one strain of bees are raised in the same yard, undesirable drones can be suppressed by cutting brood or by the use of drone-traps; also it is a fact that a queen rarely lays drone eggs when less than a year old, which, too, is a valuable point for the honey-raiser to consider.

A cross, as we have previously defined, is the result of the mating of two separate

varieties. We will also discuss under this head the closer mating, taking up first the mating of less related bees to the much closer union of related colonies.

For examination, let us look back at the most common cross—an Italian queen with a native black drone. The offsprings we call "hybrids." Almost invariably these bees are of an irritable temper. However, by reversing the parentage, mating the native queen with an Italian drone, we may obtain bees as gentle as could be desired. This fact has been proven again and again.

Just what qualities are inherited from either parent is a mooted question. However, some breeders say it can be predicted with reasonable safety that color, for example, is from the female, and the disposition from the male side. There have been and can be made hundreds of different crosses between different varieties and strains of bees. If the results of these were collected and tabulated and presented to us in concrete form, the problem of breeding bees would be greatly simplified.

Referring again to a common cross-black with Italian, or vice versa, some crosses of this nature in plant and animal life are noted for their vigorous constitutions, so that they

can resist disease and unfavorable conditions better than either of their parents. On account of these desirable qualities many bee-keepers, from results of actual experience, champion the "hybred" bee, much to the astonishment of the rearers of pure stock. This constitutional vigor is not a mystery under certain conditions for it is in accordance with a law well known among animal and plant breeders.

In making the above statement it must be limited strictly to pure "hybrids." Degenerate stocks of hybrids, or run-out pure strains, are most liable to disease. A first cross between strains is good, but a first cross between native and foreign stock is the best.

The union of native stock and foreign blood, in many circumstances where the environments have been radically different, produces an energetic offspring as well as oftimes the offspring of foreign parents in new environments. In other words, it is an introduction of new blood. Introduce new blood as long as it results in anything better. Such "hybrids" should be carefully experimented with, and, where valuable, should be made a commercial asset.

For the above reasons I would strongly urge the attention of queen-rearers to the

sale of virgin queens. There is no obstacle in the way except common prejudice, allowing, of course, for any errors in judgment that are liable when a new plan is tried. Virgins can be cheaply produced, as it relieves the queen-bearer of the most expensive part of the operation. They can be mated, usually, up to twenty-five days, which is an ample margin above mailing requirements, excluding foreign shipments. There is much less liability of injury of virgins in the mails. In fact, I do not think bee-keepers generally realize the extent that laying queens are injured during their journey, and these injuries are doubtless the cause of much dissatisfaction that often arises. A laying queen is a highly organized and delicate creature; and the sudden stoppage of her duties is dangerous. Aside from the item of probable crossing with native drones, and thus invigorating the stock, the sale of virgins at a low price would induce bee-keepers to restock often, as the best time of a queens life is her first year, and it is advisable to replace a queen for commercial purposes that has lived one full season.

Crossing disturbs the slow sluggish flow of life, and renders the clay plastic so we

can work it. By crossing, desirable combinations can be made, characteristics suppressed, blended, or made dominant. In fact, almost any change can be made if time and patience are combined with skill.

Crossing also has its dark side. We have disturbed nature, and often, though sometimes without the cause of crossing, the characteristics that dominate are those of remote or original ancestors, and usually very undesirable. When such a state of affairs occur, either under normal or abnormal conditions, we speak of it as being due to the law of atavism, the reversion to the primative types, the cause of which we little understand.

In bee-breeding it is not advisable to breed from hybrid stock, as we can not control mating enough to make sure of points which must be observed to produce desirable results. It closes to the bee-breeder a wide field of action which is being richly worked by the plant and animal breeder, of which we now speak briefly.

The question of in-and-in, line, or close breeding, have not (fortunately or unfortunately, as you choose), on account of uncontrollable mating, ever received attention from the hands of the bee-breeder as it de-

serves. In-and-in breeding is necessary when building up a strain from a few individuals, or fixing certain qualities. Line breeding is used to maintain a pedigree. Both of these systems are like sharp tools: in the hands of the unskilled they are dangerous, but the experienced operator can use them to great advantage.

In close breeding, care should always be taken in mating individuals that have no bad but only good qualities in common, as the common qualities are usually intensified. Close breeding, if carried to excess, is sure to cause degeneration, and the only remedy is the introduction of new blood. In a general way, bees long raised in a certain locality are affected with the ills of close breeding. Nature abhors continual close breeding. Introduce new stock.

True hybrids, as we have stated before, are the offspring of the union of two separate species. As yet this question in bee-breeding has not been touched. Species are arbitrary divisions made by man, and may or may not be valid. Even true division may not be a barrier to hybridization. One noted plant-breeder has been quoted as saying, "Given any two species of plant life, I can, if I live long enough, produce a

union between them." This merely illustrated the common ancestry of all life.

There are two possible hybrids which might tend toward a better bee. The Apis Dorsata is a large-bodied bee, and a larger honey-bee within certain limits would be a good thing. The great variety of the genius Melipona, or stingless bee, might afford the chance of creating a stingless bee, of commercial possibilities.

In closing this chapter we must, as in other points, confess our ignorance of many things.

NUTRITION.

This subject has been given a separate chapter on account of its importance and the tendency of the bee-breed to overlook it. It is vital, as is directly affects the results of his works. The subject might have been dealt with under "Environment" or "Heredity," in fact, it touches every where. It is as cement that binds the blocks.

The effect of food supply upon the life of the bee is immediate, and through heredity it effects future generations. As the breeder can control the food supply to a great extent, he can see the power he holds in his hands.

Honey as we all know, is a highly concentrated food upon which the bee depends for life. When we substitute candy or syrup we run the risk of checking the develop-

ment of the bee, especially the queen and drone, through malnutrition and by the adultrants or chemicals used in the manufacture of commercial sugars. It can not be urged too strongly to limit your feeding to pure honey—more strongly when you are engaged in the actual work of bee-breeding.

Some feed their larvae much more liberally than others. This is a habit, and the honey-flow is not entirely responsible. Bees properly and liberally fed must, by the law of nutrition, develop better than the starved; hence we may expect bees better constituted for honey-gathering and disease resistance, and long life. Colonies showing this valuable trait should be jealously watched and increased.

The most important single factor in the life of the colony is the queen. We must insist that the development is unchecked and her needs fully supplied. By the very nature of things, swarming time is the best season to rear the finest queens. They are always liberally fed and lavishly cared for. Queens reared out of season are apt to be stunted and not fit to perform the duties which demand such remarkable vitality.

If you wish to verify the above statement, carefully compare the size of queen-

cells reared in swarming season with those artifically stimulated out of season on syrup or those reared in starving or discouraged colonies. You can almost every time detect the queen reared under the later conditions by her small size; and if you have patience you will see her inferiority later in the colony.

The development of the drone is affected in the same way. A drone starved or ill fed is hampered in the development of his special organs, and the quantity of sperm must be less. Mating by chance, this drone is responsible for the failure of the queen in time to produce worker bees, upon which her usefulness depends.

To develop to the highest standard we must attend to nature's ways. Queens reared out of swarming season are ill fed from lack of young bees and other ways, and are apt to mate with poor drones, as any experienced queen-breeder will tell you. Your breeding stock must be reared under every favorable condition, and commercial stock reared the same way should command a high premium.

While not exactly under this subject, we can take it up here. I refer to the matter of the size of the cell as related to the devel-

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opment. It has been recently shown by some foreign observers that the cells of all bees are not the same. The size of the degenerate bee is the smallest; next to it, the common stock and largest, is the highest-developed five-banded Italians. This naturally raises the question, "Why not increase the size of the cell in foundation, and increase by spacing the width of comb, and thus increase the size of our bees?" This same principle is applied to plants and animals with success. By unrestricted development, superior strains are produced. Variations produced in this way are much slower than those induced by crossing, or another phrase of this same subject—changed environment. We must not expect to produce a giant bee in a summer this way. There is danger all along the road. You increase the diameter of the cell a few hundreths of an inch. The bee would naturally more fully develop along the line of least resistance. The abdomen would enlarge before the thorax. You would stand the risk of raising a crop of fertile workers if the bees could be induced to accept foundation too large. We must go slow. We must experiment.

CORRELATION.

Adapted to bee-breeding, correlation could be defined as "the correspondence or relation which exists between different organs, or parts, as to form or uses." To understand the laws of correlation unables a bee-breeder to judge an unseen quality by the relation it must bear to one which can be seen. For example, long tongues may be indicative of superior honey-gathering qualities.

Correlation, too, is the basis upon which most divisions of life are made, as genius, species, etc. To a biologist certain formations of a bone would place that animal under a certain division, and thus we have our varied classification.

One important part of correlation that affects directly the problem of breeding is that one quality is not developed except at the risk of reducing an opposite related quality. In cattle-breeding this law is nicely illustrated from the fact that the

highest type of beef animal is a poor milker, and vice versa.

In bee-breeding we can hardly expect to increase the size of the bee without a corresponding decrease of another quality. In making a gentle bee we may produce one less inclined to protect its stores from robber bees. Thus we see that nature always tries to strike a balance, and to raise this level is a really great work.

When judging this law of correlation in mind we should be careful to rule out any accidental cause which may have been the cause rather than the working of the law. A black queen need not always be of black stock, as a queen chilled during a critical stage of her development is often very dark, while others from the same stock may be of the brightest yellow. Bees may not always be irritable, as a colony without stores you will notice is often cross, and can not be subdued with any amount of smoke.

In the care of breeding colonies, the practice of swapping combs should never be allowed, as it destroys almost every record from which we judge a queen.

Breeders should ever be on the outlook for these little points of correlation, and record them, as they may later prove extremely valuable, not only to himself but to another breeder. Bee-breeding consists of a multitude of little things which make up the grand total.

HONEY PLANTS.

In the company of nature the bee plays an important part in the fertilization of flowers. Plants and bees by mutual evolution have become dependent up each other. The bees need the nectar for their nourishment, and the flowers need the bees for aid in accomplishing its circle of life.

Why, then, should not the bee-breeder be interested in the other form of life so related to his specialty? As we have shown before, the needs of man are not those of nature; and to accomplish his ends man must interfere, and direct the currents to his own advantage. Bee-breeding and plant-breeding hold so much in common that the bee-breeder is not a loss when he crosses the boundary.

One of the most important problems of the bee-keeper is that of pasturage. As the

country becomes more settled, the bee-keeper must depend more and more upon artificial pasturage. As the wild flowers decrease, those of cultivated plants become a greater source of honey, and he should give his attention to their honey-producing qualities. It should concern him what kinds of crops his neighbors plant.

Red clover, it seems to me, should interest the bee-breeder, for it presents the greatest value when improved in the direction desired by the bee-man. Every head contains a large amount of honey beyond the reach of the honey-bee. Can not its tubes be shortened? Yes, just as soon as the work is seriously undertaken by someone.

Buckwheat is an important source of honey in certain localities, but the product is injured by reason of its color and flavor. Why not breed a plant yielding a nectar which, gathered and stored by the bee, would be white and mild-flavored? Impossible? No, but it would take time.

Many of these suggestions could be named. It is up to the bee-breeder to interest himself in these questions, and to co-operate heartily with his plant-breeding brother and with his neighbors.