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Seed Industry of The
United States
Don B. Jewell.
1901

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T H E S I S .

**The Seed Industry of the United
States.**

-by-

Don B. Jewell, Class '01.

THESIS

**The Seed Industry of the United
States.
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**History.
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The United States is recognized the world over for the size and variety of its industries, and among these industries the one connected with the seed business both in size and importance ranks not far from the top. The industry dates back to the first settlement of the country and its history constitutes one of the most interesting chapters in the annals of American Horticulture. From the small beginning of the Colonial period, the business has so grown that today its value is measured by the tens of millions and is still rapidly progressing. At first a few seeds shared a corner of the cod fish box or a shelf with cloth and books; now it has come to claim for itself immense ware houses and business establishments whose interests extend to every part of the globe. The trade has grown with the growth of the country and its leaders have influenced popular taste for good vegetables and fine flowers, which only their own enterprise can suffice to meet.

When our forefathers landed on the rugged shores of Massachusetts they brought with them the seeds of plants they had

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cultivated in their English and Dutch homes, their first care being to obtain those seeds which were absolutely necessary, as corn and barley. The fruits were considered of secondary importance. Agricultural seeds formed an article of commerce as early as 1747, the seed most extensively imported being clover. The first record of seeds offered for sale was in 1763 when Nathaniel Bird, a book dealer in Newport, Rhode Island, advertised garden seeds just arrived from London. From this time on certain gardeners in Connecticut began raising seeds of the commoner vegetables. The prices asked were very high. Peas and beans cost thirty shillings per quart. Cabbage forty shillings per ounce. Cauliflower six pounds per ounce. In New York City garden seeds were advertised as early as 1776 but Boston being the commercial center of that time, was the chief city for their sale. In the Boston Gazette of 1767, six out of twenty-six advertisers were dealers in seeds and in 1768 Wm. Davidson offered fifty-six varieties of garden seeds for sale.

The Revolutionary War gave the industry a set back, and during that time, the few seeds offered for sale were imported from Holland or taken from prize ships. The trade made a slight improvement after the war but soon proved unprofitable and after a time advertisements disappeared altogether until about 1781 when seeds were again imported from Holland.

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However, the business did not progress to any great extent during the remainder of the eighteenth century. The small demand being supplied by David Landreth who established a regular seed growing business in connection with his nursery farm at Philadelphia in 1784. Most of his seeds were imported and the American gardens had yet to learn that seeds could be grown here as well as in England.

At the opening of the present century the business again revived and from that time until the present has steadily increased. During the first twenty-five years of this century, seed stores were opened in all the large cities, and besides, many seeds were sold by regular peddlers. While most of the trade between 1820 and 1850 was local, or wholesale to country dealers, a change took place with the advent of the locomotive. This not only opened up a vast and flourishing country, but made it possible to send seed catalogues and do a large mail order business. The trade changed greatly. The barrel of peas has grown to hundreds of sacks and the few thousand packets to millions. The large, modern seed stores are models of convenience and system. In most of them fanning mills of the Monitor and Clipper type are constantly employed in cleaning and grading seed, everything being arranged so that orders may be filled accurately and quickly. Thirty years ago

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a hundred letters a day was considered a large business; today some houses receive over six thousand a day during the busy season.

At first a narrow strip along the Atlantic coast was devoted to the industry, now seeds are grown in every state in the Union. At present comparatively few seeds are imported. The United States raises all its bean, cabbage, lettuce, celery, onion, pepper, melon, squash and corn. Those imported being mostly varieties of egg plant, kale and sugar beet. Fifty years ago there were few seedsmen who understood varieties. Today the seedsmen are variety experts and note with accuracy small differences which would entirely escape the ordinary observer.

The above has dealt with the industry in general but its history would hardly be complete without a word regarding the seed farms. So far as reported there were but two seed farms in this country previous to 1800. Of course there was land devoted to growing seeds but seeds were grown in connection with something else. These two seed farms mentioned, grew seeds exclusively. One was established at Philadelphia in 1784 and the other at Enfield, New Hampshire in 1795. At 1820 only three had been established, six in 1830, 19 in 1840, thirty-four in 1850, fifty-three in 1860, one hundred in 1870,

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two hundred seven in 1880 and the census of 1890, the latest authority, shows over five hundred, while at the present time it is safe to say that there are nearly one thousand seed farms in the United States. In 1890 there was 169851 acres of land devoted exclusively to seed production, this land was proportioned among the various vegetables as follows: 1,437 acres asparagus; 12,905 acres beans; 919 acres beets; 1,268 acres cabbage; 569 acres carrots; 11 acres cauliflower; 71 acres celery; 13 acres collards; 15,009 acres sweet corn; 10,219 acres cucumbers; 29,3/4 acres dandelion; 252 acres egg plant; 105 acres kale; 19 acres Kehl Rabi; 13,1/2 acres leek; 486,1/2 acres lettuce; 5,149 acres muskmelon; 3,978 acres water melon; 3,500 acres onion; 325 acres onion sets; 374 acres parsnips; 7,971 acres peas; 365 acres peppers; 4,102 acres potatoes; 105 acres pumpkins; 662 acres radishes; 25 acres rhubarb; 4,356 acres tomatoes; 885 acres turnips; 4,663 acres squashes; 71 acres flower seeds. Value of the farm implements etc. were \$18,325,935. There were employed 13,500 men and 1,541 women. Of these farms nearly one-half were in the north Atlantic division, the original center of seed production. These farms average but 185 acres each, while in the north central division, having only one-half the number of farms, they average 555 acres, making a greater acreage given to the industry in that division.

The eastern seed farms are much smaller than the western ones, for instance, those of Massachusetts and Connecticut average 142 acres, while those of Iowa and Nebraska average 695 acres and are producing seed on a scale of equal magnitude to the other products of the country. The largest of these farms are about 3,000 acres. All the figures taken are from the census report of 1890 and it is safe to state that in the past ten years the industry as a whole has nearly doubled. The industry has grown more rapidly and steadily than any other and indications now, as well as past history, foretell of even a more prosperous advancement during the next ten years.

Seed Department at Washington.

The seed industry owes much of its success to the cooperation and aid from the Department of Agriculture at Washington and a treatise on the industry would hardly be complete without a brief review of the history and work done by the Department.

The Department of Agriculture had its origin in the far-sightedness of Washington and Franklin who encouraged the importation of seeds and tried in every way to encourage home-grown seeds. But at best they were able to do little, partly on account of the wildness of the country and partly because they did not have the time to give the matter the attention

it deserved. Things drifted on, making little progress until 1839 when Hon. Henry E. Ellsworth of Connecticut induced Congress to make a small appropriation for the distribution of seeds and cuttings sent home by foreign ministers. The experiment was a success and the distribution steadily increased. Beyond this distributing, however, nothing was done until 1862 when Wm. Saunders was appointed superintendent of a forty acre tract appropriated by Congress for an experimental garden. In 1863 Isaac Newton imported several hundred bushels of choice seed wheat, corn and other cereals and several thousand dollars worth of other seeds. As a result, in 1863 1,200,000 packages of seed were distributed. In 1867 Horace Capron became commissioner of Agriculture and established a system of exchange of seeds and bulbs with foreign countries. About this time the Department awoke to the fact that the experimental farm was too small and because of this it was impossible to grow many different varieties on account of their mixing. The old farm was then turned into an arboretum and new farms obtained at some distance from each other. About this time the different divisions of the Department were organized and in 1869 the work on seeds was put under the direction of the Division of Botany. Under this Division the work has rapidly progressed until now many acres are given to experiments and packages of seed numbering way into the millions

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are annually distributed. In 1876 when the crops in the west were destroyed by grasshoppers, over \$30,000 worth of seeds were sent to the sufferers by the Department. The Division of Botany, besides investigating the purity and value of home-grown seeds, introduces, tests and distributes valuable seeds and plants from foreign countries. The testing is done on a small trial ground in connection with the seed laboratory. Here varieties are studied, careful notes and photographs made, so when completed, the records make accurate descriptions of all the standard sorts of vegetables and cereals. Unknown weed seeds found in imported grasses and forage crops are grown; thus the Department is kept ^{informed} as to the character of weeds being introduced into this country. In testing many seeds, the trial grounds are not used as much as the laboratory and green houses, in which the Department is well equipped with balances, lenses, reading glasses and a seed collection; in fact it has all the apparatus necessary for making purity tests. The method of testing is essentially similar to that in use in all seed testing stations and will be fully treated later.

Seed Firms.

Unlike most large business enterprises, it is extremely hard to find out the methods used by seed firms. Still these firms are hardly to be criticized for their reticence. The large iron firm controls its own mines and knowing that its raw material can only be obtained in certain localities, has not been backward in telling of its methods of business and of working up this raw material. It is much the same with other firms of the same nature, but with the seed firm it is different. Everyone having an acre of ground, if he sees fit can raise seed and if these firms were to disclose their private methods of growing, harvesting, breeding etc. it would only be opening the way for a vast number of competitors. The above statement is substantiated by the rapid increase of the seed industry in the past few years. There are, however, a few general facts which from studying catalogues and observations we are able to glean.

Many persons have the idea that seedsmen grow all their own seed, but such is far from being the case, especially with large firms. It is the general practice of the seed trade to grow or have grown plants for seed purposes where the product attains the highest degree of perfection. Seedsmen know where to look for their best seed as well as the cheap grades and

when they have a discriminating trade, do not handle seeds of questionable character. The best firms own land in various parts of the country where they grow certain seeds. Sweet peas offer a good example of one of the methods used by seedsmen. The sweet pea attains its highest degree of perfection in California but if grown there for more than one generation, attains such a long growing season that it will not blossom in the northern and north central states before frost. The scheme followed is this: The seedsmen grow their stock seeds at their own gardens and then send this stock seed to California to raise the commercial crop. In this way they get the advantage of the more vigorous California product without the disadvantage of the longer growing season which would be the case were the stock seeds raised in California. D. M. Ferry owns large tracts in northern Michigan where hardy vegetables are grown for seed in order to increase their hardiness and shorten their growing season. When these large firms have their seeds grown for them it is usually done by reliable farmers and the whole thing is overseen by some expert. There are firms who do not grow scarcely any of their own seed but these firms are not on the reliable list. They send out seeds to farmers, offer prizes, but do not pay much attention to what they get back so long as it is seed. These

are the firms that are continually selling seeds from one to three cents per package. The harvesting etc. is practically the same with all firms except regarding the efficiency of the work. The reliable firms conduct trial gardens where all seeds are tested as to variety and per cent of germination. Much fault is found with seed firms because the varieties sold by them do not come up to the purchaser's expectations, but this is not wholly the seedsman's fault. Varieties of vegetables are especially susceptible to environment and the variety which completely failed for the purchaser may have been especially promising to the grower. This is especially true where seeds are shipped any great distance. A variety which might grow well in northern Michigan might entirely fail in southern Ohio. It is therefore, best to buy only standard varieties that the purchaser is sure of or buy seeds from a firm having as nearly as possible the same conditions surrounding it as surround the purchaser.

The advertising of firms is of especial interest to the farmer as it is the only way(except by actual trial) he has of judging the different firms and their products. This advertising is done through the medium of seed catalogues. Seed catalogues were offered as early as 1805 but these were mere price lists and were not intended for general distributing purposes. The present catalogue sprang into existence

between 1860 and 1870. The varieties offered were more or less carefully described, cultural notes given and illustrations of the best kinds printed. The specialties were emphasized by colored plates. This catalogue has practically remained the same until the present date, the greatest change being in the lessening of the real advertising and making more striking illustrations, headlines, etc.

Today novelties play a prominent part in catalogues and are usually accompanied by striking illustrations, more striking than real. As before intimated, the modern catalogue is the seedsman's agent, but the up-to-date catalogue is even more, it is a text book of horticulture. These catalogues find their way into millions of homes, are studied and compared and much of the amateur's knowledge of varieties is obtained from them. This being the case, it is highly important that these catalogues be honest; we cannot ask them to be conservative but they can at least do away with some of their enormous exaggeration. A gardner soon learns to judge a firm by its catalogue and every time he sees an exaggeration it sets him against that firm. Fortunately the best firms as Vick and Sons, D. M. Ferry, Vaughan, Storrs and Harrison, Burpee, Henderson, Gregory and the like, do not transgress seriously in this matter but some inferior firms seem to entertain the idea that they can make up in printers' ink and cheapness

what they lack in experience and reliability. I have before me many catalogues from all parts of the United States and I am glad to say that most of them are well edited but some insist on claiming that three cent seeds are the best and in producing illustrations which no sane person would pay the slightest attention to. In a good catalog at least two things are essential. The varieties must be neatly, honestly and carefully described and so arranged that the purchaser can readily find what he wants. A catalogue of this description describes in a few words the essential characteristics of the varieties and in most cases the varieties are grouped. For instance, the cabbage are grouped into early, summer and late sorts. The careful seedsmen necessarily have to put in many varieties but care should be taken to weed out synonyms. This is largely hindered by the fact that many seedsmen will give an odd variety a new name in order to boom it. There is no reason why illustrations should not be correct as most firms now use half tones in place of the old wood cuts. The seed firm of today, to be successful must be strictly up-to-date; they have much competition and it is well nigh absolutely necessary that they carry on an honest business, in order to succeed for any length of time. People are getting to realize more and more that cheap seed are in the end the dearest seed and it is to be hoped that the future decade will find all cheap seed forced out of the market.

General Principles and Methods.

Location.

In any business the problem of location is an important one, but in the seed business it is especially important. A manufacturer must locate in a commercial center where he has facilities for transporting his product. The seedsman must also have this location so far as possible, but there is another more important factor entering into the location of the latter. The seedsman must have proper soil and this is hard to obtain in a good commercial center. Sometimes this difficulty can be avoided by having two establishments. One having good soil where the seeds are grown, put up in bulk and shipped to another establishment at a commercial center where the seeds are stored, put in packages and where all the business is transacted. However, this necessitates much extra expense and trouble and when possible the seedsman selects a location with the best soil at the best commercial center possible; in other words, he aims to combine good growing conditions and commercial location to the best advantage.

Soil.

The soil being one of the most important factors entering into the problem of seed growing, it is necessary that the successful seedsman must not only be familiar with the

best soil for general growth but he must be acquainted with the soil best suited to the particular needs of each species of plants and in most cases each variety. The best general soil is a deep loam more or less sandy. The subsoil should be free but not too porous. It should be naturally dry so it will not retain surface water. Clay and heavy clay loams should as a rule be avoided, the reason being that heavy lands tend to make plants break into non-typical forms. This might be considered by some an advantage if these forms possessed desirable characteristics, but such is not the case. The seedsman has or should have his ideal and it is of the utmost importance that this ideal is not changed as would be the case if these non-typical types bearing desirable characteristics were saved for seed. Heavy soils also make dwarf peas viny and increases the tendency to sport. This reason alone is sufficient to induce the seedsman to prefer a soil not too rich in nitrogen or growth production. Just how rich land should be I am not prepared to state. It is a question which can only be determined by experience in the varieties and soil peculiar to each grower's region. Each variety will, without a doubt, do better in some soils than in others and it should be the grower's aim to find and so far as possible grow his seed in those soils where the particular varieties attain the highest degree of perfection.

The land for seed growing should be free from stones and stumps and easily cultivated. Land which has a gently rolling or undulating surface and a southern exposure is very desirable as it is easily worked and allows to most perfect control of the water that falls upon it. For early seed crops a sandy soil is preferable but for fall crops a clayey loam may be used. Seed growing being as it is, only an extended branch of vegetable growing and the method of growing the seed producing crop is the same as when raising the crop for a market garden except that more care is used. It is not essential to grow the seed quite so early although in my opinion the earlier the seeds are grown just so much it will increase the earliness of the market crop.

Ploughing.

In preparing the ground, the first operation is of course ploughing. In most cases the practice of fall ploughing should be followed. This is especially applicable when the summers are dry. This puts the land in shape to receive the greatest benefit from the action of the elements and development of plant feed and may be a means of killing many cut worms, grubs and other injurious insects. Then again, autumn ploughing allows the soil to become sufficiently compacted by spring to readily transmit the subsoil moisture to

the surface. If the ploughing is left until spring it should be done as early as possible and not so deep as in the fall. Usually the soil should be ploughed to a depth of about eight inches but in ^{some} soils half this will do. Subsoiling should be done with care for in soils whose subsoil is so loose that the roots can readily penetrate them, it does no good and may do much harm, but for lands having a stiff subsoil it is a great advantage as it deepens the land and puts it in the proper condition to receive and hold water. Subsoiling gives the best results when done in the fall and even on stiff land is not needed more than once in four or five years.

Planting.

In the spring the land must be thoroughly harrowed and worked up as early as possible, thus killing the weeds and enabling the land to withstand droughts. The planting should be done the same as for vegetables excepting care must be taken to avoid mixing varieties. Machines should be used where any considerable amount is to be sown but small quantities are easily sown by hand because the seeds can be distributed more evenly and the soil better compacted. The time of sowing will depend entirely upon the nature of the crop, the early vegetables being sown as early as the ground can be worked. It is usually ^{well} to sow the seed more thickly than the plants should stand when mature, and then thin out the poorest.

Cultivation.

The methods to be pursued in the general cultivation of seed crops may vary somewhat according to the season, soil and particular crop. In cultivation we must constantly keep before us the fact that the destruction of weeds is but a small part of cultivation. The most important benefit derived is that it fits the soil to better withstand drought. This is accomplished by cultivating frequently and shallow during the dry period. The first implements should be used just as soon as the seedlings are coming up and should be those that work the ground to only a light depth and close to the plants. As soon as the plants gain strength they should be cultivated deeper until a depth of two or three inches can be worked without covering the plant with dirt. It is doubtful if the crops of garden seed should ever be cultivated deeper than three inches, but should be done frequently enough to prevent any crust forming. In order to get the best and the sturdiest plants, cultivation should be³⁰ conducted as to develop all the plant feed possible; this can best be done by deep ploughing which loosens the soil and allows the air to enter, thus increasing the chemical action and fermentation which set free plant food.

Implements.

Implements such as plows, harrows, etc. used in preparing the land for ordinary farm crops are also used in fitting the land for seed crops. In addition, however, there are a number of tools and implements not ordinarily used for other crops. These are roughly divided into three classes.

Class I. Horse hoes and horse cultivators. These are much alike in general construction, the horse hoes being used where the ground is very hard and weedy. Cultivators are especially for stirring the surface soil and keeping a dust blanket. Among the best of these is the Planet Jr.

Class II. Hand cultivators. There are many forms of these on the market and they are a necessity in every seed area over a quarter of an acre. These are adjustable to different width rows and have many valuable attachments. Under this head also the many forms of hoes, garden rakes, trowels, dibbles, etc. which are so many in variety and form that even the most critical are satisfied.

Class III. Seed drills. These are a necessity and there are many efficient kinds, among the best being Model and Planet Jr. Breed's weeder is an excellent for cultivating young corn, potatoes, etc.

Class IV. Spray pumps and Potato diggers are many in form and character, each usually having some point of supremacy.

The seed grower should study the different kinds and select the one best suited to his especial work.

Effect of Cultivation on Seed Production.

As before stated, the cultivation of all crops is for the purpose of retaining moisture, killing weeds and making plant food more available. In seed growing it has another effect, viz: its effect on seed production. Plants which are cultivated by the gardner for the market are cultivated by the seedsman for seed and whether cultivation increases or decreases, seed production is of prime importance to him. Along this line Bailey gives us the following facts: 1. Seed production has as a rule increased in those plants which are cultivated for their seeds. This comes about from the natural selection; man almost unconsciously selects for sowing those seeds which are borne in the most productive fruits. Examples of this increase are found in the pea and bean. Of course the converse of all this will be true in those cases in which a man desires a lessening of seed production in order that some advantage may be gained for the seeds that are left.

2. Seed production has decreased in those plants which are propagated by other means than the seeds. Under this may be cited the sweet potato, potato, horse radish and some onions. Such being the case the seedsman sells either the tubers or cuttings.

2. Seed production bears no immediate relation to cultivation in those plants which are cultivated for the flesh or pulp of their so called fruits. As a rule, however, the cultivated plants contain more seed than the wild ones. The wild crab apple average six seeds to each fruit while the Northern Spy averages about twelve to the fruit. Normally the apple should contain ten seed. There is generally a slight increase in seed production as fruits develop away from the first type, especially if the fruit becomes larger.

Management.

In the general management of seed growing the most important thing is to keep the varieties from mixing. Practically varieties of plants can be mixed only in the blossom; and in order to mix the different varieties must be in blossom at the same time. Only varieties of the same species are much inclined to mix. Any two varieties of corn, melons, squashes or cucumbers are especially apt to mix if grown in the same field, providing they are in flower at the same time. The distance between varieties which are apt to mix differs considerably with the different growers and is influenced by surrounding conditions. Pollen is easily carried by the wind and when different varieties flowering at the same time are planted on pieces of land which are in line with prevailing winds, there will be liability of mixing. A grove or hill

intervening will act as a check and when not in line with prevailing winds, varieties are reasonably free from mixing if five hundred feet apart, otherwise at least one thousand feet should intervene.

Incests carry pollen to a large extent and thus do much damage but the harm is more than overbalanced by pellenation of individuals of the same variety. Melons and the like are mostly mixed by insects as the pollen is too heavy to be carried far by the wind. It is a well established fact that cross fertilization tends to keep up or increase the vigor of a plant, but in raising varieties for seed we cannot cross fertilize and keep the varieties pure and the problem of keeping up vigor from cross fertilization arises. It can be done in two ways. 1. By constant selection of stock seed and 2. By growing the plants for seed when they attain the highest degree of perfection. With the stock seed selection must be rigidly practiced and everything that does not come close to the ideal disregarded, and in the commercial crops all sports and the most inferior plants should be weeded out.

Harvesting, Stering and Shipping.

Seeds should be allowed to ripen on the plant when possible but must be gathered before the pods burst or many will be lost. When there are but a few the pods can be gathered by hand as soon as they are ripe. It is usually necessary to

harvest a little before full maturity to prevent loss. The seeds of melons etc. are obtained by letting the fruit ripen and scraping out the seed and spreading out until thoroughly dry. The curing and storing is of much importance and greatly influences the germinating qualities. Seeds must be thoroughly ventilated while being cured or they are liable to mould or sprout, either of which seriously injures their value. It is also important that the so called tropical seeds, as melons, squashes, cucumbers, etc. are kept from freezing until fully dry as the freezing of green or half cured seed often destroys their vitality. Seeds are influenced by the temperature and humidity of the place in which they are kept, an absolutely dry place being necessary to keep garden seeds. The temperature and conditions of a living room are almost ideal for storing seeds. They should be stored in bags or boxes, out of the reach of mice and are usually shipped in packets, bags and boxes, depending upon the amount and kind of seed. Care should always be exercised against harvesting immature seeds, for while it may increase the number of seed and make them earlier, it also makes them smaller and causes a loss of vigor that can never be regained; it also causes a smaller per cent of germination and so weakens the seedlings that many die before maturity.

Selection.

Seed selection is important not only for effects on immediate crops but for the effect on many subsequent ones. The size of the seed bears directly upon the crop produced; it also tends to influence the strain for good or evil, dependant upon the size of the seed. Experiments go to show that almost without exception the largest and heaviest seed tend to produce the largest and most vigorous plants. This is especially true of radishes, Kaffir corn, barley, oats, sweet peas, etc. The selection above mentioned takes place after harvest but field selection is fully as important. This is usually practiced for stock seed. Not only the best fruits but the best plants should be selected. Even weak, poorly developed plants are able to produce some well developed seed and all facts present a strong argument in favor of field selection as the most logical way to select seed.

Management of Various Seed Crops.

Vegetables.**Asparagus. (*Asparagus officinalis*.)**

Asparagus produces seed when two years old. The stalks are from five to six feet high and produce an abundance of bright scarlet berries containing from three to six seeds each.

The stalks are cut as soon as the berries are ripe and the berries stripped or threshed off. They are then put in a barrel or tub and mashed up with a wooden pounder. The pulp is then separated from the seed by washing. The seed retains its vitality for two or three years.

Beans (*Phaseolus*.)

Beans are grown the same as for a commercial crop. More care must be used in threshing and cleaning. They retain their vitality two years.

Beets (*Beta vulgaris*.)

In selecting beet seed great care must be taken only to select such as possess the peculiar marks which distinguish the variety. The foliage will assist in making selections, hence it is well to go over the bed and remove any that show signs of impurity before the main crop is pulled. Having pulled and topped the roots, make the selection for seed before they are removed from the field. They should be handled carefully so as to avoid bruising. The pitting, covering etc. are the same as for market. The roots for seed are set out as soon as the danger of heavy frost is passed, usually about the first of May. They are set in rows three feet apart and from one and one-half to two feet apart in the row. When about two feet high ridge and draw the earth to the roots with a hoe. The seed bearing plant when fully developed is about four feet high and has numerous branches and it is

along the entire length of these branches that seed are produced, the larger seeds growing at the base. Pinching the tips of the sheets when the seed is forming has a tendency to increase its size and make it more uniform. When about two-thirds of the seeds on the stalk have become brown and partially dry, all such stalks should be cut, it sometimes being necessary to cut two or three different times. After having been cut two or three days the seeds thrash off quite readily but if allowed to remain until the stalks are dry these break up causing great inconvenience in cleaning. When the seeds are separated from the stalk they should be spread out thinly for a week after which they can be run through a fanning mill and stored in barrels. Beet seed retains its vitality seven years.

Cabbage (*Brassica Oleracea*.)

Cabbage seed is a somewhat difficult crop to raise in some sections, the trouble being to keep the plants over winter. For this purpose the heads should not be allowed to get very hard and should be gathered before the stumps are frozen. They are set head up in a trench and covered with about a foot of soil and mulching to prevent freezing. The seeds may be raised from the stumps after the heads have been removed but such seed is not desirable as there is a tendency to increase the length of the stump at the expense of the head. For the

best results the seed should be saved from the terminal bud of the stem. After wintering, the seed cabbage should be planted about the first of May in deep furrows four feet apart, the plants being set three feet apart in the row. In case the seed stalk cannot break through the head leaves, it is a good plan to cut through the outside leaves on the top of the head. The seed is gathered branch by branch as the pods begin to turn yellow and generally several cuttings are required to harvest the crop. These branches are dried and then threshed out, cleaned and stored.

Cucumber (*Cucumis sativus*.)

Cucumber seed is easily raised and in some localities the industry is quite large. It is important to save the seed from the early fruit for stock seed. The fruit is allowed to ripen but not rot on the ground. When the vines are dead ripe the ripe cucumbers are split open, the pulp scraped out and allowed to ferment a few days when it readily separates from the seed. The seed and pulp are separated by using a screen which will allow the pulp to be pushed through but not the seed. The seed is then carefully dried and stored. Cucumber seed retains its vitality for more than ten years.

Celery (*Apium graveolens*.)

Celery seed is raised by wintering the roots and planting out in the spring much the same as carrots and other biennials.

It retains its vitality five years.

Carrots (*Daucus carota*.)

In selecting carrots for seed the same methods are followed as are followed in selecting beets. The culture also is about the same as for beets. The seeds are produced in heads or clusters at the extremities of the branches and ripen unevenly, hence require repeated cuttings. When ripe the heads must be cut with shears, carried to the loft and spread over the floor. When fully dry the heads are carefully threshed and cleaned. Carrot seed retains its vitality two years.

Cauliflower (*Brassica oleracea*.)

Most of the cauliflower seed comes from Europe but in some cases if kept over, put in cold frames and hardened off in the spring it may be grown the same as cabbage with fair success.

Egg Plant (*Solanum Melongena*.)

To keep up and improve the variety of those wanted for stock, seed should be selected when growing and marked. When the fruit is ripe, which may be known by the change from bright purple to dull purple and sometimes to a deep yellow, these selected for stock are gathered and then make two or more gatherings of the commercial crop as those first ripe are liable to rot before the later ones are fit for seed. At the first frost all that are marketable may be cut and sold

as they will not ripen the seed. After gathering, a third or more of the stem end is cut away as it contains no seed and as those below lie deep under the skin. It sometimes pays to peel them, thus greatly reducing the labor of mashing or grinding and washing. After mashing the seed should be immediately washed and not allowed to ferment, and after washing quickly dried as the seeds are liable to sprout if allowed to remain wet. The seed retains its vitality five years.

Lettuce (*Lactuca sativa*.)

When the stock is pure there is little choice to be made in selecting lettuce seed. It is best to go over the bed when the heads are in their prime and remove all that do not head or show signs of impurity. For stock seed select those that are extra fine. When the seed is ripe the heads which contain it are plump and yellow but it ripens very unevenly, hence making two or three cuttings necessary. The small branches to which the seed heads are attached are cut from the stalk, put on cloths, dried in the sun and threshed. It is then thoroughly cleaned by means of sieves and fanning mills and stored. Lettuce seed retains its vitality three years.

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Melons. (*Cucumis mele.* and *Citrullis vulgaris.*)

Melon seeds are easily grown, the melon being left until dead ripe, the seed being scraped out and treated the same as cucumber seed. The seeds retain their vitality ten years.

Onions (*Alium sepa.*)

Onion seed is raised by planting out the bulbs in the spring and for this purpose only the best bulbs should be used. The seed clusters ripen somewhat unevenly and should be gathered before they are quite dry or the seeds will shell badly. When they are gathered they should be put in airy chambers and dried and afterward threshed. They may be cleaned with fanning mill or by throwing into water. This method secures the best seed. All seed that is good and plump sinks while chaff and light seed float.

Pepper (*Capsicum annum.*)

The seed is produced about the core attached to the stem within the pods and is ripe when the pods are red and begin to shrivel. The fruit is gathered and treated similar to the egg plant. The seed retains its vitality two years.

Parsnip (*Pastinaca sativa.*)

Seed plants treated same as carrots but should not be grown near wild parsnips as they mix. Seed retains its vitality only one year.

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Peas (*Pisum sativum*.)

Many of the seed peas sold in this country are grown in England because they are free from pea weevil. The manner of growing and saving the seed is the same as for the market crop only more care is taken. The seed retains its vitality two years.

Radish (*Raphanus sativus*.)

Radish seed is easily grown. The plants are raised as for the market, thinned, and all untrue types taken out. When ripe the stalks are cut and dried and threshed. The seeds are easily cleaned by the fanning mill, only the largest and heaviest seed being used. The seed retains its vitality three years.

Balsify (*Tragopogon porrifolius*.)

The seed are produced the second year and the plants, being hardy, may remain in the ground for that purpose. The seed heads resemble those of the dandelion but are much larger. The pods should be cut when about half open, cutting away the furze at the same time. It must be attended to several times as the seeds will blow away when the heads are fully expanded. The seed retains its vitality two years.

Squashes (*Cucurbita*.)

Varieties should be grown far apart as they readily mix in the blossom and should not be grown near melons. The seeds

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are treated the same as melons and retain their vitality a number of years.

Tomatoes (*Lycopersicum esculentum*.)

Tomato seed to secure the best results should be saved from the best tomatoes from vines producing the largest amount of good fruit, but with seed firms the large amount of seed required makes it impracticable to do this. The firms select very carefully their stock seed and then in growing the commercial crop save everything that is true to type. The seeds are obtained by harvesting the fruit as fast as ripe and then crushing it. For this purpose an old corn sheller does very well. The pulp is then placed in a barrel and allowed to ferment until the pulp readily separates. For separating the seed a shute of three divisions is arranged, these being lower from the upper end down. A coarse screen is put over the upper division the pulp put in this and the water turned on. The water rinses the seed through the screen which retains most of the pulp. The smaller particles of pulp float away in the water but the seed, being heavier, sink, the few seeds that do go over being caught in the lower divisions. Those seed that go entirely over are light and poor and are much better out of the way. If there is a hydrant or any means by which a steady stream of water is obtainable, this method is by far cheaper and easier than the old method of

stirring the pulp in water and then taking it out. The seed are dried by spreading thinly on cloths in a dry place. The seed retain their vitality seven years.

Turnips (*Brassica Napus*.)

Rutabagas (*Brassica Campestris*.)

Turnips for seed must be set out as early as the ground can be worked. After carefully preparing the ground mark out light furrows three feet apart and set the roots fifteen inches apart. When they begin to blossom the earth should be drawn about their roots to support them against stem. The pod should be cut as soon as dry and as early in the morning as possible to prevent shelling. Thresh and clean the same as cabbage seed.

Flower Seeds.

The seedsmen of the United States grow very few of their own flower seeds, the greater part of those engaged in the business putting forth their energies in the production of new varieties as these bring a better profit than the common sorts. In 1849 Vick began to grow flower seeds in New York and during the sixties they were grown in New Jersey, Pennsylvania and New England. The amount raised was, however, very small in comparison with the amount demanded by the trade. This same condition exists today, the greater part of our flower seed coming from Europe with the exception of sweet peas and

nasturtiums which grow quite extensively in California.

flower seeds are very hard to test. This is due to four reasons. 1. There is always the possibility that the seed are not fresh, hence less vigorous and apt to decay even if much care is taken. 2. Owing to the great variety of orders in our ornamental plants it is impossible to apply the uniformity of method in testing such seed that one would use in testing common vegetable seed. 3. Most of our garden and field seed have been grown for seed purposes many years which has produced a tendency to bear vigorous seed, while ornamental plants are frequently propagated by cuttings, and in comparatively few instances has the habit of producing vigorous seed been fixed. 4. Owing to the relative small importance of flower seed but little attention has been given to testing them.

Nearly all the bulbs in this country come from Europe, especially from Holland which is well adapted to growing them and where they, as well as seeds, can be grown much cheaper than here.

Agricultural Seeds.

Many years before the farmers of this country ceased to depend upon Europe for their vegetable seed, they raised their own supply of agricultural seed and some of the staples even became articles of export. This was especially true of the grass seeds. Now the imports are chiefly confined to the so-

called fancy grasses. There is scarcely a region in the United States in which some of our agricultural seeds cannot be grown, but their profitable production is generally confined to more or less well defined localities, depending upon favorable soil and climatic conditions. With few exceptions these seeds are raised by the general farmer as a part of his regular crop. Their production on regular seed farms has been attempted but did not prove profitable because the prices which were satisfactory when the seed was raised as a secondary crop did not prove sufficient to meet the expenses of special production. Nearly every farmer raises his own corn, wheat and oat seed. Care must be exercised, however, in selection. Corn must be selected from the best ear on the best plant, hence selection must take place in the field. The same rule applies to the other grains only in a more general way. The improvements along the line of machinery have been great and have been of incalculable value in cheapening the production, increasing the acreage and in making possible by better cultivation the production of purer and more vigorous seed.

Seed Testing.

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Testing at Dept. of Agriculture.

The economic importance of seed testing cannot be overestimated. If a farmer or gardner sows seed which has lost its vitality, he loses not only the original cost of the seed but also the time and labor of sowing and the immediate use of the ground which was planted. Or if the seed contains weed seed it may cause great damage by introducing noxious weeds. It is however, encouraging to note that the interest in testing is greater at the present time than ever before. This is due no doubt, largely to the special investigations along this line which have been made by the Department of Agriculture.

The Department of Agriculture has for the past few years conducted a small trial garden in connection with the seed laboratory. Here studies of the varieties are made and all obtainable varieties of one kind grown for one or more seasons and careful notes and photographs taken. Experiments in growing special crops are carried on and many new or little known economic plants are cultivated. Undetermined weed seeds found in imported grasses and grains are planted and grown to maturity, thus enabling the Department to keep informed as to the kinds of weeds being introduced into this country.

Samples also are planted of all seeds sent out for Congressional distribution. For the testing of clover and other forage plants the trial grounds are not so much used as the laboratory and greenhouses. In both these respects the Department is well provided. The laboratory is equipped with balances, lenses, reading glasses, a seed collection and all other apparatus needed for making purity tests. There are also germinating chambers with all the necessary accessories and abundant greenhouse facilities. The method of making tests is the same as that used in all seed testing stations. When the purity test is to be made the sample is poured into a bowl and thoroughly mixed. A small sample is then weighed and spread on a sheet of white paper. Here it is examined with a hand glass and all foreign matter removed. This matter usually consists of sticks, stones, dirt, broken seed and chaff; it is placed to one side and weighed. All seeds not of the kind under examination are put to one side and weighed. The per cent of each kind of impurity is determined and recorded. The germination tests are made either in the germinating chambers or greenhouses or both as best suited to the seed. The chambers are the kind in general use, blue blotters and cotton flannel being used to hold the seed. Temperature and moisture are regulated to suit the variety. Studies are constantly being made with a view to designing better appa-

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ratus and experiments are conducted to clear up difficulties in germination and preservation of seed.

Testing by Seedsmen.

Most reputable seedsmen make germination tests and by some these tests are conducted with great care. However, there is no uniform method of testing. In 1887 the American Seed Trade Association appointed a committee to adopt some uniform method but the committee failed to report. To the seed tester all seeds belong to one of two classes, those whose botanical purity can be determined by the seed and those of whose purity one can judge only by the plants they produce. The first class, roughly speaking, includes all the agricultural seeds while the second includes the vegetables and flowers whose variety cannot be determined by the seed. The first class are more easily tested and their purity can be known long before planting but not so with garden seeds. The thing of most importance in them is that they be true to name and of good stock. It is of course essential that the seed germinates but a good gardner would rather have cabbage seed of good stock and low vitality than of poor stock and good vitality. So important is this matter of genuiness that most seedsmen conduct trial grounds where the different stocks are grown and observed. This trial ground is the seedsmen's testing station and its importance cannot be over-estimated.

Here he plants not only samples of his own stock but also those of his competitors. As the season advances he reads his field like an open book and he is enabled to pick out poor stocks and discard them. Without the trial ground the seedsman might sell poor stock for several years without knowing it except from the complaints of his customers. The tests on a well regulated ground are made in good but not highly enriched loam. The seeds are planted in rows from five to six feet long according to the kind and variety, and a white label bearing the number is placed at the head of the row. Careful notes are taken throughout the year. The seeds are tested for germination in flats filled with dirt, the object being to put the seed under, as nearly as possible, its natural conditions.

Testing at Home.

Whenever the farmer purchases large quantities of seed they should be tested for purity and germination. Germination depends upon a proper supply of heat and moisture, and for accuracy, darkness is essential. Seeds will germinate through quite a range of temperature but the farther away from the normal temperature we get the less will be the percent of germination. All seeds do not have the same temperature limit, those of tropical plants needing more heat to germinate than northern seed. Some seeds, as rye, will even germinate on ice. Usually the heat of an ordinary living room will

do for home testing but care should be exercised that the temperature does not fall too low during the night. The best temperature is between 18 and 20 degrees C. Moisture is as important as temperature. The absorption of water is purely mechanical and does not effect the vitality of the seed, but those seed having hard seed coats impervious to water will not germinate so quickly as those through which the water is readily absorbed. An atmosphere saturated with water is not sufficient to induce germination. Too much water is equally injurious for as a general rule seeds will not germinate well when immersed in water, it being necessary to have the seeds in contact with some medium from which they can obtain an abundant supply without allowing the water to stand around them. Light exerts a harmful influence on germination and even more important is the free access of air and escape of noxious gases generated by the starting seeds; if this is not done, growth will be seriously checked.

The selection of the sample to test is an important step. It must be fair, containing both good and bad seed as found in the bulk. If the quantity to be tested is large, a small amount should be taken from different parts, thoroughly mixed and the small sample taken from this. Then count out from one hundred to three hundred according to the size of the seed, the increased number being a check upon error in counting the

small seeds. In counting out select fairly, taking small and immature ones as well as large and plump ones; although not absolutely necessary, it is always best to keep a record which includes the date of beginning the test, name of variety, number of seeds and number of germinated seeds removed from day to day. The length of time the test should be continued depends upon the seed. In the Seed Control Station ten days has been accepted as the proper length of time. A seed is considered germinated as soon as the root breaks through the seed coat.

The apparatus for home testing should be as simple as consistent with a reasonable degree of accuracy. Any method which will comply with the conditions previously given will give good results. About the simplest method is to take two plates and place in one of them a folded cloth, wool or flannel being preferable as they remain moist a long time. The cloth should be free from dyes which are liable to injure the seed. Wet the cloth and press out the surplus water leaving it very damp but not soaked. Place the seeds between the folds, put in your record on a piece of paper and invert the second plate over the whole. Another good tester is the Geneva which is easily made and very efficient. Take an ordinary tin dish about eight inches wide and four inches deep. Fasten a piece of cotton cloth the same width as the dish to several

wires long enough to extend over the sides of the dish. By shoving the wires together, pockets are formed which are dark and in which several kinds of seed can be tested separately in the same dish. Put as much water in the bottom as possible and not have it touch the bottoms of the pockets and by letting the ends of the cloth hang in the water they will absorb enough by capillary attraction to keep the seeds moist so they will germinate properly. Some trouble will be experienced by moulds and fungus, and all apparatus should be thoroughly boiled after each testing, to kill this.

Should a Farmer Grow his own Seed.

This is a question of considerable importance and one to which attention is frequently called. It is a well known fact that the condition of soil and cultivation under which plants are grown have much to do in fixing the value of the seeds maturing on those plants. Undoubtedly there was a time when many farmers bought commission seeds with but few satisfactory results, for these seeds were often impoverished, adulterated, and as a whole reflect much discredit on the seed business. But at the present time it is safe to say that the seeds found in country stores bearing the name of some reputa-

ble firm, are quite as good as seeds obtained directly from warehouses. Tests have shown that the germinative value of these seeds compared very favorably with those bought in bulk. Considered from a financial standpoint, no farmer or gardner can complain about the price when, for a dollar, a full assortment of good, clean seed in quantity sufficient for a family can be obtained. If, however, the farmer tries to save this expense by raising his own seed, he finds in a few years that his vegetables are not so choice as once because the seeds have not been selected with sufficient care and proper cultivation has not been given the garden. But aside from the expense view the question comes to us from a scientific aspect. Are seeds which have matured under high cultivation as on our best seed farms, better for less enriched farm soils than seeds which have matured in this poorer soil? The answer is found in a comparison of results regarding earliness, productiveness, viger and quality of products, carefully followed out by the Pennsylvania Experiment Station. Seeds grown on ordinary soil were compared with those obtained from Dreer, Landreth, Therburn and other reliable firms. It was found that with the exception of lettuce, the Station grown seeds were heaviest. In the germination test the result was about equal. The seeds of each vegetable were sown at the same time and given equal treatment. In May the plants suffered from a frost and it was

noticed that the plants from Station grown seed were more seriously affected than the others. The result of the trial led to the following conclusions:

I. The Station seed were as a rule the heaviest.

II. In the majority of cases the earlier marketable products were obtained from the purchased seed.

III. The weight was no indication as to germinative value.

IV. The greater yield was obtained from purchased seed.

V. Lettuce from purchased seed did not shoot up to flower as early as that from Station grown seed.

VI. Radishes from purchased seed were larger, tenderer and more uniform.

VII. On the whole the purchased seed were much better.

These facts go to show that as a rule the farmer cannot grow his own seed with profit, because he can buy it cheaper, he cannot give proper selection, and seeds grown on ordinary soil are not so good as seeds raised on the greatly enriched lands of reputable seedsmen. This applies more particularly to garden seeds, for nearly every farmer can, with a little care, successfully grow his own grain seed. There are cases, however, where there is a piece of land especially adapted to some particular vegetable, and in such cases, by careful selection, and cultivation, the farmer might raise seed with a fair

degree of success. But no farmer can profitably raise all his own garden seed. The practice of cutting the best of the crop for table use and leaving the poorer plants for seed is by far too common and accounts for much of the farmer's dissatisfaction with his garden.

Conclusion.

The Importance of Good Seed.

The importance of good seeds cannot be over-estimated and yet how many gardeners and farmers, after spending weeks carefully preparing a piece of ground, practically throw away all their labor by sowing inferior seed. They seem to think that the seed are of minor importance and nine times out of ten they buy the cheapest, regardless of quality. By a good seed I mean not only a seed of a good variety, but also having a fair percent of germination. Many firms advertise seeds at from one to three cents per package; these are the seeds we must beware of, for just as it is impossible to make a sixty dollar buggy and make money by selling it for twenty-five dollars, so it is impossible to grow good seeds the way they should be grown and sell them at the prices quoted above and make money. That the firms selling these cheap seed do make money, is evident from the fact that they continue in business

year after year. Granting this to be true, it is again evident that the seeds put out by them are produced at a smaller cost than the more expensive ones, and this means that the cheap seed are not carefully selected, are not properly cared for before and after harvest, in short it means they have to be cheaper in every way in order to be profitable. This, as before stated, means much to the gardner. There are plenty of firms who put out good seed at reasonable prices, so there is no excuse for using inferior seed. Cease to patronize the inferior seed grower and he will soon go out of business. Get good seed, raise good vegetables, satisfy yourself and customers, and at the same time rid the country of the cheap firms that are doing so much harm.

Conclusion.

To conclude the subject it can be said that, while like every other occupation, seed growing has its discouragements and losses, it is one that allows the exercise of acute observation, and one in which those familiar with plant life may readily overcome obstacles. It is one of the highest branches of practical Horticulture and as such presents many attractions and oppertunities not offered by other kinds of soil cultivation.

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