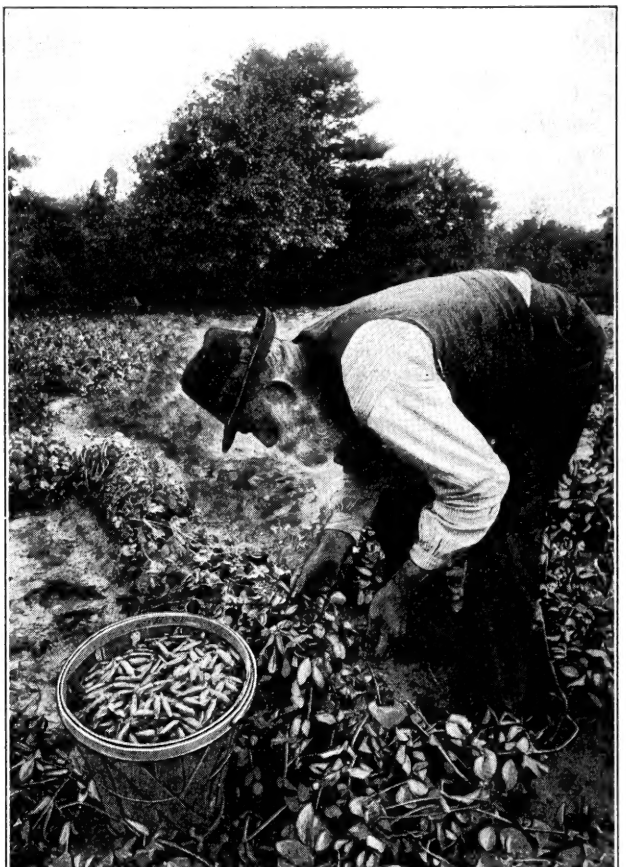
PEAS AND PEA CULTURE

GLENN C. SEVEY



SOMETHING FOR MOTHER'S DINNER

Peas and Pea Culture

A Practical and Scientific Discussion of Peas, Relating to the History, Varieties, Cultural Methods, Insect and Fungous Pests, with special chapters on the Canned Pea Industry, Peas as Forage and Soiling Crops, Garden Peas, Sweet Peas, Seed Breeding, Etc.

By

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PREFACE

This little book on Peas and Pea Culture is intended to be of value to the student and practical farmer alike. Enough of the scientific has been provided to meet the demands of the former, and the references to principles of breeding and improvement of existing strains go into sufficient detail to prove about as interesting and sleep providing for the average college student as some of Darwin's extensive treatises on plant and animal life. For the practical grower, great care has been exercised to keep details true to field conditions. The author has been interested in this crop from his early days when he first helped "dadder" to gather a mess for dinner, on through to his more mature years when gathering for his own family and sending the surplus to early market at $1 to $2 per bushel.

The canning of peas, which has grown to vast proportions, is an industry by itself. So the author took two weeks' vacation and visited large canning districts in New York and Michigan. Here he studied conditions at first hand, visiting with the packers, noting the various processes and climbing on to the lumber wagon to go and visit the farmer, watch him gather the crop and bring it to the factory. Aside from this, many resources have been drawn upon, including the scraps of testimony from various experiment stations, agricultural colleges, individual experimenters, etc.

So far as advised we know of no individual treatise on the subject of Peas and their culture. In

fact, one is surprised to note the dearth of specific information provided on the subject in printed form. One wishing facts on certain cultural principles might find them in one place, and to get ideas on insect and fungous pests would perhaps spend hours searching elsewhere for desired information. Therefore, the aim of this book is to save all this time and perhaps spare the temper.

An honest effort has been made to provide comprehensive, authoritative, and specific information on the subject of Peas. Readers who note errors, who have experiences not in accord, or which will supplement the principles herein set forth, will confer a favor by sending direct to the undersigned to the end that the second edition may prove more satisfactory to the author and the public alike.

GLENN C. SEVEY.

RUSSELL, MASS., April 4, 1911.

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CHAPTER I

BOTANY, HISTORY AND DISTRIBUTION

Peas belong to the great legume family of plants —a family which constitutes the backbone of an improved agriculture. The Greek and Latin name of the pea is *Pisum* and there are six species. The important one is the common garden pea or *Pisum sativum. Pisum sativum,* var. *arvense,* is the field pea commonly known as Canada field pea. Several so-called peas are not peas at all, although belonging to the leguminosæ family. Some are given herewith.

Flat Pea *(Lathyrus sylvestris)* is a forage plant closely resembling the sweet pea. It is particularly adapted to light soils, succeeding where clover or corn would fail. Under favorable conditions it will produce a remarkable growth of vines, three to four feet in length, and provide several cuttings each season. A serious objection is that stock do not like it. In experiment, at the Michigan station, sheep and cattle lost flesh on rations of either flat pea hay or flat pea silage. It is rich in protein, air-dried hay analyzing 27 per cent protein, and would probably be more largely grown, except that it requires two or three years to get it established. Plants grow eight to twelve inches tall the first season, and ground must be kept free from weeds. Can be sown in the spring in drills 18 inches apart.

Chick Pea *(Cicer arietinum),* also called Idaho and Egyptian pea, is adapted to a variety of soils, but succeeds best on clay loams. In composition it is similar to the common field pea, but leaves

possess a large amount of oxalic acid, which makes plant unfavorable for feeding horses. It is an annual, with vetchlike leaves growing 12 to 18 inches high. Pods are one-half to three-fourths inch long, and contain one or two wrinkled peas slightly larger than the common garden pea. The slight growth makes it undesirable for a forage plant. At the Colorado experiment station chick peas were planted in rows 30 inches apart and 6 to 12 inches distant in the row. A fine growth resulted. The cost of production was about one cent a pound.

Cowpea *(Vigna Catjang)*, really more of a bean than a pea, is a wonderful soil renovator and has been used in the South for a century and a half. While the plant is sensitive to frost, it is being grown as far north as Massachusetts and Wisconsin. A special chapter is devoted to peas and cowpeas as forage plants on a later page, which see.

Partridge Pea *(Cassia Chamæcrista)*.—Sometimes called sensitive pea and Magothy Bay bean. This was once popular for plowing under, and was used largely in the South, notably in Virginia and Maryland. There it was sown with oats in the spring, and after the oats were harvested peas came on to maturity. The cowpea for the South is so much superior for green manuring that the partridge pea is being used only occasionally. Plants have a conspicuous yellowish purple flower.

Square Pod Pea *(Lobus Tetrogonolbus)* is a fine soil renovator, owing to its pronounced tendency to produce root tubercles. Plants grow rapidly, but unfortunately will not stand our climate. In California it produced 24 tons herbage to the acre, but will not stand either frost or drouth.

Tangier Pea *(Lathyrus Tingitanus)*.—An annual plant native to Barbary. It was brought to California in 1889. Apparently, it is hardy, and seeds can be used for table, while cattle will eat plants. Very little known in the United States.

Buffalo Pea *(Astragalus crassicarpus)*.—This, like the others, belongs to the legume family. It is found in the Mississippi valley, and vines are sprawling, bearing short stubby pods about one-half to two-thirds inch in diameter. These are apparently relished by hogs, cattle and sheep. The plant gains maturity in Texas in April, and by the middle of June in northern latitudes. Has been very little cultivated.

Sweet Pea *(Lathyrus odoratus)*.—This is known to all people, and a special chapter on the subject will be found on later pages.

Ceylon Pea.—In the California experiment station report for 1895 to 1897, E. J. Wixon speaks of the Ceylon pea. He describes it as having large pods, being very prolific, stating that it grows well throughout the state. "It is of value as a late pea for table or canning."

Various Classifications of Peas.—Common, every-day peas can be classified as either garden or field. The former may be used in the green state shelled, or the pods and all may be used like string beans. The latter are frequently called "edible podded" peas. The field peas, grown in a larger way, may be used as seed, canning, forage and green manuring, for split peas for culinary purposes, and for stock feeding. Special chapters are devoted to these industries.

The garden pea differs from the field or stock

pea in that the blossoms are white instead of violet or purple, the seed is larger but more tender and sweet. Another classification of peas is, smooth and wrinkled sorts, the latter being sweeter and more edible, with larger pods and more peas in the pod. However, the smooth sorts are earlier and more hardy. Peas are frequently classified as early, medium, and late, according to the season of ripening. The varying characteristic of climbing, dwarf, and semi-dwarf habit of growth, constitutes yet another basis of classification.

History.—Peas have been known for centuries and were no doubt cultivated before the Christian era. It was a common plant among the Greeks and Romans, and reference to it is frequently found in their literature. One Lydgate, a writer in the time of Henry VII, mentions peas being peddled about the streets of London.

Distribution.—Peas are pretty generally scattered about the country. They are native to Europe, but are widely cultivated in the United States and Canada. The plant prefers cool temperatures and abundant moisture supply. Growing them for seed is not recommended in the South. In Canada it is a leading crop. In the province of Ontario alone the average annual area devoted to peas for the 20 years ending 1902, was 710,498 acres, and the average annual yield approximated 13,000,000 bushels, with an average yield around 19 bushels to the acre. Most of these are fed out on the farms. The northern tier of states down to, and including Pennsylvania, New York, and New England, will produce seed. The southern limit for the successful growing of seed peas has been designated as the

northern limit for the most successful growing of cowpeas. In the warmer southern climate they are grown with great success for soiling purposes and in restricted sections for canning factories, and in green state for northern markets.

The accompanying table, taken from the Federal Census of 1900, affords something of an idea of the pea-producing states. It gives the number of acres, comparative yield in bushels, with the increase and the average yield to the acre.

PEA-PRODUCING STATES

States	Acres	Bushels produced 1899	Bushels produced 1889	Per cent increase	Average yield per acre, 1899
South Carolina	143,070	1,162,705	698,281	66.5	8.1
Michigan	71,376	1,134,431	1,428,475	20.6	15.9
Georgia	167,032	1,130,441	974,670	16.0	6.8
Wisconsin	68,819	1,098,819	919,058	19.6	16.0
North Carolina	88,407	876,167	437,284	100.4	9.9
Tennessee	82,841	760,663	96,972	684.4	9.2
Alabama	91,126	665,388	326,413	103.8	7.3
Mississippi	69,490	590,537	254,526	132.0	8.5
Texas	33,974	333,462	205,692	62.1	9.8
New York	14,748	251,889	228,726	10.1	17.1
Arkansas	31,414	245,894	169,170	45.4	7.8
Virginia	22,206	219,142	19,864	1,003.2	9.9
Florida	17,875	159,814	70,632	126.3	8.9
Louisiana	15,190	146,298	81,700	79.1	9.6
Illinois	12,982	103,386	9,010	1,047.5	8.0
Washington	3,573	91,889	25,523	260.1	25.7
Kentucky	8,394	83,089	8,445	883.9	9.9
California	2,014	57,299	32,364	77.0	28.5
Missouri	5,319	54,763	14,486	278.0	10.3
Colorado	3,621	47,461	45,270	4.8	13.1
Maine	2,300	35,991	23,146	55.5	15.6
Montana	1,512	32,265	9,612	235.7	21.3
New Mexico	2,220	28,071	7,430	277.8	12.6
Iowa	1,556	27,606	27,240	1.3	17.7
Oregon	1,304	22,615	11,214	101.7	17.3

Director C. B. Williams of the North Carolina

experiment station writes the author: "We consider the pea industry important in this state. They are mostly grown for garden seed and hay purposes. Very few are canned. Throughout the coastal plain section of the state much attention is devoted to the growth of garden peas for market purposes. Georgia produces large quantities of green peas, and this constitutes an important truck crop. North Carolina raises a lot of sugar peas for early markets. These are familiarly known as garden peas, pods being picked green and sold. A large dealer at Hickory, N. C., states that 500 to 1,000 acres of such peas are shipped from the vicinity of Elizabeth City and Goldsboro annually. These go to the produce trade and none reach the canning market. North Carolina is also a great state for cowpeas, there probably being about 100,000 bushels going to the North and West every season, and used for fertilizing purposes." Jonathan Havens, of Washington, N. C., writes: "It is a broad assertion, but I believe every kind under the sun grows luxuriantly in this section. I can personally name 30-odd varieties and with one exception they are good both for stock and human food."

Wisconsin is a great pea-growing state. There are many factories within its borders and numerous varieties of peas are grown for the market. Field peas constitute an important farm crop.

Michigan produces large quantities of both field and garden peas. Growing for seed is developing into an important industry. New York produces large quantities of peas for canning factories. More will be specified on this subject in the chapter on the Canned Pea Industry.

CHAPTER II

SOILS, FERTILIZERS AND INOCULATION

A wide variety of soils will produce peas, but for best results plant on a clay loam which is not in an acid condition. The stiffest of clays, well tilled, will produce peas, and light sandy soils will return a moderate yield. Mucky soil overladen with humus is likely to produce too rank vines, and light sandy soil will not produce enough vine growth. The ideal soil is cool and reasonably moist. W. M. Hayes[1] conducted experiments in Dakota and Minnesota which indicate that a larger yield of peas than of wheat can be obtained on sandy lands. Suzuki[2] gives results of four years' continuous culture of peas grown on humus loam soil unfertilized and fertilized. He declares no trace of soil weariness or sickness appeared when soil was liberally fertilized and concluded that soil sickness may in some cases be due simply to deficiency of available plant food.

Place in Rotation.—As the pea crop gathers more nitrogen than consumed by the plant, it may be followed with distinct advantage by a variety of crops, notably the cereals. Von Sellhorst[3] states that peas, owing to the small quantity of water drawn from the soil, can with advantage be followed by winter cereals.

[1] N. D. Sta., Bul. No. 10.
[2] Experiment Station Record, Vol. 20.
[3] E. S. R., Vol. 14.

HARVESTING PEAS WITH MOWING MACHINE.

Shuttleworth[4] tried surface and underground irrigation with oats, wheat and peas. The water required for maturing crops in subwatered cylinders was 65 pounds for oats, 34 for wheat, and 104 for peas. In the case of peas the yield in the subwatered cylinder was 116 grams, as compared with 63 grams on the surface water. Nobbe and Richter[5] state that ether and hydrogen peroxide applied to soils where peas were grown failed to sterilize the soil and increase the yield of peas. Nakamura[6] states that borax when used at the rate of one milligram per kilogram of soil exerted a stimulating action on peas.

Fertilizers for Peas.—It is a mistaken idea that peas do not require much fertilizer. While it is possible to have lands too rich in nitrogen and humus, resulting in heavy vine growth, there is little danger of oversupply of potash and phosphoric acid, both of which materials are essential to success. Some experts say there is nothing better than stable manure, especially if plowed under the preceding fall. It supplies a good amount of decaying vegetable matter. Ashes and even well-composted hen manure will give good results. One expert says that an application of 400 to 500 pounds commercial fertilizer to the acre, composed almost wholly of potash and phosphoric acid, is desirable. He says 10 per cent potash in a fertilizer is none too much on sandy soil for peas. Nitrate of soda is used sparingly, and at time of planting, to start early growth.

[4] Ont. Agri. Col. Farm Rpt., 1899.
[5] E. S. R., Vol. 16.
[6] E. S. R., Vol. 16.

Jenkins[7] found that a crop of peas removed from each acre 47.8 pounds nitrogen, 13.1 pounds phosphoric acid, and 12.7 pounds potash.

Brooks[8] reports that with peas, dried blood gave somewhat larger crop than nitrogen in other forms. When sulphate of ammonia and muriate of potash were used together, the growth was decidedly inferior to that where other combinations were used. Newman[9] tested seven varieties of peas grown on poor sandy upland with different fertilizers. Highest per cent of germination was 95, as grown on the plot fertilized with acid phosphate. The lowest germination was 66, resulting on the nitrate of soda plot. Peas planted on acid phosphate germinated three to four days earlier, blossomed four to six days earlier, and produced ripe pods six to nine days earlier than those where kainit, nitrate of soda, or cottonseed meal were used. The application of each was at the rate of 400 pounds to the acre.

Clinton[10] reports fertilizer tests with Canada field peas and various other crops. Best returns were secured with acid phosphate and dissolved bone black. Untreated phosphate floats were apparently without effect upon the peas.

Von Sellhorst[11] states that the yield of peas was largely increased by the use of potash, while nitrogen was only slightly beneficial. Wagner[12] reports experiments extending over 12 years, which show

[7] Ct. Exper Sta. Rpt., 1896, p. 334.
[8] Mass. Exper. Sta. Rpt., 1897.
[9] Ark. Exper. Sta., Bul. 34.
[10] N. Y. Exper. Sta., Cornell Bulletin 201.
[11] E. S. R., Vol 17.
[12] E. S. R., Vol. 16.

that continuous medium applications of basic slag, frequently called Thomas slag meal, were continuously beneficial. He declares the richer the soils are in phosphoric acid, the smaller application of nitrogen is required.

Brooks[13] found that muriate of potash is slightly better for peas than is the sulphate of potash. Clausen[14] found that potash fertilizers, notably kainit, increased the proportion of seed to the vine to a marked extent.

Wheeler and Adams[15] reported that liming the soil was especially valuable in the case of White Wonder Canada field pea. Nodules were abundant and quite evenly distributed upon the roots. On unlimed plots only a very few nodules were found, which were of large size and tended to grow in clusters. The application of caustic lime may be so large as to prove injurious.

Nitrogen-Gathering Characteristic.—As with other legumes, one of the most valuable assets of the pea is its ability to gather nitrogen from the air and store it up in the soil and the plants. This is done through the medium of root tubercles, or nodules as frequently called. Beeson[16] conducted a rather elaborate set of experiments relative to gathering of nitrogen by the pea plant and states that there is a greater accumulation of nitrates in the soil under leguminous plants than in the bare soil or the soil under corn, cotton, or sorghum. His results indicate that the micro-organisms or tuber-

[13] Mass. Exper. Sta. Rpt., 1903.
[14] E. S. R., Vol. 20.
[15] R. I. Exper. Sta., Bul. 96.
[16] E. S. R., Vol. 10.

cles of the pea roots, assimilate more nitrogen than the plant needs for its growth. If this be true he argues that peas planted with a crop will tend to increase the yield of that crop unless plants are so thick as to interfere with the root development or as to use up too much water in growth. Various experiments have shown that uncultivated soils produce a less number of bacteria than cultivated. A fair proportion of humus favors tubercle development, yet there is likely to be slight development of tubercles where soil is exceedingly rich in humus. Potash, phosphoric acid, and lime, all favor the production of root tubercles.

Inoculation.—There have been many experiments relative to development of root tubercles by treating the soil or the seed with materials carrying great numbers of the desirable bacteria. Kirk[17] made a thorough investigation and declared that his results proved (1) that on land which will already produce a good crop of legumes the inoculation is of little benefit to the crop; but (2) it increases the number of nodules on the root and consequently a quantity of nitrogen is left in the soil for the benefit of the following crop, such as grains or roots, which have not the power of providing nitrogen for themselves; (3) inoculated seed invariably gave better results than the inoculated soil.

Halsted[18] planted peas on soil where no leguminous plants had grown for at least eight years. Portions of the plot received a dressing of soil that had recently borne peas. At harvest ten plants were taken at random from the treated and untreated

[17] N. Z. Dept. of Agri. Annual Rpt., 1905.
[18] N. J. Exper. Sta. Rpt., 1898.

plats and the tubercles counted, the result being that there were nearly ten times as many on the roots of the treated vines as on the untreated ones. This shows decidedly favorable results through artificial inoculation by means of soil taken from a field which bore peas.

Ladd[19] conducted a series of experiments to ascertain whether any advantage would be derived through inoculation from especially prepared cultures. He used the commercial culture known as Nitragin. He reached the conclusion that where the soil is well stocked with organic matter the gain obtained is not sufficient to warrant use of the culture. However, in the case of light sandy soils and for truck gardening, it may prove valuable. In recent months another proprietary culture known as Farmogerm is reported as having given excellent results.

One interesting experiment by Nobbe and Hiltner[20] deals with the reciprocal inoculations of bacteria upon beans and peas. It was found that if either plant were inoculated with germs from the tubercles of the other, some nodules would be formed, but the organism seemed to be without power of nitrogen assimilation. If the inoculation continued a second season, or through a second and third series of culture, the bacteria became nearly as efficient as those from the roots of the same genus. The possibility of transfer of tubercle bacteria from the roots of one plant to those of the other genus is affirmed.

Whatever the method of inoculation, the grower

[19] N. D. Exper. Sta., Bul. 35.
[20] E. S. R., Vol. 12.

should take pains to incorporate the bacteria-carrying agent with the soil without delay, so as to prevent the killing of organisms by the hot sun and wind. This artificial inoculation does not differ materially from that recommended for alfalfa, clover, and other legumes, whether it be through "cultures" or through soil from old fields.

CHAPTER III

CULTURAL PRINCIPLES—HARVEST

Authorities agree that fall plowing for peas is preferable. If for no other reason, it is desirable from the general advantage that fall plowing opens up the land for the action of frost and the elements through winter. Fall plowing is less important when light ground forms the seed bed. Spring plowing, however, is not objectionable, and is in common practice. Thorough harrowing with disk and smoothing harrows will be appreciated by the crop. Peas are very vigorous and free growers, and are broadcasted by some on the furrow and simply disked in. This provides no thoroughly worked seed bed.

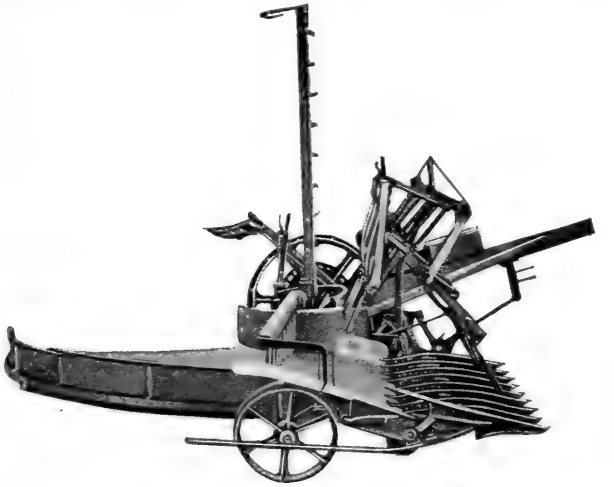
Planting.—The time of planting may vary with varieties and the object for which grown. In general, sow the peas early in the spring, as soon as ground can be worked. Peas do not succeed best in hot, drying sun and winds, and an early start will provide ample shade for the ground by the time the hottest days come. Shaw and Zavitz[1] state that peas were sown at different dates between April 22 and June 6. The weight of peas per bushel increased with each successive seeding. However, the best average yield to the acre was from seed sown April 22.

Amount of Seed.—This will vary according to variety, soil, and for purpose grown. From two to three and one-half bushels is the range, with per-

[1] Ont. Agri. Col. Rpt. for 1892.

LOADING GREEN PEA VINES FOR THE CANNERY.

haps the average between two and one-half and three. Zavitz and Lochhead[2] state that some varieties of peas, like New Canadian Beauty, are double in size those of other sorts, as Common Globe vine. Hence in seeding it was found necessary to vary



SPECIAL PEA VINE HARVESTER.

the amount sown from two to three and one-half bushels to the acre. The time of maturity has varied for 26 varieties, from 94 to 101 days, and the experiments in length of vines from 19 to 52 inches.

Depth of Planting.—It is generally recommended to plant deep, three to four inches. An exception may be for early sorts for gardening purposes. Corbett[3] reports a test made of planting peas at depths

[2] Ont. Agri. Col., Bul. 126.
[3] W. Va. Exper. Sta., Bul. 49.

of two, three, four, five, six and eight inches. Those planted three inches deep gained highest per cent of germination and a greater yield than those planted at other depths. Time of maturity was not materially affected by depth of planting.

Manner of Planting.—The popular method is drilling with grain drill. Of course, in garden culture hand planting and drilling with corn planter, with special seed plates, are in vogue. When a grain drill is not available, peas are frequently broadcasted by hand. In this event they may be either sown on the rough furrow and disked in, or the ground previously harrowed and left rather rough, peas broadcasted and a light smoothing harrow used for covering the seed. The danger of this method is that seeds will not be covered deeply enough and if heavy showers follow, are likely to be washed out. Some recommend broadcasting the peas on the land and plowing them under. The danger here is of getting them too deep. Zavitz[4] states that in general, during a two years' test, drilling gave better results than broadcasting.

Seed Considerations.—Good seed is an important consideration with the pea crop as with all others. "As a man sows so shall he reap." Zavitz and Lochhead[5] report experiments for a number of years in selecting large and small seed of the same variety. It resulted in an average yield of 30.3 bushels grain and one and one-third tons straw per acre for large seed, as against 23.9 bushels grain and one and one-tenth tons straw per acre for small seed. Using split pea seed as it came from the

[4] Ont. Agri. Col. Rpt. for 1897.
[5] Ont. Agri. Col., Bul. 126, p. 32.

thrasher in comparison with whole seed, the averages were 10 bushels grain for the former and 30.7 bushels for the latter. Only about 30 per cent of weevil-infected peas were found to germinate.

Buchanan[6] reports a yield from sound pea seed of 28 bushels to the acre; broken seed, 10.2 bushels.

MOWER WITH PEA-LIFTING ATTACHMENT FOR CUTTER BAR.

This covered a test of six years. Ward[7] declares that soaking pea seed in pure water tends to dissolve materials needed in the germination and growth of the seed. He recommends soaking in a solution of some fertilizer salt, which will add to, rather than detract from, the vigor of the seed. Electricity in

[6] Ont. Agri. Col. Annual Rpt. for 1906.
[7] E. S. R., Vol 11.

the soil has a favorable action on the crop, one instance being recorded where the yield on the peas was double. Electricity was provided by means of upright rods placed in the ground and a network of wire connecting them below, in the soil.

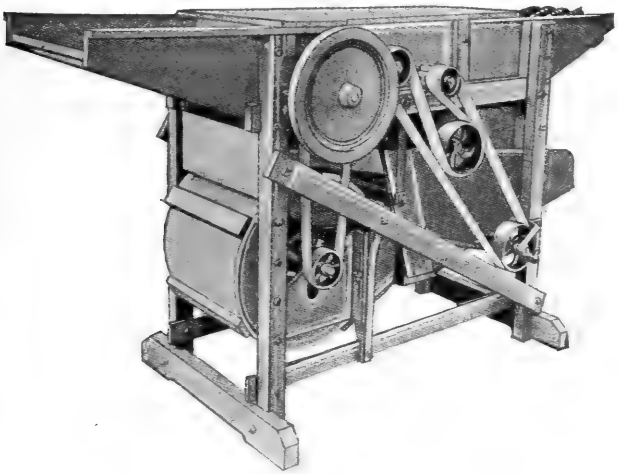
Cultivation.—No after-cultivation is expected when field peas are broadcasted in the usual custom of growing field peas. However, in case land is badly infested with weeds or grass, drilling in rows is sometimes practiced so that cultivation can be given to destroy foul growth. Soil moisture has an important relation to cultivation, and it is interesting to note the conclusion of King[8] on the amount of water required to produce a pound of dry matter. For peas it required 477 pounds of water to produce one pound dry matter. This may be compared with 564 pounds for clover, 301 pounds for corn, 375 pounds for barley, and 515 pounds for oats.

If cultivation is resorted to it should be shallow. Experiments by Rotmistrov[9] were conducted to show the vertical and lateral distribution of roots. The season's average growth of peas was 92 centimeters[10] vertically, and 104 centimeters laterally. Corn roots measured 113 centimeters vertically and 134 laterally, while rye grew 118 and 60 respectively.

Harvesting.—Harvest field peas when the majority of the pods have matured and when vines are beginning to turn yellow. The scythe is sometimes used to mow the peas, in which case they are later

[8] Wis. Exper. Sta. Annual Rpt., 1892.
[9] E. S. R., Vol. 20.
[10] A centimeter is slightly over one-third of an inch.

bunched and eventually taken to the barn or thrasher, or possibly fed to stock. Occasionally, horse rakes have been used to pull the vines, but this is inclined to shell them badly, even though raking is done when vines are damp. If hogs are



A PEA AND BEAN HULLER, OR THRASHER.

to follow the harvester the loss will not be so great.

The approved method of harvesting peas is with a mowing machine. Green peas for canneries are sometimes harvested with a special machine, something similar to a reaper. When mowing machine is used a special attachment consisting of long finger guards is placed on the cutter bar of the mowing machine and lifts the vines from the ground, when they are cut off readily by the knives. One or two men can follow the mower and bunch the

peas. Three men and a team can harvest ten acres a day, under favorable conditions. Some growers provide a homemade table, something similar to that on a reaper, for vines to run back on to, and then one man follows with a rake and pulls them off in bunches.

If peas are well matured when harvested, the curing will be simple, unless very rainy weather prevails. In this event it is well to keep bunches turned to prevent molding and sprouting of those on the bottom. Peas can be hauled direct to the thrasher or to the barn and can even be stacked satisfactorily. In the latter event be sure to provide a suitable covering of hay, meadow grass, or something of that character, on top of the stack to protect against rains. The coarseness of pea vines makes it very easy for rain to soak through if not carefully topped out with suitable material. It is well to remember this when stacking the pea straw outside, to be used later for stock. Some farmers do not take the trouble of harvesting the crop with a machine, but turn in the hogs and let them clean up the peas.

Thrashing.—This may be done either with stock, with a flail, or with a machine. The latter is the approved method, especially in a large way. The vines are simply run through a machine very similar to a grain separator, only that the cylinder is specially constructed. The cylinder should be run slowly to avoid cracking. If peas are to be fed to stock, this is not so important. Quereau[11] describes a pea and bean thrasher which does good

[11] Tenn. Exper. Sta., Bul. 79.

work. It resembles the ordinary grain separator in general makeup, but the distinctive differences are large, knife-edge cylinder teeth and notched sharp-edged concave teeth. He states that in tests which included 200 bushels and represented eight varieties, and with the vines in all degrees of toughness and stages of curing, a surprisingly high percentage of separation resulted. There are regular pea hullers on the market that do fine work.

In a small way peas can be effectively thrashed on the barn floor with a flail or by stock being turned in to tread the seed from the pods. In either event a layer of pea vines is distributed on the floor and contact of flail or stock with the pods causes them to split open and free the seed. One or two turnings of each layer is recommended. Later the floor can be cleaned up and the product run through a fanning mill. Old line farmers state that this method of thrashing will result in far less breaking of seed.

Yields.—Naturally the yield of peas varies much, running from five to 40 bushels to the acre. Zavitz and Lochhead[12] found that in setting peas at different dates between April 18 and May 23, the average yield for the former date was 21 bushels to the acre, and for the latter nine bushels. There was an average increased yield in 30 experiments of one and one-third bushels to the acre from seeding peas in hills rather than broadcasting. The same authority reports a trial of 47 varieties of peas sown in drills one link apart. Yields varied from 14½ bushels to 33 bushels to the acre. Chancellor matured

[12] Ont. Agri. Col., Bul. 126.

first and Oakshott Field last, there being a difference of 24 days in the ripening period of the two varieties. The best average yields for seven years ranged from 33 to 38 bushels per acre and were produced by White Wonder, Early Briton, Mummy, Brown and Blue. All, excepting Early Briton and Mummy, are New Zealand varieties. In another trial with New Canada Beauty and Common Globe Vine, yields varied from 23 to 38 bushels to the acre, and the average weight per bushel was 59.4 pounds for whole peas. Weevil peas varied in weight from 38 to 52 pounds and usually the smaller the peas the greater amount of injury was done by weevils. The best yielding varieties for the whole province of Ontario averaged upwards of 25 bushels to the acre, and were Egyptian Mummy, Chancellor, Prussian Blue, Striped Briton, Canadian Beauty, and Canada Cluster.

Chapman[13] reports yields on light sandy soil ranging from 8 to 13 bushels to the acre in 1896. In 1898, on bottom land, underlaid with clay, the yield was 15 to 28 bushels to the acre.

[13] Minn. Exper. Sta., Bul. 81, p. 181.

CHAPTER IV

COMPOSITION AND FEEDING VALUE

Peas carry a large supply of protein, therefore should be combined carefully with carbohydrates and fats to form balanced rations. The protein in peas is not as completely digestible as the proteins of rice and cereal, although they supply just about the same amount of digestible nutrients as do beans. Moore[1] states that the average amount of digestible protein taken from an average crop of one acre peas equals 192 pounds, while corn would supply only 156 pounds protein from the same area, barley 102, and oats 72 pounds.

Composition.—Legumin forms the chief protein constituent in peas. It is closely associated with vicilin. Some investigators have supposed that legumin carried a little phosphorus, but Osborne and Campbell[2] were able to find only slight traces of phosphorus in some samples, while others showed no trace whatever. The same authorities gave a very comprehensive report of the action of legumin, its manner of precipitation, etc. They show that legumin carries 5.17 per cent carbon, 6.9 per cent hydrogen, 18 per cent nitrogen, .42 per cent sulphur, 22.9 per cent oxygen.

Vicilin is a globulin associated with legumin in the pea, the lentil, and the horse bean. The striking characteristic of it is its content of sulphur,

[1] Wis. Exper. Sta., Bul. 178, for July, 1909.
[2] Ct. Exper. Sta. Rpt. for 1897.

being less than any other known protein. Its composition is reported by Osborne and Campbell[3] as follows: 32 per cent carbon, 7 per cent hydrogen, 17 per cent nitrogen, .18 per cent sulphur and 23 per cent oxygen. Legumelin is also found in peas. The composition of peas varies slightly with the size of grain, with particular reference to nitrogen content.

The accompanying table, secured from analyses made by G. W. Cavanaugh of Cornell experiment station, New York, affords specific data as to the composition of seed, straw, silage, peas and oats, and pea meal.

COMPOSITION OF PEAS

	Dry matter %	Digestible nutrients %		
		Protein	Carbohydrates	Ether extract
Pea seed	89.5	16.8	51.8	.7
Pea-vine straw	86.4	4.3	32.3	.8
Pea-vine silage	27.2	4.71	11.0	.5
Peas and oats (green)	16.0	1.8	7.1	.2
Pea-hull meal (residue from split peas)	89.8	15.9	36.3	.9

Pea Meal.—According to Gamble[4] pea meal had an average composition of 10.34 per cent water, 23.27 per cent protein, 1.9 per cent fat, 54.62 per cent nitrogen free extract, 7 per cent crude fiber, and 2.83 per cent ash. The same authority gives the average composition of pea hulls as 7.51 per cent water, 10 per cent protein, 1.44 per cent fat, 36 per cent nitrogen free extract, 42 per cent crude fiber, and 2.92 per cent ash.

[3] Ct. Exper. Sta. Rpt. for 1897.
[4] Ont. Agri. Col. Farm, Bul. 138, p. 32.

Composition Compared with Other Feedstuffs.—Moore[5] gives the following table showing the comparative composition of peas with other common feedstuffs. The table indicates peas as being far the highest in protein content. This is of significance to the feeder, inasmuch as protein is the most expensive food element. Pea straw has a greater feeding value than barley or oat straw and compares favorably with clover and timothy hay. It is especially valuable as a feed for sheep. The table follows:

PEAS COMPARED WITH OTHER FOODS

	Digestible nutrients in 100 pounds		
	Protein lbs.	Carbohydrates lbs.	Fat lbs.
Peas:			
Grain	16.8	51.8	0.7
Straw	4.3	32.3	.8
Corn:			
Grain	7.9	66.7	4.3
Stover	1.7	32.4	.7
Barley:			
Grain	8.7	65.6	1.6
Straw	.7	41.2	.6
Oats:			
Grain	9.2	47.3	4.2
Straw	1.2	38.6	.8
Clover Hay	6.8	35.8	1.7
Timothy Hay	2.8	43.4	1.4

Nutritive Value.—Zuntz and Hagemann[6] report an interesting experiment to determine the nutritive value of a kilogram of different feeding stuffs. The comparison is given herewith:

[5] Wis. Exper. Sta., Bul. 178.
[6] E. S. R., Vol. 11.

GREEN PEA VINES BUNCHED READY FOR HAULING.

NUTRITIVE VALUE DETERMINED

Feeding stuff	Dry matter	Crude fiber	Total digestible nutrients	Labor expended in chewing and digestion		True nutritive value	
				In terms of energy	In terms of nutrients	In terms of energy	In terms of nutrients
	%	Grams	Grams	Calories	Grams	Calories	Grams
Field Peas	86	69	720	439	111	2,412	609
Peas	86	59	687	402	102	2,319	586
Medium hay (Average quality)	85	260	391	828	209	721	182
Alfalfa hay cut at beginning of bloom	84	266	453	866	219	928	234
Oats (medium quality)	87	103	615	492	124	1,943	491
Maize	87	17	785	325	82	2,784	703

Cooking and Digestibility.—In general it is figured that cooked vegetable foods are five-sixths to nine-tenths less tough or resistant than the raw foods. Lehmann and Gunkel[7] report a rather elaborate experiment along this line with peas. The relative resistance to the cutting surface or toughness was 220 when cooked for 15 minutes, 39 when cooked for 60 minutes in distilled water, and 65 when cooked for 60 minutes in spring water. Richter[8] speaks of an experiment as to the digestibility by man of peas cooked in soft and in hard water. Peas cooked in distilled water were better borne and caused less digestive disturbance than others. When cooked in distilled water peas had the following coefficients and digestibility: Dry matter 92, protein 89, fat 87, and ash 81. When cooked in hard water the coefficients were: Dry matter 91, protein 33, fat 58, and ash 51.

Further digestive experiments are reported by

[7] E. S. R., Vol. 19.
[8] E. S. R., Vol. 15.

Lindsey.[9] Some 40 experiments covering a period of three years are tabulated and given in the accompanying table:

COEFFICIENTS OF DIGESTIBILITY OF DIFFERENT FEEDING STUFFS

Kind of feedstuff	Number of trials	Dry matter	Protein	Fat	Extract	Fiber	Ash
		%	%	%	%	%	%
Hay (largely *Poa Pratensis*)	6	62	61	50	63	65	46
Do	4	60	58	53	61	60	50
Average both samples	10	61	60	51	62	63	48
Hay of mixed grasses (late cut)	2	53	54	39	54	56	26
Do	2	57	55	44	57	59	42
Barnyard millet hay (late blossom)	3	57	64	46	52	62	63
Barnyard millet (green in blossom)	2	74	68	64	76	74	66
Barnyard millet (green, week later than above)	1	67	72	61	65	71	61
Peas and oats (green in blossom)	3	70	70	57	76	68	49
Vetch and oats	3	67	75	47	68	68	49
Corn silage (Pride of North)	2	74	45	77	82	80	26
Hominy meal	1	89	53	94	94	--	--

Feeding Value.—Peas are fed successfully in various forms to practically all kinds of live stock. They are rich in muscle, bone and blood-making constituents. They are, therefore, particularly adapted to young growing animals or even animals at work. In the early stages of fattening of all farm animals before full maturity of animal is reached, there is no better grain ration than peas. Mix peas with ground oats, shorts, or wheat bran in proportion of one-third to one-half and you have an ideal ration for brood sows, milch cows, ewes in milk, lambs and horses. Peas need not be ground for sheep, poultry and hogs. Neither need they be thrashed, as these animals can do that for themselves.

[9] Mass. Exper. Sta. Rpt., 1898.

Pea straw is valuable and relished by sheep, horses and cattle. When vines are cut while a little green and carefully cured without being drenched with rain they will be nearly as good as clover in feeding value. Pea silage is valuable, as well as the fresh product cut green and brought direct to the stock in the form of forage. In the latter event it is usually customary to sow peas with oats or barley. More will be found concerning this subject in the special chapter on Peas as Forage and Soiling Crop.

Peas for Cows.—In foreign countries, notably Scotland, peas are regarded highly as a grain ration for cows. In America their use is limited. This refers to the grain crop, but when it comes to mixtures of peas with other crops to be used in the green state for dairy cows, American farmers prize the combination highly. Hills[10] speaks of pea and oat hay not being relished by milch cows. However, when eaten, the hay proved decidedly better, pound for pound than any other fodder used. Snyder[11] reports experiments with milch cows of the digestibility of a ration of pea silage and wheat bran. Peas were cut while green and placed in the silo and opened the following March. The silage was sweet and in good condition and was generally relished by cows, especially when mixed with bran or corn. A ration consisting of 34 pounds pea silage and 12 pounds wheat bran gave satisfactory results.

Day[12] gives a comparison of green oats and peas with oats and tares for milch cows. The seed was mixed in the proportion of two bushels oats to one

[10] Third Annual Rpt. of Vt. Exper. Sta., pp. 51-84.
[11] Minn. Exper. Sta., Bul. 26.
[12] Ont. Agri. Col. Rpt. for 1897, pp. 84-85.

of peas, and two bushels oats to one bushel tares. Both fodders were eaten readily and neither could be said to excel the other as a milk producer. The oats and peas yielded at the rate of 14,760 pounds green fodder to the acre, and oats and tares yielded 14,688 pounds to the acre.

Neale[13] compared results of dairy value of pea vine silage with June pasture. The cows received a ration of 25 pounds pea vine silage and six pounds hay. In June the animals were turned to pasture and the grain ration remained the same. The change from silage to pasture indicated a possible gain of one-half pound butter per cow per week. The relative cost of silage and pasture showed about $2.91 per acre in favor of pasture.

Peas for Steers.—In either a whole or ground state peas are used extensively for feeding steers in Canada and parts of the United States. Canadian experiments[14] indicate that peas are slightly inferior to corn for fattening steers. In the experiment, corn, barley, and oats gave better results than did peas, barley, and oats. It is believed the results are more or less influenced by the individuality of the steers.

Peas for Sheep and Lambs.—Field peas form an admirable ration for growing lambs. They are relished by sheep and make the finest of mutton.

Day[15] found that the cost of food per pound of gain was 6.63 cents when peas and oats were fed lambs, and only 5.79 cents when fed corn and oats. This was based on peas at 48 cents and corn at

[13] Del Exper. Sta., Bul. 46, pp. 9-12.
[14] E. S. R., Vol. 11.
[15] Ont. Agri. Col. Rpt. for 1898, pp. 81-82.

38 cents a bushel, with hay at $6 a ton. The value of corn and peas includes cost of grinding.

Ramm[16] conducted experiments to determine the effect of pea meal and sunflower seed cake on the quality of fat, flesh, and wool of sheep. Merino sheep made 10 per cent higher gains than English sheep. They also produced more wool than others. Gains made with pea meal were about 2.2 per cent better, and the results of slaughter tests were about 6.54 per cent better than in the case of sunflower seed cake. Sheep fed pea meal showed more belly fat, the flesh containing more dry matter and more nitrogen. Morton[17] found that peas grazed off showed returns approximately equaling the returns from feeding alfalfa and corn, with the peas valued at $8 an acre, alfalfa at $5 a ton, and corn at $1 per 100 pounds. This although alfalfa and corn lambs gained about one-half more than pea lambs. During shipment the lambs fed corn and alfalfa shrank 4.2 per cent per head more than the pea-fed lambs.

Peas for Swine.—Mills[18] conducted an elaborate experiment using wheat, peas, corn, and barley in producing pork. Four lots of three pigs each were in the test, and in about five months the lot of pigs receiving peas and bran made the most rapid gain and the largest gain for the food consumed. The wheat mixture came second, followed by corn and barley. Wheat and bran proved the cheapest food. Another test with 12 Berkshire boars showed that hogs fed peas and bran made the largest gain as well as the best gain for the food consumed. How-

[16] E. S. R., Vol. 10.
[17] Wyo. Exper. Sta., Bul. 73, p. 18.
[18] Utah Exper. Sta., Bul. 34, pp. 8-10.

ever, at ruling prices, the lot receiving wheat made the cheapest gain. Deducting the cost of bran and allowing 4 cents a pound live weight for pork, the following prices per bushel were realized through feeding: Wheat 89 cents, peas $1.02, corn 70 cents, barley 59 cents.

Shaw and Zavitz[19] tried out three lots of pigs, feeding peas, barley, ground oats, and wheat middlings in various combinations. The test continued for 91 days and the best gain was made on a ration of two parts peas and one part of ground barley, grain, oats, and wheat middlings. The next best gain was with a ration of equal parts peas and barley ground. The third lot was fed a mixture of equal parts peas and barley unground, and the least gain was made. Experiments demonstrated the advantage of feeding ground peas and barley to pigs rather than unground. The Wisconsin experiment station found that ground field peas are more valuable for pork production than corn meal. However, corn was so much lower in price than peas that the meal formed a cheaper feed. The thigh bones of pigs fed on peas were 26 per cent stronger than corn-fed pigs. As an exclusive grain ration pea meal is unsatisfactory. Peas contain large amounts of protein and will produce much lean meat in hogs. They should be ground or soaked and fed with corn meal or some lighter feed. Sown with oats or barley peas make an excellent forage crop or pasture for hogs.

Peas for Horses and Chickens.—Working horses thrive on peas. A ration of eight parts peas, eight

[19] Ont. Agri. Col. Rpt., 1891, pp. 106-133.

parts corn, and one part flaxseed ground together, makes a fine ration for horses. Sometimes there is a tendency to constipation, but the flaxseed will tend to correct that. Peas, either cracked or whole, can be fed poultry with good results, either for egg or meat production. Be sure that this is used in combination with something else, as the chickens will do poorly if given the peas as a regular diet.

Robertson[20] tested sugar beets and pea silage for fattening hogs. Two lots of eight pigs averaging 60 pounds in weight received a mixture of ground peas, barley and rye, with sugar beets and pea silage respectively. To one-half of each lot the grain was fed steamed and the other half raw. Pea silage was made from peas harvested when the pods were full of peas still soft, the vines being green and succulent. The silage kept well, but pigs refused to eat much of it. The results showed no striking differences between the gains on pea silage and on sugar beet rations, or between the amounts of cooked and raw food consumed per pound of gain.

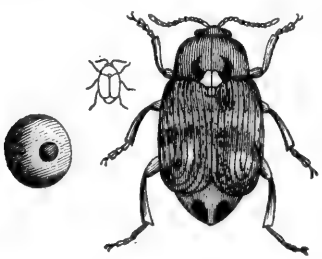
[20] Canada Experimental Farm Rpt. for 1891, pp. 83-87.

CHAPTER V

INSECT AND FUNGOUS PESTS

There are two classes of pests which the grower of peas must be prepared to combat: insect and fungous. They are more troublesome some season than others, also in some sections more than others, and even some varieties of peas are more susceptible than others. There are three leading insect pests of the pea, namely, the weevil, the moth, and the louse, or aphis. There are several fungous pests which may assert themselves under favorable conditions.

Pea Weevil *(Bruchus pisi)*, much resembles the bean weevil, and the life history is similar. The beetle is brownish gray color, with two conspicuous



PEA WEEVIL AND INFECTED PEA.

(From U. S. Dept. of Agri.)

oval black dots at the end of the abdomen, which are not entirely concealed by the wing covers. The

beetle is about one-fifth to one-half inch in length, with the head bent under the front of the body and ending in a square-cut beak. When peas blossom these miserable insects may be found upon them waiting for the young pod to develop. On the pod the eggs are deposited and the grubs as soon as hatched bore through and enter the small green peas, one beetle only infesting a single pea. The grub remains in the pea, feeding upon its substance, and passes into the pupal stage, gaining maturity when peas are ripe. Most of the beetles remain inside the peas until sown the following spring, although some emerge at harvest and remain in the field or in the barn all winter. Unlike bean weevils, the pea weevil does not increase and multiply in stored peas, but will die if kept over another year.

Fletcher[1] discusses the question whether pea weevil can be exterminated. He argues that since the weevil has no other food plant than the common pea it could probably be exterminated by interrupting the cultivation of the crop for one or two years, or by thoroughly fumigating the seed peas. There are difficulties in the way of either plan, and the author recommends harvesting peas a little earlier in the fall and immediately thrashing and sacking them so as to prevent escape of beetles in the field. Then treat all the seed peas with bisulphide of carbon. Weevil-infested peas used as seed will give very unsatisfactory results.

Zavitz[2] found that only about one-fourth of the seed infested with weevil grew. In treating the in-

[1] E. S. R., Vol. 14.
[2] Ont. Agri. Col. Rpt. of 1898, pp. 144-148.

fested seed with carbon bisulphide, put in a tight barrel or bin, and pour on one ounce for every 100 pounds. Then close the receptacle tightly and leave for 48 hours. Remains of the pea crop not taken from the field should be raked up and burned. Weevil-infested seed kept for two years in tight bags or boxes will kill the insects. Zavitz[3] reports that Grass peas proved resistant to the weevil in Ontario and gave a yield of 25 bushels grain to the acre and two tons straw.

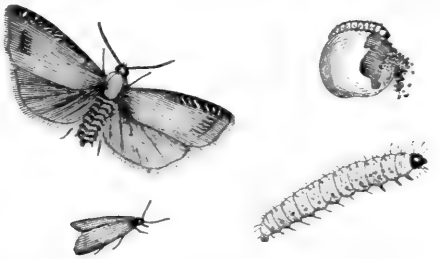
Pea Moth *(Semasia Nigricana).*—This insect occasionally does considerable damage, although it is not nearly as common as the weevil. The matured moth is small, perhaps less than one-half inch in expanse of wings and has a dull gray color. The moth deposits its eggs on the growing pea pods. Caterpillars soon hatch out and eat their way into the pod, feeding upon the young peas, consuming many of them and filling the space with a mass of excrement. Finally, the worms leave the pods and form small oval cocoons below the surface of the ground.

The remedy is preventive. Pea vines may be sprayed as soon as blossoms are open with one pound soap and 25 gallons water in which has been dissolved one-fourth pound paris green. The spraying should be repeated once or twice at intervals of seven to ten days. The object of spraying is to kill the young caterpillars when they eat their way through the pod. Another precaution is to plow the ground deeply in the fall, so that the cocoons will be buried and thus prevent the moths coming

[3] E. S. R., Vol. 14.

out in the spring. All unripe pods should be burned, as they may contain worms; and peas should not be grown upon or near the same piece of ground the following season if the moth is known to be in the soil. Sowing early varieties as early as possible in the season has been found useful, as pods get ahead of the worms. Late sowing is recommended for the opposite reason that the peas will mature after the worm has disappeared.

Pea Louse *(Nectar Ophora Destructor).*—This pest is frequently called the pea aphis. It does great damage on the growing vines all through Nova Scotia, Canada, and the states. It is particularly destructive in some canning sections, where the an-



PEA MOTH AND CATERPILLAR; INFECTED PEA.
(From U. S. Dept. of Agri.)

nual loss runs into the millions of dollars. These lice attack the young pea vines and multiply with great rapidity, often killing the vines outright. They have been found upon sweet peas. On a small scale, spraying with a 25 per cent solution of kerosene and water has proved effective. Whale oil soap and tobacco dust are effective, but in a large way these remedies are too expensive. Large numbers are de-

stroyed by their insect enemies, which include the lady beetle, laced wing flies, and syrphus flies. Johnson[4] reports experiments in planting peas in rows, so that the cultivator and a brush can be used to knock off the lice. By this method a man or boy goes ahead of the cultivator with a pine switch and brushes the vines vigorously, knocking off the lice, and the cultivator follows and buries them. This operation can be repeated every three days during the height of the outbreak of the pea louse.

Miscellaneous Insects.—Occasional references are found in literature to damage through other insects which sometimes attack peas. A myriapod belonging to the species *Blaniulus guttulatus* has been known to cause serious injury to peas as well as beans. The attack is largely upon the seed in the ground. A small mite *(Notophallus Haematopus)* is mentioned by Marchal[5] as causing considerable injury to peas in central France. A four-spotted pea weevil *(Bruchus Gudri-maculatus)* is described by Osborn and Malley.[6] Experiments were conducted in treating seed with carbon bisulphide and to note the possible effect upon the germination of the seed. The seed containing larvæ, pupæ and the newly formed adults were not all destroyed by the treatment. To be most effective they recommend two or three applications about three or four weeks apart. The germinating power of the seed was not affected in any perceptible degree by the fumes of the carbon. On the other hand Bolle[7] says

[4] E. S. R., Vol. 12.
[5] E. S. R., Vol. 20.
[6] Ia. Exper. Sta., Bul. 32, p. 361.
[7] E. S. R., Vol. 16.

the germination of peas and doubtless other leguminous seed is lowered by 10 days' exposure to carbon bisulphide fumes. Trybom[8] states that the pea was attacked by a number of species of the physopoda. He mentions particularly *physopos robusta,* which attacks the field as well as the garden pea.

Pea Blight or Leaf Spot *(Ascochyta Pisi).*—This is the most prominent fungous disease to which peas are heir, which corresponds to the anthracnose of the bean. Discolored areas of dead tissue are noted on the pea stems. The attack is usually more pronounced near the ground. The leaves are also attacked and show round or oval discolored spots from one-fourth to one-half inch in diameter. On the pods the disease appears as sunken spots like those of bean anthracnose, only paler in color. The fungus works through the pod and on to the seed, thus infecting it.

The treatment starts with planting seed free from the disease. This can be guaranteed by selecting pods that are free from the trouble, or by getting seed from sections where the disease is not prevalent. Spraying with bordeaux, beginning when plants are from four to ten inches high and repeating at intervals of four to five days, will do much toward controlling the disease. In a large way this would not be practical. Sturgis[9] gives it as his opinion that fungous attack is not primarily above ground, but that it may be present in the seed. In addition to planting clean seed he urges that growers avoid planting on land where peas have not been

[8] E. S. R., Vol. 11.
[9] Ct. Exper. Sta. Rpt. for 1899, p. 277.

grown for a number of years. As soon as the crop is harvested all vines should be gathered and burned.

Powdery Mildew *(Erysiphe Polygoni).*—This usually appears late in the season, is of a superficial nature, and readily detected through its whitish or grayish coating. The mildew may appear on any part of the plant above ground. In the mature state the minute black fruiting bodies may be found scattered about the mildew surface. Halsted[10] speaks of soil treatments with sulphur, corrosive sublimate, carbonate of lime, and copper sulphate for the prevention primarily of stem blight. On the second crop of peas mildew was quite abundant, but it did not materially injure the crop. Vines sprayed with bordeaux had less mildew than others, but stem blight was not materially lessened. The most satisfactory treatment for mildew is probably the use of bordeaux.

Root Rot Fungus *(Thielavia Vasicola).*—Paddock[11] declares the pea root disease is very destructive. His attention was first called to it in September, 1900. During the following winter, soil from infected fields was secured and greenhouse experiments conducted. Plants in the soil were nearly always attacked by fungi on the roots and stems below ground. In his opinion the fungus belongs to genus *Rhizoctonia.* He recommends the use of corrosive sublimate treatment of seed as a remedy.

Miscellaneous Pea Fungi.—Van Hall[12] speaks of a disease of the pea due to attacks of fungus called

[10] N. J. Exper. Sta. Rpt., 1896, p. 314.
[11] Col. Exper. Sta., Bul. 69, p. 23.
[12] E. S. R., Vol. 15.

Fusarium basinfectum. It has been known in Holland for a number of years. Infected plants turn yellow and soon die. Investigation shows that the roots are the seat of the fungous attack. His investigation leads him to believe that the fungus is closely related to that which causes wilt of melons, cotton, cowpeas, etc. Masserson[13] gives an account of *Sclerotium* disease of peas and beans which is due to the fungus *Chlerotinia libertana.* The disease was especially destructive in certain regions of France in the spring of 1907. Its usual development is said to be due to intensive culture of peas, the crop being frequently grown successively on the same soil. Then, too, the favorable conditions of humidity and temperature are a consideration. Rotation of crops is recommended as a preventive. In addition the debris of all diseased plants should be collected and burned.

[13] E. S. R., Vol. 19.

CHAPTER VI

THE CANNED PEA INDUSTRY

Peas were among the first vegetables to be preserved by canning, and the practice is as old as is the canning industry itself. The invention of the tin can gave the enterprise marked impetus, owing to the reduced cost of production. In America, the pea-canning industry had its birth in Baltimore, Md., in the early fifties. The pea-podding machine, as invented in France, in 1883, and duplicated in America in 1889, and further perfected during the next half dozen years, revolutionized the industry. By means of this machine one person could do the work of 100 or more people in removing the peas from the pods. After improvements of 1893, the device was known as the "vining machine." This machine does away with people going through the fields and picking the pods, as the viner hulls the green peas direct from the vines.

As generally known, the northeastern and north central states grow most of the peas for canning purposes. Wisconsin and New York are the big leaders, these two states producing perhaps nearly half the entire pack of the country. However, Indiana, Michigan, Maryland and Illinois are liberal producers. The accompanying data[1] shows the pack for the United States in 1907:

[1] Canner and Dried Fruit Packer, December 26, 1907.

PEAS CANNED DURING 1907, BY STATES

	Cases		Cases
California	90,450	Minnesota	25,750
Colorado, Idaho, Utah and Oregon	193,018	New Jersey	153,564
Delaware	141,046	New York	1,659,944
Illinois	216,508	Ohio	101,521
Indiana	826,500	Pennsylvania	80,373
Iowa	50,000	Virginia	15,486
Kansas	11,589	Wisconsin	1,773,599
Maryland	568,393	Other States	3,132
Michigan	595,088	Total U. S.	6,505,961

The writer spent several days in the big canning districts of New York and Michigan the season previous to writing this chapter. Farmers were visited and the various operations watched from the time of harvesting the peas on to storing the canned peas in the warehouses. It is a specialized industry, and one has to see the many devices and operations in progress to appreciate its importance.

Varieties Grown.—In the sections visited Alaska was the favorite for the early June pea. The other standards were Telephone, Advancer and Admiral. Farmers were then receiving $2.25 per 100 pounds of green peas, and the later sorts ran from $1.75 to $2 per 100 pounds. There was a reduction of 75 cents per 100 pounds for low grade goods. The canning establishments have men on the road advising farmers about care and time of sending to the factory.

Time of Harvesting.—This varies according to the section, being about 20 days' duration in Indiana and Illinois, and fully six to eight weeks in Wisconsin and Michigan. The longer period of harvesting in the northern states comes through

LOAD OF GREEN PEA VINES GOING TO NEW YORK CANNERY.

successive plantings. Bitting[2] gives many helpful pointers on the canned pea industry. The average dates of harvesting peas as reported by him for various sections are given herewith:

AVERAGE DATES FOR HARVESTING PEAS FOR A SERIES OF YEARS

State	Date
California	May 20 to June 20
Colorado	June 15 to Aug. 15
Delaware	June 1 to June 30
Illinois	June 10 to July 14
Indiana	June 5 to July 10
Maryland	May 25 to July 1
Michigan	June 15 to Aug. 10
New Jersey	June 1 to July 3
New York	June 15 to Aug. 1
Ohio	June 1 to July 10
Oregon	June 10 to July 30
Pennsylvania	June 1 to July 1
Utah	June 10 to July 15
Virginia	May 20 to June 10
Wisconsin	June 15 to Aug. 10

Grading the Crop.—This varies with the section and with the factory. In some cases the farmer receives so much per bushel, which is not satisfactory, inasmuch as it provides no extra returns for the man who takes particular care and has the peas young and tender and in the best of condition. A better method is to take a sample from each load during the thrashing and run it through the grader. The grower receives pay according to the way they separate, the highest price being given for those which make the largest number of smaller sizes. There are other methods of grading the crop, such as letting some expert look at each load as brought to the factory. Another plan is to take a sample of

[2] U. S. Dept. of Agri., Bulletin 125.

the peas, shell them, and place in a solution of salt. If peas are young and tender it is argued a large percentage will float in a weak brine. If of old and poor quality they will sink to the bottom. The density of the solution can be varied to suit the changing conditions of varieties, season, etc.

Thrashing.—The pea viners separate the green peas from the pods and vines in a very satisfactory way. A self-feeding machine has been perfected. The farmer draws his peas and vines to the factory on his hay wagon, like so much straw, only of course, small loads are taken owing to the greater weight of green pea vines and pods. At the factory are long sheds, the same as at sweet corn factories, and the farmer pitches the vines off into these sheds. In the shed is a long table carrying an endless chain. Factory employees throw small bunches of the pea vines as brought in by the farmer on to this endless chain and table, which carries the vines to the viner. This viner separates the peas, running them into a box and the vines are carried out into the farmer's wagon or into the silo. The old system of gathering the pods required fully 2,000 pickers to keep a large factory in operation and added about two cents to the cost of each can of product. Farmers usually mow the vines in the morning, and cut down only such amounts as can be delivered the same day. In wet weather there is danger of vines heating, so large quantities are not thrown together. Growers exercise much care to have the crop mature evenly. Strive as he will, the farmer must expect a few peas to be over-ripe when the bulk of the crop is at its best. Factories are laying more and

more stress on quality, and the grower must recognize this, along with the size of the product.

Blanching the Peas.—This is an important operation with the canner. Young peas will stand either a long or short blanch better than old ones. The object of blanching is twofold. (1) To remove mucous substances from the outside and a part of the green coloring matter; and (2) to drive water into the peas so they will all be tender. A system of perforated cylinders in the blanching process removes most of the small, broken peas. From here the peas go into a large filling tank. Empty cans are run down a chute from the floor above and drop into place on a circle connected with the filling tank. Liquor is also added at this time, mechanically. The cans, filled, pass on to the soldering machines, thence to the cooking vats, or retorts, where they remain 40 minutes at a temperature of 240 degrees. From here they go to the cooling vats and after that to the storage. As the cans are packed in boxes for storage, the ends are pressed in, this having the twofold effect of telling whether or not the can is full and also facilitating the labeling later. Special labels are put on to suit the trade.

Size of Cans.—Within recent years quite a trade is developing in gallon cans. This makes the product cheaper and is sold to the hotel and boarding house trade. When filling, peas are put in to within three-eighths inch of the cap and the liquid just covers the peas. The average fill of a can is such that there will be 14 ounces of peas and seven and one-fourth ounces liquor after the cans have gone through the cooking vat, or the processing, as it is called. The better the grade of pea, the greater

the quantity which will go into the can, and these will be less affected by either blanching or processing, while the poorest grade of peas is affected the most. The consumer would do well to recall this fact when buying short-weight cans. The liquor used in canning peas varies with the ideals of the factory. It is composed of water, sugar and salt. Heavy liquors are used in the fancy and extra fancy grades. In fact, this usually constitutes the difference between extra fine and fine. The analyses of 35 brands of peas purchased in the open market showed the sugar content of the liquor to vary between .46 and 4.17 per cent, the average being 2.62 per cent. More sugar is used in eastern than in western packing sections. The average amount of salt used appears to be around 10 pounds to 100 gallons water. About the same amount of sugar is used as of salt.

Processing or Cooking.—The peas are cooked in great iron retorts, under pressure, or in a solution of calcium salt, in order to secure a temperature above that of boiling water. This is necessary because all germs are not killed at boiling temperature, unless continued long enough to disintegrate the peas. Occasionally, packers process only 25 to 30 minutes at a temperature of 240 degrees F, but the great majority process around 35 to 40 minutes. This for peas which are allowed to stand overnight on the vines. Old, hard peas are processed 40 to 45 minutes at a temperature of 245 degrees. Packers are not agreed as to the best form of heat for processing. Some use dry steam, others use water, and still others use the calcium bath. Water advocates declare they secure a clearer liquid and

a brighter can. Cans heated gradually by turning steam on slowly have a clearer liquid than when steam is turned on suddenly at full pressure. Very quick heating injures the peas in contact with the can, and also causes a blackening inside of the can. As the calcium system is maintained at a high heat the effect upon the peas is more like that of the quick dry steam. Sterilization is effective in either of the three processes.

The experienced packer cools the cans immediately after taking from the processing vats. If cans are only slightly cooled and stacked in large quantities, those in the center will retain heat for many days. This will tend to break down the peas, and injure their final appearance as they come onto the table. Cooling prevents this. Then, too, it aids in prompt detection of leaks.

Peas Spoiling.—All factories face the possibility of more or less loss through spoilage. This may be due to insufficient processing, to leaks in the can, or possibly spoilage prior to the canning. Harding and Nicholson[3] report studies of bacteria causing serious losses in canned peas. In general, the spoiled cans presented a bulged appearance, and in some cases were actually broken open. The peas had a disagreeable odor, suggesting hydrogen sulphide. They were mushy, skins were inflated, and liquor was darkened and of a greenish tinge, due to the particles of the ruptured peas. A microscopical examination of the juice showed that the cans in which the disagreeable odor was noticed carried bacteria, which survived the heat employed in proc-

[3] N. Y. Exper. Sta., Bul. 249, pp. 153-168.

essing. This bacteria was found to be the cause of the fermentation. These spores were destroyed on heating the canned peas to 240 degrees for 30 minutes. This was done without injury to the commercial quality of the goods.

Manufacturers of cans allow two per 1,000 for defects in workmanship. This appears to be ample. Tip and cap leaks are much more common than end or side leaks, and, of course, are due to incompetent workers and lax inspection. Spoilage due to leaks usually occurs within 24 to 48 hours. Peas spoiled, owing to insufficient processing, are known to the trade as "swells" or "sours." Occasionally, peas spoil while standing in piles, on the wagons, in piles at factory, or perhaps after thrashing. If so, the heat and fermentation are noted. Thus it is important to see that the peas move from the grower's field on through the viner, the grader, the blanching and processer, and into the cans, with the greatest possible dispatch.

Pea Silage.—In the early days, pea vines were a waste product in many factories. In fact, some managers actually paid to have them hauled away. Many farmers now take the pea vines home with them and feed direct to the stock, or place them in their silos. Factory managers frequently provide a series of large silos at the factory and in case farmers have no facilities for storing the silage, the factory silo is used and later the farmer buys this silage at $2, or thereabouts, a ton. Crosby[4] has recently compiled a very helpful bulletin on the utilization of pea-cannery refuse for forage. He de-

[4] U. S. Dept. of Agri., Circular No. 45.

clares the refuse vines from pea canneries are valuable as silage, as hay, as a soiling crop, and as a fertilizer. They can be ensiled either in a silo or in a stack. "The silage compares favorably with corn silage, and by many is regarded as superior, especially for dairy cows. It is also valuable for beef cattle and for sheep, and is sometimes fed to horses, mules and hogs. It has been used successfully as an exclusive roughage for dairy and beef cattle, sheep and horses. Pea-vine hay is a valuable feed for all classes of stock. It is of exceptional value for milch cows and sheep. It is generally considered equal or even superior to clover hay. The vines are valuable as a soiling crop, but their use as such is limited to the immediate vicinity of the cannery or viner. As a manure, pea vines have an actual fertilizing value around $2.60 a ton."

CHAPTER VII

PEAS AS FORAGE AND SOILING CROPS

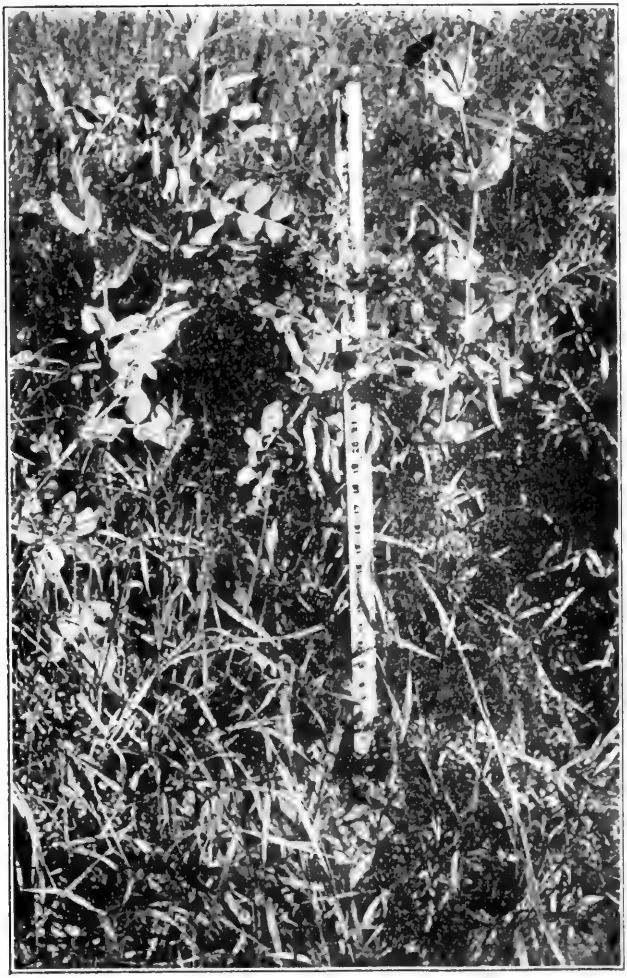
In its broadest sense, forage means any food suitable for live stock, whether it be pasture, grass, crops cut green and fed, matured crops with or without seeds, etc. As generally applied, however, the term means a pasture crop other than grasses. A soiling crop is one which is cut green and fed directly to the animals in the green state. Forage crops is a term for that practice of feeding to stock in its matured form, being fed either before or after the removal of the seeds. Forage, soiling, and fodder crops include a large number of the same plants. However, this chapter is to deal with only peas in the different combinations in common use among farmers. It will include a brief discussion of cowpeas, the king of forage plants, in the South.

Culture.—Whether for soiling or forage purposes, the preparation of the land, cultivation, seed considerations, etc., do not differ radically from those already set forth in preceding chapters. For green pasture, peas are usually sown with some grain like oats. For instance, peas and oats are sown at the rate of one and one-half to two bushels each to the acre. Small varieties of peas are preferred, as they produce more forage. Seed can be mixed and sown with the drill, or the peas can be sown broadcast, and the land plowed three or four inches deep and then the oats broadcasted or drilled in. Peas are sometimes sown alone as food for

swine. About two bushels seed to the acre should be used. When peas and oats are pastured by sheep they may be turned in to graze them down when six to ten inches high. Do not allow sheep to pasture on them when the vines are wet. This mixture constitutes an excellent pasture for both sheep and lambs. The peas may be pastured by swine, either before or after maturity. When pasturing before peas are ripe, it is customary to begin when seeds are about ready to cook. Swine should not be turned into a field of peas, green or ripe, and left there for a long period at the start. The green peas may derange the digestive organs, and ripe peas are apt to swell in the stomach and cause death through undue distention. Later, when swine are accustomed to the feed, they may forage upon the crop at will. When pasturing swine on ripe peas, allow them an area only large enough to accommodate them for a short period. If allowed to roam about the entire field there is apt to be much loss, especially if there be rainy weather.

Fertilizers.—As explained in earlier chapters, peas belong to the legume family, and gather much nitrogen from the atmosphere. Therefore, whether grown alone or with other crops for forage or soiling purposes, the land is benefited. Peas are an excellent crop to sow for green manure. If sown as late as July 15, in northern latitudes, a large amount of green manure will be secured before frost comes. This crop of vines turned under contributes materially to soil improvement. Shutt[1] reports the value of peas as a substitute for clover for soil improve-

[1] Can. Exper. Sta. Rpt. of 1906, pp. 155-158.



OATS AND PEAS FOR FORAGE.

(Over three feet tall.)

ment. He found that crops of peas can be grown, supplying 130 pounds nitrogen per acre, which is almost identical with that produced by alfalfa, vetches, and many of the clovers. The organic matter produced is equal in quantity to that given by a good clover crop, although somewhat less than produced by alfalfa. In addition to nitrogen the pea crop shows large percentages of phosphoric acid and potash, particularly the latter.

Balentine[2] conducted a series of contests to determine comparative value of peas and barley as a fertilizer and for feeding. He concluded that peas for stock purposes are to be preferred to barley. A Black-Eyed Marrowfat pea yielded double the amount of the Canada field pea. Zavitz and Lochhead[3] seeded peas with oats as a pasture crop for cattle. The results were not entirely satisfactory, as the oats were eaten much more readily than the peas. The mixture is more suitable for sheep or swine. Wheat grown after a crop of peas averaged 36 bushels to the acre, after a crop of rape 30 bushels, and after a crop of buckwheat 29 bushels.

Schneidewind[4] secured good results with peas as a green manure. He states that the success of green manures depends more largely upon the rainfall during the period of growth than upon the character of the soil. In Canada, where field peas were used as a green manure for preparation of land for winter wheat, an average of six and one-half bushels more wheat to the acre was secured than where buckwheat was plowed under. A for-

[2] Me. Exper. Sta. Farm, Bul. 1890.
[3] Ont. Agri. Col. Farm, Bul. 126.
[4] E. S. R., Vol. 19.

eign experiment with lupines, crimson clover, and peas as a green manure for oats and barley, showed that peas were most effective. Sweetser[5] gives the following data as to yields of forage plants per acre:

YIELDS OF FORAGE PLANTS PER ACRE (TOPS AND ROOTS)

	Total yield	Dry matter	Ash	Organic matter	Nitrogen	Phosphoric acid	Potash	Lime	Nitrate of soda furnishing same amount of nitrogen
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Flat pea	41,412	9,073	906	8,167	239.3	49.8	161 3	122 2	1,495.7
Canada field pea	21,582	4,218	615	3,603	114.6	30.3	54 0	73.1	716.3
Medium red clover	29,760	7,438	626	6,812	143.7	39.6	156.6	98.3	898.2
Timothy	21,750	6,281	555	5,726	47.0	27.5	78.0	35.5	.....

Feed for Live Stock.—Whether as forage, soiling, or a fodder crop, peas constitute an exceedingly important crop in live stock husbandry. They are becoming more popular every year, and justly so. While building up soil fertility they are also providing the best kind of feed for the stock, and in the right sort of combinations are the most economical crop.

Peas and oats are the most popular combination, although wheat, barley, and occasionally rye, and even corn, have been used in combination. Oats and peas mature about the same time, while barley is a little ahead of the peas, and wheat is a little behind. Oats and peas can be planted in succession of about two weeks, and by planting as soon as

[5] Pa. Exper. Sta. Rpt., 1897-98.

ground can be worked in the spring, there will be a soiling crop for the stock early in the season. Succession crops on other plots can be made to carry the stock on through most of the season. If a more general use were made of oats and peas for the summer feeding, there would be a decrease in the expense of producing milk. For late feeding barley and oats instead of oats and peas may prove a better combination. A guide will be to sow barley with the peas after July 1, instead of oats.

Wilson[6] gives an interesting report of a trial of feeding four cows with green oat and pea fodder. The breeds were Shorthorn, Holstein, Red Polled, and Jerseys. Previous to the experiment they had been grazing on a good blue grass pasture, and had received four pounds cornmeal daily in addition. The soiling commenced July 21, feeding green oat and pea fodder. From 110 to 125 pounds were fed per cow daily, together with four pounds cornmeal. Taking the cows from an abundant pasture at this season, keeping them confined in a barn, and feeding them all they would eat of peas and oats resulted in an increased flow of milk from all. Shaw[7] describes how peas are grown in the San Luis Valley, Col., at an altitude of 7,000 feet, and used for fattening sheep and lambs. They are allowed to pasture the crop. In his opinion this system of grazing is capable of being extended in the mountain states. Lindsey[8] found that cured hay from peas and oats is nearly or quite equal to good rowen.

Cowpea.—Here is a justly popular plant. The

[6] Ia. Exper. Sta., Bul. 23.
[7] U. S. Dept. of Agri., Bul. 224.
[8] Mass. Exper. Sta. Rpt. for 1893.

COWPEAS GROWING AT MICHIGAN EXPERIMENT STATION.

Louisiana experiment station has summarized the advantages of the cowpea as follows:

1. It is a nitrogen gatherer.

2. It shades the soil in summer, keeping it in a condition most suitable to the most rapid nitrification, leaving the soil friable and loose for the succeeding crop.

3. The cowpea has a large root development, and hence pumps up large amounts of water from great depths, also mineral matter.

4. Its adaptability to all kinds of soil, stiffest clays to most porous sands, is marvelous.

5. It stands the heat and sunshine of southern summers.

6. Its rapid growth enables farmers in the South to grow two crops annually on the same soil.

7. When sown thickly it shades the soil effectually, smothering out all weeds.

8. It is the best preparatory crop known to the southern farmer, as every kind of crop grows well after it.

9. It furnishes excellent food in large quantities for both man and animals.

Cultural principles of the cowpea vary with the latitude and object for which grown. If vines are wanted in the South, the crop is planted early; later planting is the rule if the crop is for seed. Amount of seed to sow depends in a large measure on size of peas and manner of sowing. If broadcasted, one bushel of the smaller to two bushels of the larger varieties will be required. If drilled, six to 16 quarts to the acre is sufficient. The best soil is one which is warm and comparatively moist. Seed will rot if planted too early, and this is why many northern

farmers have failed. Wait until the ground is thoroughly warm before starting cowpeas. If sown in drills, rows are made 18 to 30 inches, and seed is covered two inches deep. The Mississippi experiment station reports that the increased yield of both seed and hay obtained by drilling the seed is more than sufficient to pay the additional expense of drilling and cultivation. If the crop is sown broadcast and harrowed in, no cultivation is necessary.

As with field peas it is necessary to apply a nitrogenous fertilizer. Potash and phosphoric acid will give good results. The Delaware experiment station used 160 pounds muriate potash to the acre, and it doubled the yield of vines. Best yields in Georgia were obtained when phosphate was used at the rate of 200 to 400 pounds per acre. A dressing of 100 to 200 pounds acid phosphate, with about the same amount of muriate of potash, applied to each acre should give satisfactory results on average soils.

Harvesting cowpeas is not a simple operation, especially if damp weather prevails. If cured for hay, vines are cut when pods begin to ripen. They are cut with a mowing machine in the morning after the dew is off, and when the vines have wilted the hay tedder is run over the field. A second tedding may be given to hasten curing. Ordinarily, peas cut in the morning and tedded in the afternoon will be ready to go into the small bunches the following afternoon. They are left in these bunches, or cocks, for two or three days before being hauled into the barn. If it rains in the meantime, these bunches have to be opened up. Such are the methods in

vogue at the Mississippi experiment station. The North Carolina experiment station advocates putting them into the barn when dried out enough so that no juice will run out of the vines when they are twisted with the hands. This station advises leaving the vines on the ground where mowed until they are half cured. It is argued that the crop is liable to mold if put in bunches.

Cowpea seed can be harvested for grain by picking off the pods when ripe and thrashing with a flail or machine. Farmers and experiment stations agree that the most economical way of using cowpeas is to feed the vines and peas to stock, and return the manure to the soil. Stock is frequently turned into the field and allowed to do the harvesting. Swine are especially proficient in this connection. Then again, the crop is frequently plowed under as a green manure. This practice is especially commendable on heavy soils. Various analyses show that a good crop of cowpeas plowed under will add to the soil fully 110 pounds nitrogen to the acre, which has a cash value of $14 to $16. It has also added about 24 pounds phosphoric acid and 100 pounds potash to the acre. The Georgia station found that mowing the vines, permitting them to lie on the surface, and plowing under in November, was better than turning the green vines under in August.

There are 65 or more varieties of cowpeas, and certain varieties are best adapted to specific localities. Good advice from a local seedsman and actual experience of the grower, are desirable in determining the best variety for each section. King is a good variety to plant in corn. Pea is of medium

size, bluish-black in color, and if not pastured too close it will reseed the ground every year. The Red Ripper is a medium-size pea of dark red color, and possesses good quality, like the King. Both of these varieties make a large yield of hay or feed, as they are heavy, even producers. They are more rank than the Iron, Crowder, New Era, Whippoorwill, or Black Eye. The Speckled Java is the largest of the cowpea family, but must be harvested as soon as ripe, as the seed will shell easily. The Brown Crowder is said to be a good general purpose pea. The earliest cowpea, and hence the one best adapted to northern latitudes, is the New Era. It matures in a little more than 60 days from time of planting. The Georgia experiment station says the heaviest yielder of vines is Red Ripper, followed closely by Forage or Shiny Black, and Unknown; the heaviest producers of peas are Unknown, Calico, Clay, and White Brown Hull. Cowpeas are attacked by the weevils, the same as are field peas. Treatment is similar.

Cover Crop for Orchards.—Peas alone, and in combination with oats and barley, have been used advantageously as a cover crop in orchards. Peas and oats can be sown early in the spring and plowed under when the oats are in bloom. The land can be thoroughly harrowed, and August 1 peas and barley sown. The latter crop is left to stand through the winter, and plowed under the succeeding spring. Beach and Close[9] speak of Canada peas and buckwheat, and blue peas and buckwheat, as cover crops. Both combinations gave satisfactory results. The growth

[9] N. Y. Exper. Sta. Rpt., 1896.

of Canada peas and buckwheat was so great as to interfere with gathering the winter apples. Cowpeas can be included in the category of cover crops, the same as field peas. In using these and other combinations, practically the same good results are secured as with clover or vetch used as a cover crop.

CHAPTER VIII

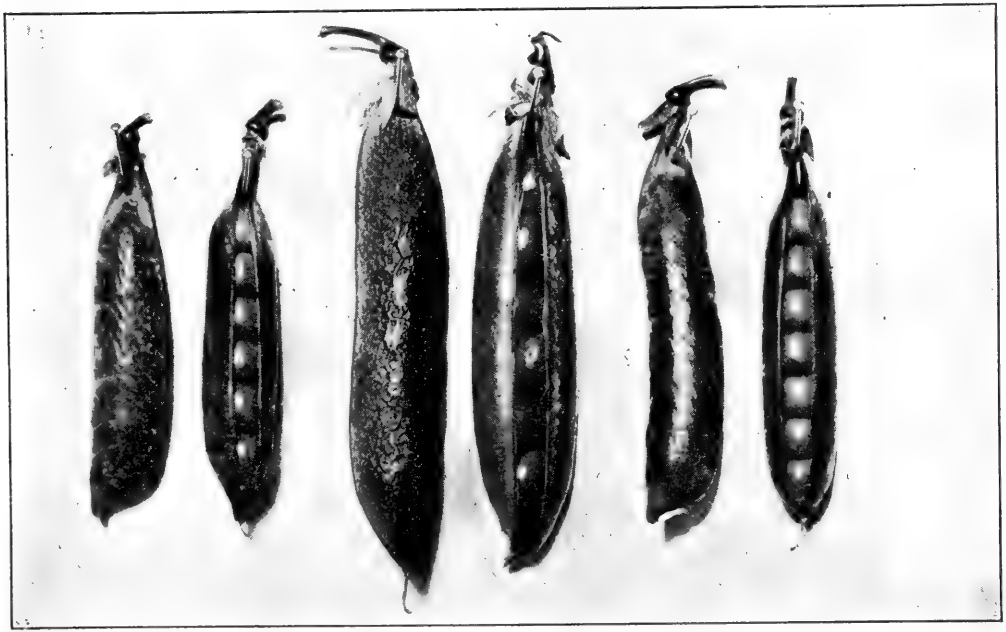
BREEDING AND SEED IMPROVEMENT

Thousands of acres of peas are grown annually for the sole purpose of seed. Large seed houses arrange with farmers to grow a certain acreage at a stated contract price per bushel. The seedsman furnishes the seed and receives the entire output of the individual farmer. The returns to the farmer are usually a little better than from general culture, although the soil requirements and cultural methods are not materially different than for the general crop. Therefore, the ample supply ordinarily keeps prices at a comparatively moderate level. Yet the harvesting must be done on time and with care, and the farmer must see to it that varieties are not mixed, since the seed houses are held responsible for the product. The seed is delivered in good, bright condition without being badly broken or full of foreign matter.

Seed Growing Specialty.—Wisconsin ranks high as a pea-growing state, as does also Michigan, New York, and South Dakota. In the Lake Shore counties of Wisconsin farmers regard the pea crop of the utmost importance, and it is a specialty with them. The ground is usually plowed in the fall so as to be ready for early spring planting. The ground is fitted as early as possible in the spring, and two to three bushels seed to the acre sown, depending upon size. A drill or seeder is used for the purpose, and peas are covered about three to four

inches deep. Harvesting is done when the larger portion of vines and pods have turned yellow. A mower with bunching attachment is the approved harvester, although science has now provided a special pea-harvesting machine which does excellent work. Peas are thrashed in an ordinary grain separator, blank concaves being substituted for the regulation ones. It is not uncommon for a machine to thrash out 1,000 bushels daily. Peas may be stored in granaries or taken to the market. Many farmers find it to their advantage to grow on their own hook without any contract with seed dealers. The Scotch green pea is a leader in this section of Wisconsin.

In 1909 Lake county, S. D., alone had an acreage around 3,000 acres garden peas which were raised for seed purposes. The preceding season an eastern seed company went into the county and interested the farmers in the crop. The company furnished the seed and contracted with farmers to pay them $1 a bushel at the station for the crop. An overseer was furnished by the company and he gave advice as to cultural methods, manner of harvesting, marketing, etc. The yield was irregular, running from five to 20 bushels to the acre. Farmers considered the results disappointing, and many took up other lines. One of the special drawbacks reported was the great number of weeds that infested the fields. On land that was fairly well prepared before seeding, peas grew nicely until they had reached full height. Then the weeds began to catch up with them, and soon had outgrown them. When harvest arrived, one could hardly tell without close examination, whether it was a crop of peas or weeds in



TWO EACH OF NOTT'S EXCELSIOR, PROSPERITY AND ADV NCER.

the field. Another difficulty experienced was in harvesting. Vines were cut with a mowing machine, and raked into windrows with a horse rake. Unseasonable weather dampened the pods, which later dried. The drying process cracked open the pods and the peas fell in every direction. These points are mentioned as factors to be avoided. One Dakota farmer writes that the farmers could have saved nearly all the crop if they had forked over the piles immediately after the rain. The state experiment station has secured yields of 15 to 25 bushels to the acre, and it is evident the state is well adapted to the industry.

Possibilities in Breeding.—Beyond question the future has much in store for those who will carefully select and breed peas along well-defined lines. M. B. Keeney, one of the largest seed growers in New York, says: "There are great possibilities open to the careful student of peas, in selecting and reselecting, with reference to purity and productiveness. However, if selections are made on account of productiveness only, there is great danger of drifting away from the true type of the variety, and while increased productiveness may be obtained, there may at the same time be a loss in quality, of earliness, or both. A man who does hybridizing in peas should not expect to get more than one new variety out of 200 crosses. If he saves all that seem to be fairly good, he will soon have a great accumulation of types and strains of doubtful value. Then again, a cross or a selection may seem to be particularly interesting during the first two or three years, but later it may develop other qualities which make it undesirable. It generally takes five to ten

years to fix the type of a new variety, for during the first half dozen years a new sort is apt to be unsteady and uncertain as to its character."

Some comprehensive and interesting experiments in breeding of peas were undertaken at the Massachusetts experiment station by Pomeroy in 1907. The work has been continued ever since, and is now in charge of Professor Shaw, who in July, 1909, wrote as follows: "We are aiming at some definite data regarding heredity, variation and correlation. The characters studied are vine length, number of pods per vine, pod length, number of peas per pod, and the total number of peas per vine. We aim to keep an exact record of the descent of each plant, and examine into the correlation of these factors in each generation, and in what degree they are transmitted to succeeding generations. The amount of variation of each factor in each generation is also carefully considered. The methods used are somewhat technical, being worked out by Galton and Pearson in England. Results so far are not very conclusive. The work was started as a sort of side issue, and last year developed great interest. One or two distinctive strains have appeared, probably because of mixed seed at the start. The descendants of different plants show marked differences, and are remarkably uniform among themselves. Probably the fact that peas are very generally self-fertilized accounts for this fact. The puzzling thing that appeared last year was the occurrence of one or two negative heredity coefficients, but this demands further investigation before much dependence can be placed in it."

Gregory[1] studied the historical nature of differences between round and wrinkled peas, basing work on Mendel's experiments. He found that round peas, which included indented sugar peas, have the central tissues of the cotyledons filled with very large starch grains. In the same region the starch grains of wrinkled peas are of a decidedly different type, frequently being compound.

Interesting facts relative to weight and specific gravity of pea seed is given by Andree.[2] He learned the lightest peas are always found near both ends of the pod. The average weight of a pea in a pod was greater the larger the number of peas in the pod, so that the largest pods contain the heaviest peas. The weight of peas next the point of pod increased with the increased number of peas in the pod. However, with exception of the first and last peas, there was but a very small difference in the weight of the peas in the same pod. Experiments as to specific gravity were, in general, comparable with those found for weights. In general practice, however, he believes it is not necessary to pay much attention to specific gravity in selecting seed.

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[1] E. S. R., Vol. 16.
[2] E. S. R., Vol. 5.

CHAPTER IX

GARDEN PEAS AND VARIETIES

The general principles underlying the success of growing garden peas do not differ materially from those already outlined for the field sorts. It is possible, however, to do a few things on a small scale which would not be practical in a large way. For the early sorts sow as early as possible, perhaps preparing the ground the preceding fall. This crop will stand a low temperature in the spring without ill effect. If the smooth and early seed is sown there is little danger of its rotting, although this will not hold for the wrinkled sorts. Peas will give quicker returns if covered only one inch deep with soil. Larger pods and more of them will be produced if the seed be planted in trenches three to six inches deep, covering seed only shallow at first, and then gradually bringing the soil to the vine as the culture proceeds. This favors deep rooting, tends to prevent mildew, and prolongs the bearing season.

In garden culture it is customary to provide succession either by sowing at different periods or by using varieties which differ in time required to produce a crop. Plant breeders have done much for the housewife in finding suitable varieties to cover varying conditions. Refer to special chapters for details concerning soils, fertilizers, breeding, etc. Peas are frequently grown in the double-crop system, as peas followed by tomatoes, corn, cabbage,

etc. It has been recommended by some to sow corn and peas together, with the idea of the corn providing a support for the peas and a corn crop to come on later. The author has tried this without success. Corn grows much slower than peas, and the support part of the argument is nil.

GOOD AND POOR SPECIMENS OF JUNO PEA.

Germination.—William Saunders[1] reports an experiment designed to show the vitality of different seeds. The percentage of germination of peas with seed five years old on different tests was 94, 95, 88,

[1] E. S. R., Vol. 14.

64, and 64. His results showed that the seeds germinated as well the second year as the first and that a slight decrease in germination occurred during the third year. In the fourth year the decrease was much more marked.

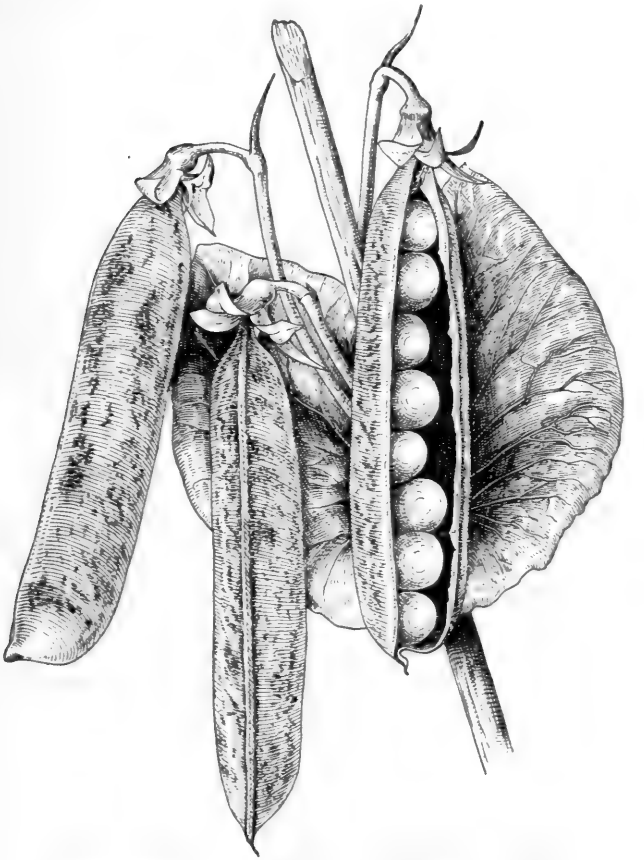
The temperature at which pea seed germinates varies somewhat with the type and variety. For instance, smooth peas germinate at a temperature of 80 degrees F, while wrinkled sorts run between 68 and 72. On the smooth sorts vitality is almost destroyed at 90 degrees.

Supports.—The more productive and tall-growing varieties are given some sort of support in the garden. Various methods are resorted to, including wires strung on posts, poultry netting and brush. As to the advantage of supports Jordan[2] speaks of plants trained to woven wire trellis and untrained plants. He concluded that generally the untrained gave a larger percentage of the total yields in first pickings than those trained, but in total yield and weight per plant the trained sorts, with two exceptions, gave much better results than those untrained. Macoum and Balir[3] report it is a decided advantage to provide a support for even half tall varieties of peas, and to plant two rows six inches apart and allowing two feet space to the next row. This was recommended as preferable to a single row two and one-half feet apart, since nearly double the crop is secured. There is more difficulty in hoeing the double rows. Pods from the staked peas were much superior to the unstaked ones.

Probably the most common method of support is

[2] N. J. Exper. Sta. Rpt., 1898.
[3] E. S. R., Vol. 17.

the familiar brush system. The grower simply takes some small branches of trees or growing sprouts, like young birch, and sticks them into the ground along the row for the vines to climb. This



FAIR SAMPLE OF POPULAR THOMAS LAXTON.

should be done before the peas are six inches tall, as they will find difficulty in climbing if once becoming incumbent on the ground. When brush are used, many plant two rows, either six inches apart or perhaps 12 inches, and if in a section where winds are high, brush are leaned together to support each other.

Winter Forcing.—Bailey[4] reports investigations in growing peas in forcing houses to determine value as a commercial crop under glass. Experiments showed that the tall or half dwarfed varieties force readily in a cool house, yielding edible peas in 11 or 12 weeks from the time of sowing. The very dwarf varieties were found to yield too little to pay for their growing. Extra Early Market and Rural New Yorker gave satisfactory results.

Varieties.—The number of varieties covering different types, seasons, etc., is legion. A single work mentions over 240. Anticipating this particular chapter, I secured all the different varieties offered for sale by the following reputable seed concerns: Peter Henderson & Co., Northrup, King & Co., D. M. Ferry & Co., and W. A. Burpee. Through their co-operation I was able to test out more than 100 varieties the same season, under similar conditions. The results were satisfactory, and in the main I find varieties as represented. Any one of these firms, or other reputable ones, provide a formidable list of varieties for different conditions, which will be more than an average gardener will want. Therefore, the reader who finds it hard to decide upon varieties cannot do better than secure the latest cat-

[4] N. Y. Exper. Sta., Cornell, Bul. 96.

alogue of some of these concerns. Varieties change more or less in the course of years. My conclusion, after trying all those varieties, was that Alaska is about the earliest pea, and other good ones following along later in the season were Thomas Laxton, Gradus, Champion, Telephone, Teddy Roosevelt, and Prosperity. I was especially pleased with the two last named.

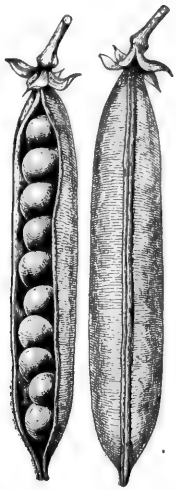
Jordan[5] gives a comparative test made with 81 varieties of peas with reference to earliness of starting, earliness of maturity, length of season, percentage of shelled peas, total weight, number of peas per pod, height of vine, and yield. Smooth sorts were reported inferior to the wrinkled varieties in all respects except earliness. He believes that all the numerous varieties of dwarf or smooth peas are developed from the old Philadelphia Extra Early and Dan O'Rourke, from which they differ but little.

"Varieties differ much in the yield of shelled peas obtained from a given quantity of pod, the extreme variation of 12 per cent being found. Among the early dwarf wrinkled varieties Exonian and Station were earliest. Among the late half dwarf and tall, smooth varieties, Pride of America gave nearly twice as large a yield as any other. New Giant Pod Marrow was one of the earliest and most productive of the Marrowfats. Melting Sugar is recommended." This pea is an edible-podded sort, the pods being picked and eaten, much like string beans. Among the medium and late dwarf and tall wrinkled varieties, the following are mentioned

[5] N. J. Exper. Sta. Rpt., 1898.

favorably by Dr. Jordan: Advancer, Admiral, Bliss, Abundance, Bliss Everbearing, Yorkshire Hero, Stratagem, Stratagem Improved, Queen, and Heroine. Besides a good yield, the last named gave the largest percentage edible of any variety raised.

Bulletin 5 for January, 1889, at the Nebraska experiment station, gives a tabular record of one



GRADUS, AN EXCELLENT PEA.

season's test of 22 varieties of peas. The best early peas were Cleveland's Alaska, Maud S, and Rural New Yorker. The best continuous bearer was the Dwarf Sugar. Vick's King of the Dwarfs was the best dwarf pea tried. Carter's Premium Gem, American Wonder, Telegraph, Quality, and Pride of the Market, were good bearers. Brown[6] recom-

[6] E. S. R., Vol. 14.

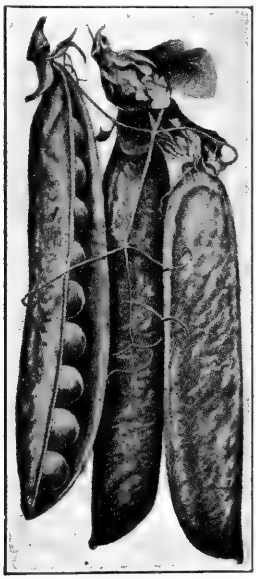
mends Surprise and Gradus for an early, and Champion of England for a later pea.

As one goes into the literature of varieties, and notes the different sorts recommended at the experiment stations and agricultural colleges, he is surprised to note the multitude of names which are unfamiliar. Very few of the popular sorts, 15 or 20 years ago, are recognized as standards now.

The classification of varieties is found in an earlier chapter, to which the prospective gardener is referred. Let the novice remember, one classification would divide green peas into two great classes, smooth and wrinkled. The former is the early type, and can be planted much earlier in the season, but the peas are not nearly as sweet. The wrinkled sorts are the standard, and strains are being developed which come on so rapidly that they are nearly as early as the smooth sorts. A number of new classes in the extra early, early, mid-season, and late peas, have been added recently. The Alaska or Extra Early type has been added to by the Ameer and Claudit. The latter is really a large-podded Alaska. The Ameer is almost as early as the Alaska, and possesses much longer pods. It is blue-seeded, grows about three feet tall, and the pods are nearly as large as Telephone.

The next class of dwarf wrinkled earlies takes in American Wonder, Nott's Excelsior, etc. The alleged improvement in this group is Laxtonian, which is really a dwarf Gradus. Another class is the taller, early wrinkled varieties represented by the Thomas Laxton, Gradus, etc. These are two very popular varieties, and an alleged improvement on them is Early Morn. Another is re-selected Pilot.

For the average reader a division made by one of the large seed houses already mentioned is perhaps as helpful as can be suggested: "Peas for the garden are divided into four classes, Extra Early Round Seeded sorts, Extra Early Wrinkled sorts, Early Dwarf sorts, and Main Crop sorts. The extra early varieties are largely grown by gardeners for early market. They ripen more uniformly than



THE PRODUCTIVE PROSPERITY

other peas, and most of the pods can be taken from the vine at the first picking. The peas are not sweet, but can be planted very early. Examples of this class are Alaska, Maud S, First and Best, New Prolific, etc.

"The extra early wrinkled varieties are nearly as early as the round seeded sorts, but do not mature as uniformly. These, while less desirable for early market purposes, are fine for family use. They are much sweeter than the round sorts. Examples are Surprise, Thomas Laxton, Gradus, Advancer, etc. The third class of early dwarf varieties require no brushing, and are in strong demand for family use. The Improved American Wonder, Nott's Excelsior, Little Gem, Stratagem, Daisy, etc. The fourth division is the main crop sorts, including the Marrowfats, Telephone, Champion, Everbearing, Duke of Albany, Telegraph, Alderman, and Prosperity."

Some may be interested in the edible-podded peas, but I must confess they do not appeal to me. I tried both Dwarf Gray Sugar and Mammoth Melting Sugar. They grow as represented, and are marvelous yielders. The Dwarf Gray Sugar vines grow only about 15 to 20 inches tall, whereas the Mammoth Melting Sugar will reach a height of four feet or even more. A package of these might not be amiss in the family garden.

At best the multitude of varieties is confusing to the gardener without experience. However, after two or three years, he settles down to a half dozen or so varieties as best for his particular conditions. Naturally the selection will vary, but this chapter, together with the earlier ones, I, II and III, also suggestions from the latest seed catalogues, will prove helpful in arriving at the most satisfactory combination.

CHAPTER X

SWEET PEAS AND THEIR CULTURE

The sweet pea has very properly been termed the queen of all annuals. It is a magnificent flower, and its culture is comparatively simple. So much so that even amateurs secure with it most gratifying results. The sweet pea is native of Sicily, and has been known hundreds of years. The story goes that an Italian monk, by the name of Franciscus Cupani, sent seeds to England as early as 1699, and their real culture dates from that period. In 1870 impetus was given the culture through the work of Henry Eckford of England. Another improver was the well-known plant specialist, Thomas Laxton of England. In 1901, Silas Cole of England set the trade agog by bringing out the now famous Countess Spencer, which was a great improvement in size, texture, color and conformation. This was introduced in 1904, and now there are many sports from the Countess Spencer variety which are proving very popular. Enterprising seedsmen in America were not long in taking up the improvements brought out in England, the well-known firm of W. A. Burpee of Pennsylvania perhaps taking the lead. This firm alone has a two-acre garden given over exclusively to the cultivation of sweet peas. George W. Kerr, who has had many years' experience in England with the flower, recently edited a little booklet for the Burpee firm, which gives many helpful pointers on sweet peas.

Soil Considerations.—The ideal soil for sweet peas is a heavy, deep loam, inclined to stiffness. However, ordinary garden soil will produce good results. Do not plant the sweet peas on soil too poor to grow anything else. While a little shade will be particularly appreciated when the sun is hot in July and August, the plants should have plenty of light. Many successful growers plant in the open garden, where there is free circulation of air and sunshine.

The best preparation of the soil means a start the preceding fall. Dig a trench 24 to 30 inches deep, and mix the soil with light stable dressing or something to provide humus for the plants. Replace the soil, putting in a good layer of well-decayed cow manure, which is also covered with a few inches of dirt. Allow to remain over winter, and early the following spring the ground will be ready for planting. The trenches can be 18 to 24 inches wide for the rows, and rows themselves four to five feet apart.

Sowing.—There is little danger of sowing sweet pea seed too early. In fact, many believe in starting the seed the preceding fall. In the southern states fall planting can be safely done, perhaps in October, but in the latitude of New York, November and early December would be better. If they are sown too early they will get too much of a start and be frozen back through the winter. The ideal thing is to have the seed just nicely germinated before going into winter quarters. Of course the advantage of fall planting is to secure flowers early. In northern latitudes the advisability of fall planting is questionable.

Do not sow the seed less than two inches deep, and even three and four inches gives good results. When the young plants begin to grow and reach a height of three to six inches, it is easy enough to draw more soil to them to strengthen the stalks and keep the roots cool through the hot summer. An ounce of seed will sow about 15 feet in a row. Later thin out the plants to five to six inches. This will give better results, for if the plants stand too thick the vine growth will be dwarfed and flowers in proportion.

The methods of the sweet pea enthusiast, Rev. W. T. Hutchings, formerly of Massachusetts, now of Colorado, is interesting. He figures on the plants standing five inches apart in the row. To make sure of each plant coming, he puts the seed into separate papers and buries the packets for about a week in an inch of dirt. Then he selects the seed that has germinated first, and plants it as indicated. This gives an even stand and he knows exactly what to expect. His method is of special importance where seed is high priced. In ordinary practice amateurs sow sweet peas just about the same as they would ordinary garden sorts.

Culture.—The hoe and plenty of elbow grease back of it will be repaid many-fold through extra growth, size, and desirable bloom. The sweet pea is not unlike other plants in this respect, for frequent stirring of the soil conserves moisture and opens up the soil to the action of the elements. In hot, dry seasons many provide mulching in the form of straw, swale grass, or coarse stable manure. This may be made even more successful by thorough watering occasionally.

As to fertilizer, bone combinations are recognized as among the best. English gardeners recommend ordinary soot, this not only because of its fertilizing value, but also its action in keeping away insects. One method of using this is as follows: Take a peck of soot in a bag and let it dissolve for a few hours in a pail or tub of water. Guano may be used in the proportion of one pound to 20 gallons of the water. Farm yard manure in a liquid state, about the consistency of weak tea, is very good. Nitrate of soda should be used sparingly, and only at the start, to force the plants along.

One New York enthusiast gives the following experience: "Last year I sowed sweet peas early in May, along the east side of the house. A trench was dug six inches deep in which was placed some well-rotted cow manure. A little earth was placed over this, and the seeds sown. They were covered with about two inches of dirt. When peas were well up I placed eight-inch boards around the bed to hold in the dirt and as the plants grew I put in a mixture of two parts good, rich earth and one part well-rotted manure, also one part wood ashes. This was filled in occasionally until the soil was even with the top of the boards. July 1 the peas were three feet tall and had started blooming. They continued until November, and were a continual mass of blossoms, reaching a height of seven feet. They were watered almost every night after sundown."

Sweet peas are occasionally grown in greenhouses to furnish winter bloom. The early varieties will require two to three months to furnish profusion of bloom. They are usually started in pots, kept cool in the early stage, and later forced with heat

and well-rotted stable manure. The trailing type of sweet pea is best adapted to indoor culture. Occasionally, there is bother about buds dropping, especially if plants are overfertilized. This is not likely to continue beyond a few days when plants will assume the proper balance, and blossoms will appear as desired. Sweet pea seed germinates slowly. Therefore, the grower should not be in too big a hurry to dig out the seed or condemn it.

Enemies of the Sweet Pea.—Red spider and green aphis must be watched. They multiply rapidly and sap a tremendous amount of nourishment from the growing plants. Spraying with whale-oil soap, or a weak solution of kerosene oil, will be effective. Cutworms are occasionally destructive, especially if land has not been worked for two or three years. Trap crops, such as peas, lettuce, etc., have been used to protect the peas, also a dusting of tobacco powder about the plants. However, the poisoned bait, such as a little paris green mixed with bran or a few sprigs of clover dipped in paris green and placed for the cut worms to eat, is perhaps best of all. The blight occasionally appears and causes trouble, usually during dry seasons and when plants are cultivated shallow. The remedy is to plant the seed deeper and use every means to keep the vines growing vigorously.

Trellising.—Except in the dwarf and recumbent types, some means of support should be provided for the rapidly growing vines. The simplest method in vogue is brush. In other cases, various types of framework are provided. It is possible to drive posts and string wires or strings every few inches, beginning at the bottom and working up to the top

as the vines grow. An ordinary poultry wire nailed to posts furnishes a satisfactory support. This may be placed on a movable post and taken up each fall and wire rolled and set aside for another season.

Types and Varieties.—The varieties of sweet pea are legion. As far back as 1793, a London seed man listed five varieties, including the following colors: White, purple, scarlet, black, and painted lily. Three or four decades later yellow and striped variations appeared. Then came flesh pink, rose pink, etc. When Henry Eckford interested himself in the breeding and improvement of sweet peas in 1876, he soon had many variations and combinations of color, also of form and conformation. In 1898 there were about 150 specifically named sorts. Now there are many more.

The standard type of sweet peas for decades was the tall-growing sort for northern latitudes where climate is comparatively cool. California was among the first states in America to become interested in sweet peas. It was not long before the environment produced a variation of the tall sorts; a semi-dwarf more adapted to exposure where climate is dry and hot became recognized. This class is known as the Cupid sweet pea. Foliage is thick, dense, and reaches down well over the ground, protecting the roots from exposure. Another type is the Bush sweet pea, something similar to the Cupid as regards height and adaptability. However, foliage is not so dense and does not reach down to the ground as thoroughly. It is sufficiently dwarfed so that no support is needed. Still a third type is the Trailing sweet pea, where the vine is inclined to be recumbent. It seldom reaches more

than 18 inches in height, is an exceedingly early bloomer and adapted to sections further south than the standard sorts. This latter type is also recommended for growing under glass to furnish blooms for winter gardening.

Edwin Jenkins, superintendent of the Bellefontaine Gardens of Massachusetts, makes the following selection of varieties for producing satisfactory results in almost any garden. White: Dorothy Eckford, Nora Unwin, White Spencer. Pink: Countess Spencer, Gladys Unwin, Bolton's Pink. Primrose: James Grieve, Primrose Spencer, Mrs. Collier. Rose: John Ingham, George Herbert, E. J. Castle. Scarlet: Queen Alexandra, Marie Corelli, King Edward. Maroon: Black Knight, Othello, Duke of Westminster. Orange: Miss Wilmott, Helen Lewis, St. George. Light Blue: Flora Norton, Mrs. George Higginson, Jr., Romolo Piazzaini. Dark Blue: Lord Nelson, Navy Blue, Captain of the Blues. Variegated Blue: Helen Pierce, Prince Olaf, Phenomenal. Lavender: Asta Ohn, Frank Dolby, Lady Grisel, Hamilton.

Four Cardinal Don'ts.—When it comes to selecting varieties one can hardly do better than get in touch with some reputable seed grower who will provide a catalogue with full description for various types and strains. If one would succeed with sweet peas, there are four fundamental don'ts suggested by W. A. Burpee, the Pennsylvania seed grower, worthy of emphasis: (1) Don't expect sweet peas to thrive in soil too poor for any other culture, or in a sunless location. They need, as nearly as possible, a free deep loam and moderately rich freely cultivated soil. (2) Don't sow too shallow. Plant seed

at least two inches deep, and when plants are two to three inches tall draw more soil up to them in ridge form. (3) Don't overfeed with a view to obtain vigorous growth and profusion of growth. Bone in some form is the best fertilizer. Nitrate of soda will do for a hurry-up stimulant, but use it sparingly. (4) Don't gather the blooms grudgingly. The more you cut the longer the vine will continue to flower. Remember, when they go to seed, sweet peas will cease flowering.

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