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THE GERMINATION OF WEEVILED PEAS.

In the course of the comparison of varieties of peas and beans on the grounds of this Station, it has been necessary for us to investigate anew the subject of the germinating power of seeds infested by weevils; and as the results of these observations do not corroborate entirely the statements on this point in authoritative entomological works, it has been thought well to put on record a statement of these results.

Writers have disagreed in their estimate of the injury to the germinating power and vigor of the seed resulting from the work of the weevil, and while most have noticed the occasional destruction of the germ, and the consequent loss of the seed, the amount of injury has been very generally underestimated. Indeed, it is currently held in some localities that "buggy" peas are as good seed as those uninhabited by weevils, the only difference made being to sow the "buggy" seed a little more thickly to insure a full stand. Some seedsmen have participated in this delusion, as witnessed by the statement in Buist's *Garden Guide* (seed catalogue) for 1888 and for 1889 (page 68), from which we quote: "Some seasons peas are more or less punctured with the pea-bug, and many judge they are worthless from their appearance. These holes are caused by the sting of an insect called *Bruchus Pisi*, which deposits its egg while the pod is forming, and perfects the insect when the pea is subject to heat after ripening. Strange to say, the germ is never destroyed, and those which have the largest holes grow equal

to the most perfect. We explain this from the fact that we have frequently had customers remark that peas must be bad, as they had holes in them."

As showing the opinion of prominent authorities on this point, the following extracts are pertinent here: In the *Journal of the Royal Agricultural Society*, Vol. VII, (1846-7,) Mr. John Curtis gives the following, (page 420): "Latreille asserts . . . that the seeds will grow notwithstanding their inhabitants, which spare, owing to a wonderful instinct, the vital germ of the pea"; on page 422: ". . . as the beetles generally leave the germ uninjured, the vitality of infested seeds is not destroyed. I doubt, however, if they produce strong, healthy plants"; on page 440: "The maggots do not generally destroy the germ, so that the seeds will vegetate." In his important work, "Farm Insects," (1883,) on page 359, Mr. Curtis again quotes Latreille as above, and adds, in a foot-note: "This is the case with beans also."

In the report for 1849 of the U. S. Patent Office on Agriculture, on page 341, "W. P. F." states, apparently following Curtis in the main: "The vitality of the seed is not usually destroyed, as the egg is deposited in the side of the pea, where the insect, when hatched, emerges, leaving the germ uninjured. It is doubtful, however, whether the plants raised from such peas are as strong and healthy as those from perfect seed, and they should therefore never be used when it can be avoided."

Dr. Harris says (*Insects Inj. to Vegetation*, 1862, p. 63) the larva leaves the hull, "and generally the germ of the future sprout, untouched. Hence these buggy peas, as they are called by seedsmen and gardeners, will frequently sprout and grow when planted."

In the First Annual Report of the New York Experiment Station, 1882, page 142, it is stated, that "Our experiments showed that though peas that have been inhabited by the weevil will frequently germinate, they rarely make strong and productive plants. In one test of fifteen seeds, only two vegetated, and but one made a vigorous plant. In an experiment in germination with a larger number, 57.2 per cent. of the 'buggy' peas germinated."

Professor C. V. Riley, in the Third Missouri Report, page 47, says: "The larva feeds and grows apace, and generally avoids the germ of the future sprout, perhaps because it is distasteful, so that the most of the buggy peas will germinate as readily as those that have been untouched." Professor C. Thomas, in the Sixth Illinois Report, page 128, states that the larva "feeds upon the marrow, or albuminous portion of the pea, being careful not to eat the germ, probably, as has been suggested, because it is distasteful to it."

Most of the writers above quoted do not emphasize sufficiently, if indeed they recognize, the fact of the worthlessness of infested peas for seed. While the suggestion is often made that no buggy peas should be planted without first having taken some means to destroy the contained weevils, as by scald-

ing, or by the use of poisonous vapors in close receptacles, or by keeping the peas in sealed vessels until the weevils have died, let the beetles escaping should lay their eggs in the growing crop; yet the reader is left to infer that, whether this foresight be exercised or not, the peas will largely germinate and grow into plants, and penny-wise economy will still dictate the planting of infected seed. Now, as shown by the trials made in our gardens the past season, the facts are that in many more cases than allowed for by those who recognize a "wonderful instinct" governing the action of this insect, the germ is destroyed or injured. A germination test of weeviled beans in the greenhouse gave, out of 1,800 beans, representing eighteen sorts, the following results: Fifty per cent. started; of these, three-fifths might have grown into plants, as the injury was restricted to the seed-leaves. But the remaining two-fifths were variously mutilated by the loss of a part or the whole of the germ or plumule, so that under no circumstances could they have made plants. Here, then, but 30 per cent. could have passed the germinating stage, and these, owing to more or less considerable injury to the seed-leaves, would probably have made plants of low vigor. In a check lot of perfect beans of the same varieties and in the same numbers, planted alongside, 95 per cent. germinated.

Of five hundred peas of ten sorts tested in a similar manner, but one-fourth germinated, and the partial destruction of the cotyledons rendered the further growth of these doubtful. A check lot of the same number of sound peas gave a germination of 97 per cent. An examination of 275 injured peas showed but 69 in which the germ was not wholly or partially destroyed.

In a field test of the growth of sound as compared with weeviled peas, the results were more decisive from a practical standpoint. In this test 23 varieties were represented, each by 100 sound and 100 weeviled peas, taken as they came, without further selection. The seeds were planted in the garden in parallel rows the sound and weeviled peas of each sort side by side, the rows eighteen inches apart. The planting was done on the 5th of June, and the dryness of the season hindered the perfect germination and growth to a noticeable degree. Of the sound peas 68 per cent. came up, and 64 per cent. made strong plants. In 10 varieties of the weeviled peas no seeds germinated; the remaining 13 varieties were represented in all by 55 plants, or 4.4 per cent., in germination, of which but 49, or 3.5 per cent., grew to average size and strength.

The inference is plain, that weeviled seed should not be planted; because it is worthless compared with sound, and because by planting infested seed without more care than usually taken to destroy the contained weevils, one thus simply propagates the insect for the sake of a minimum of return in plants. The proper course is to throw infested seed into the fire as soon as the insects are detected. As an easy mode of separating the sound from the

unsound seed, it is suggested by Professor Riley, in his Third Missouri Report, that if thrown into water the infested seed will float, while the sound seed, being heavier, will sink.

GARDEN NOTES.

A TRIAL OF SECOND-CROP POTATO SEED.

The question of the influence of different qualities of seed upon the earliness and productiveness of a given variety of potatoes is one that has been much discussed, and the following experimental planting was made to test the value of three qualities of seed which we had in store: The seed of Lot I was grown from a planting made the middle of March, and harvested and stored in the cellar as they ripened. They had sprouted badly during the winter, and were a good deal shriveled. Lot II was from the main planting made the latter part of April and dug and stored in September. The tubers were quite firm, and had sprouted but moderately. Lot III was seed from a second crop grown in 1889 in the following way: A few hills each of several sorts, from the plat which produced the seed of Lot I, were dug July 11th, and the potatoes planted the same day on ground that had been cleared of early peas. These gave a light yield of tubers of even size and of very fine quality. When taken from the cellar for planting they were as firm and free from sprouts as when stored.

Three pounds of each of the above lots were cut to three-eye pieces, and planted March 18th. By reference to the appended table it will be seen that with one exception--the Cuyahoga--the sorts in Lot III were from five to eight days later than the others in coming up, while between Lots I and II no difference could be noted.

The vines of Lot III when they came were much stronger than the others, and in a few weeks overtook and outgrew the other lots, making a much more vigorous and heavy stand.

The date of blooming, though not varying uniformly on the whole, favors the vigorous plants of Lot III for earliness, and shows that the comparatively weak and slender plants of Lot I bloomed later, or in three cases failed to perfect any bloom.

The date at which they afforded potatoes of table quality did not vary appreciably in favor of either, but the product, both in quantity and quality, was largely in favor of Lot III.

The varying length of row planted, caused by the difference in the size of the tubers of the different lots, is corrected in the columns headed "Product to a rod of row," and from this the comparison should be made. While the product of Lot II was not, in all cases, much ahead of Lot I in weight, the per cent. of marketable tubers was greater, and these were of greater average size.

Summarizing the results of this trial we learn, first, that nothing is gained in earliness by the use of second-crop seed; second, that there is a positive gain in amount of product, as well as size of tubers, over that of first-crop seed grown in the same locality; third, that firm, well-kept, unsprouted seed is better than that which is sprouted and shriveled, giving a heavier product of better size and quality. These inferences may not be conclusive, but seem to be fairly deducible from the above results.

Name.	No. tubers in 3 lbs. planted.			No. of 5-eye pieces planted.			No. of feet of row planted.			First appearance, days from planting.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
Cuyahoga.....	12	8	12	54	36	48	57½	43	56	27	27	27
Durham.....	19	7	10	79	33	42	89	43	49	27	27	32
Early Harvest.....	15	10	12	58	49	50	61	48	62	27	27	32
Early Washington.....	39	10	17	118	58	72	115	69	81	29	29	34
New Queen.....	15	7	22	59	34	71	69	43	80	27	27	34
Rochester Favorite.....	19	8	12	82	43	48	85	49	55	27	27	35
Thorburn.....	19	8	12	64	35	52	68	42	57	27	27	35
Vanguard.....	13	8	21	51	48	74	59	57	81	27	27	35
White Prize.....	14	9	24	55	37	71	64	43	80	27	27	35

Name.	First bloom, days from planting.			Total product, pounds.			Product to a rod of row, pounds.			Av. wt. of marketable tubers, ounces.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
Cuyahoga.....	88	88	78	19½	14½	27½	5.66	5.57	8.11	14	2	4
Durham.....	92	73	78	19	11½	23½	3.52	4.51	7.35	2½	1½	3½
Early Harvest.....		73	78	11½	13½	25	3.19	4.65	6.66	1½	1½	3½
Early Washington.....			81	8	22	30½	1.13	5.26	6.26	2	2½	4½
New Queen.....	73	73	73	19½	20½	44	5.37	7.96	9.09	2½	2½	6½
Rochester Favorite.....		73	73	19½	17½	28½	3.83	5.93	8.48	2	2½	5
Thorburn.....	83	73	78	22½	18½	30½	5.40	7.28	8.91	2½	2½	4½
Vanguard.....	88	81	80	18½	17½	30½	5.11	5.07	6.17	2	2½	3½
White Prize.....	88	73	73	23	20	33	5.94	7.69	6.81	2	2	4½

SECOND-CROP POTATOES IN 1890.

Still further to test the practicability of growing the second crop of potatoes in one season, five pounds of seed of each variety in Lot III, as above mentioned, were dug July 23, and planted the same day, cut in half. These came up rather unevenly, the same fault having been noticed in the previous trial. The product was of unusually fine quality, and the yield a very good one, when it is considered that potatoes of ordinary planting were almost a failure in this section of country.

The list, with estimated yield per acre, is as follows:

	<i>Bushels.</i>		<i>Bushels.</i>	
Cuyahoga.....	173.3		Rochester Favorite.....	142.0
Durham.....	121.2		Thorburn.....	71.0
Early Harvest.....	93.8		Vanguard.....	67.2
Early Washington.....	74.2		White Prize.....	102.5
New Queen.....	99.3			

NOTES ON THE BEANS PLANTED IN THE SEASON OF 1890.

In the planting of the present year the list of beans included 194 varieties, of which 122 were bush-beans. These were planted May 17th and 19th on rich bottom soil, in row three and one-half feet apart, the hills two feet apart in the row for pole-beans and eighteen inches for the bush-beans. With the exception of two sorts they came up evenly and made a vigorous growth till the severe midsummer drought, when many sorts were entirely killed and of others the blossoms were so blighted by heat that no pods set.

Of the entire list, nineteen sorts proved able to survive the dry period and give a moderate product, or in some cases even a fair yield. These are given in the list below, arranged as nearly as possible in the order of their ability to resist drought :

- | | |
|------------------------------------|--|
| No. 85. Henderson's New Bush Lima. | No. 122. Southern Creaseback (three lots). |
| No. 83. Dwarf Carolina. | No. 155. Red Speckled Cutshort. |
| No. 193. Huntington's Bush Lima. | No. 60. Algerian Wax. |
| No. 91. Small Lima. | No. 196. Small Speckled Lima. |
| No. 78. Southern Prolific. | No. 76. Red Giant Wax. |
| No. 140. Kentucky Wonder. | No. 103. Turtle-soup. |
| No. 92. "Belcher." | No. 206. Yardlong. |
| No. 67. Dutch Case-knife. | No. 20. French Asparagus. |
| No. 90. (Unnamed.) | No. 12. Dun-colored Bush. |
| No. 71. Hungarian Butter. | |

Henderson's Bush Lima, which heads the list, deserves special mention as a really valuable addition to the list of beans that may be grown in this climate with profit. Grown on bottom land and on a badly-washed clay upland soil, it gave a product that would have been regarded as creditable even in a more favorable season. No. 193 seems to be absolutely identical with this, though in this lot the two differed slightly in yield, with the advantage in favor of the seed from Henderson.

Dwarf Carolina, as noted in our last Annual Report, is a Lima bean of a similar character to the preceding, both being related to the Small Lima, or Siva, and while equally hardy with the Henderson Dwarf Lima, and yielding nearly as well, the dark color of its beans when cooked is a forcible objection to the use of this sort on the table.

The "Belcher" bean, No. 92, was grown from seed supplied by a farmer living in Rooks county, Kansas, where this variety has been grown with profit even as a field crop. The name is local, being given because of its introduction by a farmer of that name. This variety closely resembles the Rhode Island Caseknife (see Second Annual Report, this Station, p. 140), but bloomed five days later and gave a profitable yield, while the Caseknife failed entirely. The "Belcher" was least injured by drought and heat of any white variety of the common bean (*Phaseolus vulgaris*) on trial in these gardens.

SOME JAPANESE BEANS.

The seed of the following list, excepting numbers 4 and 208, was procured from Japan by Professor Georgeson, and placed with this department for trial. The list was planted Map 19th, in rows three and a half feet apart. Numbers 5 to 9, inclusive, and number 205 were planted in drills two or three inches apart. The remaining numbers were planted in hills two feet apart.

While in productiveness several of these sorts are ahead of any of our common garden beans, and are reported to be of great nutritive value, their appearance and flavor when cooked do not commend them to the average American consumer, and a taste for them would need to be acquired. The three imported Soy beans seem to be specially commendable as resisting drought and heat to a degree surpassing all others on trial, and in ripening so uniformly that they may be pulled or cut, harvesting the crop at once without material loss from shelling.

No. 1. *Dolichos cultratus*--"Fuji mame" (Jap.).

A strong-growing pole bean, with leaves much resembling our common varieties of garden beans; leaflets broad, abruptly, acutely pointed, rather smooth and flat. The large, white flowers are borne in racemes 12 to 20 inches long, and are quite ornamental. The strongly curved, flat pods, 3 to 4 inches long and an inch or more wide, are nearly erect upon the stem instead of pendent, and are silvery green in color. These vines began to bloom about the first week in August, and continued to bloom and set pods in great abundance until cut off by frost. They were attacked so persistently by the common boll-worm that no ripe seed was secured.

No. 2. *Mucuna capitata*--"Osharaku-mame" (Jap.).

A strong-growing pole bean of straggling habit; leaves very large, thin, dark green, slightly pubescent, the outer portion of the basal leaflets very much broader than the inner. The first bloom August 7th. The deep purple flowers, an inch in length, are borne in crowded racemes, and are followed by densely hairy cylindrical pods 4 to 6 inches long; seeds about three-fourths of an inch long, oval, slightly flattened, smooth, polished, mottled gray. But few seeds of this matured before frost.

No. 3. *Canavalia incurva*--"Nata-mame." (Jap.).

A vigorous but rather slender pole bean, with very large leaflets, ovate or broadly lanceolate, nearly symmetrical, smooth, shining green; flowers large violet, pods eight to ten inches long, two to two and a half inches broad, and three-fourths of an inch thick, flat and straight; seeds oblong, an inch to an inch and a quarter long, slightly flattened, dull rose-colored. No seed matured before frost.

No. 4. *Canavalia* - sp?

This seed was obtained from Texas without name, and is included in this list from its evident relation to No. 3. The plants are very strong growers of bushy, branching habit, attaining a height of from two to two and a half feet. Judged by its leaves, flowers, and pods, there can be no question as to its generic position. The pods are nine to thirteen

inches long, an inch and a quarter wide, slightly curved, flat, pale green; seeds three-fourths of an inch long, oval, somewhat flattened, smooth, porcelain white. But few seeds matured. From its compact habit, handsome foliage, and showy violet flower-clusters, this would well repay cultivation as an ornamental plant.

No. 5. *Phaseolus radiatus*--"Adzuki" (Jap.).

Plants sixteen to twenty-four inches high; erect, but little branched; stalks and leaves slightly hairy; leaves composed of three leaflets which are more or less three-lobed, often the terminal leaflet is quite deeply lobed and the outer pair have only a slight indentation of the outer margin, in others the three leaflets are about equally lobed; flowers conspicuous, bright yellow; pods four to eight in a close raceme, linear, nearly cylindrical, three to four inches long; seeds oblong, one fourth inch long, with truncated ends, smooth, shining, dull red. The first pods were ripe August 7th, and the vines continued to bear freely till the first of September. They require gathering as they ripen, to avoid loss from shelling. The yield per acre was estimated at 628 pounds.

No. 6. *Phaseolus radiatus*--"Adzuki" (Jap.).

(Var. Black-podded.)

This has rather smaller and more uniformly lobed leaflets than the type, and is a little later. The pods, as they ripen, turn a peculiar grayish, not strictly black. No difference can be noted in the seeds. The yield per acre is estimated at 934 pounds.

No. 7. *Glycine hispida*--"Soy"--"Eda-mame" (Jap.).

Plants about two feet high, erect; strong growing; dark green; leaflets one to three inches long, ovate, entire; blossoms minute, white, in very short axillary racemes; pods one and one-half to two inches long, one-half to five-eighths inches broad, flat, a little curved, densely hairy, usually containing two or rarely three beans, and borne so freely as completely to hide the stalk in some cases; the seeds are one-fourth to three-eighths of an inch long, oval, or nearly round, smooth, greenish yellow. This was the earliest of the Soy beans, being fully ripe by August 29th. The plants continued vigorous through the severest drought of the summer, seeming to suffer little from it. The average yield per acre was estimated at 1,669 pounds.

No. 8. Soy--"Kiuski Daidzu" (Jap.).

Plants two and a half feet high, erect, rank growers, with dark-green foliage; stems and petioles hairy; leaflets wrinkled or folded along the midrib, narrowly ovate, or in some nearly lanceolate. The flowers closely resemble those of No. 7; the pods are slightly narrower, and the seeds a little smaller and more yellow in color. Ripened a week to ten days later. Average yield per acre estimated at 1,026 pounds.

No. 9. Soy--"Yamagata Cha-daidzu" (Jap.).

Plants two to two and a half feet high, quite spreading, and very rank, strong growers; leaves larger and coarser than in Nos. 7 and 8; blossoms of about the same size as the others, but of a deep violet color; pods two to three inches long, three-fourths of an inch wide, densely hairy, often having three beans in a pod; seeds three-eighths of an inch long, oval, dull brown in color. Began bearing the latter part of August and continued till frost. The average yield per acre estimated at 1,693 pounds.

No. 208. "Soja"-*Glycine hispida* (Wood).

The seed of this was received from T. W. Wood & Sons, of Richmond, Va., and the results obtained are shown for comparison with the Japanese varieties. Planted at the same time, they were only in first bloom August 27th, when No. 7 of the Japanese list was nearly ripened. The vines grew rank and succulent, three to four feet high. No pods were ripened till late in September, and further production was cut short by frost. The estimated yield per acre was 496 pounds.

CABBAGES.

Ninety-four varieties of cabbage were included in the planting of 1890. Twenty-five strong plants of each sort were set May 10, in rows three and a half feet apart, and two feet apart in the row. Three times during the severest drought, the ground was thoroughly irrigated from the water works. With this help, some of the more vigorous sorts gave a fair return, but many failed to perfect any heads of value. All varieties sustained considerable injury from the Cabbage Plusia and the Cabbage Aphis, and the weight of heads marketed was materially reduced by stripping off the injured leaves. The figures given are net weights, and the numbers show the number of heads of marketable quality out of the twenty-five plants set. The more productive sorts are arranged in the following list according to their hardiness and value, under the three heads of Early, Medium, and late:

Early Varieties.

- No. 4. Burpee's All Head. Burpee. 22 heads weighed 31½ pounds.
- No. 27. Early Newark Flat Dutch. Wilson. 23 heads weighed 31½ pounds.
- No. 35. Early Schweinfurth. Henderson. 16 heads weighed 28½ pounds; heads very solid, of good quality.
- No. 25. New Peerless Early. Burpee. 17 heads weighed 26 pounds.
- No. 24. Low's Peerless Early. Farquhar. 16 heads weighed 25 1/2 pounds.
- No. 13. Henderson's Early Summer. Henderson. 19 heads weighed 22½ pounds.
- No. 6. Denmark Drumhead. Vaughan. 13 heads weighed 21 1/2 pounds.
- No. 68. Early Etampes. Vaughan. 22 heads weighed 20 1/2 pounds; heads rather soft.
- No. 9. Deep Head Brunswick. Farquhar. 19 heads weighed 19½ pounds.
- No. 47. Early Wyman. Farquhar, 14 heads weighed 16½ pounds.
- No. 71. Everitt's Earliest. Everitt. 13 heads weighed 15 pounds; lacking in firmness.
- No. 64. Long Island Wakefield. Hallock. 12 heads weighed 14 pounds.
- No. 2. Bergen. Perry. 13 heads weighed 11½ pounds.

Medium Varieties.

- No. 14. Henderson's Succession. Henderson. Twenty-five heads weighed 41 pounds. The most productive cabbage on the list.
- No. 50. The Reynolds. Gregory. Twenty-two heads weighed 39½ pounds.
- No. 60. Cassell. Vaughan. Seventeen heads weighed 28 pounds.
- No. 49. Vaughan's Market Gardener. Vaughan. Eighteen heads weighed 26 pounds.

- No. 86. Stone Mason. Vaughan.
- No. 19. Fottler's Improved Brunswick. Henderson. Eighteen heads weighed 23 1/2 pounds.
36. Stone Mason. Vaughan. Fifteen heads weighed 21 pounds.
Heads very solid.
- No. 45. Everitt's Early Giant. Everitt. Eighteen heads weighed 21½ pounds.
- No. 39. Burpee's Surehead. Vaughan. Twenty-two heads weighed 21½ pounds.
- No. 41. Vandergaw. Burpee. Twelve heads weighed 20 pounds.
- No. 32. Henderson's Autumn King. Henderson. Fifteen heads weighed 17 pounds.
- No. 1. All Seasons. Vaughan. Thirteen heads weighed 16½1/2 pounds.
- No. 34. Quintal Drumhead. Ferry. Fourteen heads weighed 16½1/2 pounds.
- No. 28. Berks County Flat Dutch. Vaughan. Fifteen heads weighed 14½1/2 pounds.
- No. 18. Chase's Excelsior. Ferry. Twelve heads weighed 13 1/2 pounds.
- Late Varieties*
- No. 29. Henderson's Selected Late Flat Dutch. Henderson. 21 heads weighed 31 1/2 pounds.
- No. 38. Burpee's Surehead. Burpee. 19 heads weighed 30½1/2 pounds.
- No. 40. Warren's Improved. Vaughan. 16 heads weighed 28½1/2 pounds.
- No. 17. Excelsior Late Flat Dutch. Hallock. 22 heads weighed 26 1/2 pounds.
- No. 52. Warren's Improved Drumhead. Farquhar. 14 heads weighed 25½1/2 pounds.
- No. 78. Filderkraut. Henderson. 17 heads weighed 21 pounds.
- No. 20. Bridgeport Late Drumhead. Vaughan. 7 heads weighed 14½1/2 pounds.
- No. 16. Hyde Park. Vaughan. 10 heads weighed 14½ pound?.
- No. 51. Royal Drumhead. Johnson & Stokes. 12 heads weighed 13½1/2 pounds.
- No. 22. Large Late American Drumhead. Vaughan. 12 heads weighed 12½1/2 pounds.