OREGON VEGETABLE Digest

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How Much Do Nitidulid Beetles Affect Bean Blossom Drop?

The problem of blossom-drop of green beans received considerable attention from growers in 1961. In the March 1961 issue of the Oregon County Agents' Vegetable Newsletter, Andy Duncan, Oregon State's Extension Vegetable Crop Specialist, pointed out the various factors which might, either singly or in combination, bring about the failure of blossoms to set pods. One of the factors mentioned was insects, and the black nitidulid pollen beetle has been the most commonly accused.

Early studies on this insect, with small cages containing different numbers of beetles, indicated strongly that populations averaging six to eight per blossom could be correlated with blossom drop. Later studies, made to see if the early results could be repeated, have failed to produce conclusive evidence that these insects are important in blossom drop.

There is no doubt that nitidulids can damage blossoms when the beetles are present in large numbers. They are known to rag red clover blossoms to the point where the florets turn brown and are no longer attractive to pollenating bees, thus greatly reducing seed yield. The solution in this case is to spray or dust with Toxaphene, an insecticide chosen more for its low toxicity to honey bees than for its effectiveness against the "nits." With the

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Vegetable Crops Field Day Planned for August 2

You are invited to view research plots at the OSU Vegetable Research Farm August 2. The field day begins at 2:00 pm PDT (1:00 pm PST). Major emphasis will be on bush and pole bean breeding and cultural studies, although there will be opportunity to see work on other crops -- sweet corn, broccoli and other crucifers, carrots, peas, onions, and tomatoes. Also included will be work on various phases of weed control, slug control, symphylid control, and pesticide residues.

To reach the Vegetable Research Farm, cross the Van Buren street bridge going east from Corvallis, then turn left on Smith Lane (about one-half mile from bridge); proceed past the Botany and Plant Pathology Farm, and through the "cut." Parking areas will be designated.

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Nitidulid Beetle . . . (Continued from page 1)

beetle population cut down temporarily by the insecticide, the field will "color up" with new florets and a set of seed is possible.

With beans, observations have repeatedly shown that the beetles can damage the blossoms by feeding on the pollen and flower parts, especially if this takes place before blossoms have opened. The problem is, "How much do nitidulids contribute to the blossom drop which, in bush beans especially, could reduce the yield of green beans?"

The black nitidulid pollen beetle has a rather strange life history. Winter is spent as an adult in sheltered places, such as thick moss on trees. Beetles appear in the spring about the time wild mustard (Brassica campestris) comes into full bloom. Pollen from these and other spring flowers is apparently a main food source. When vetch (and to some extent clover) starts to bloom, female beetles deposit eggs in the individual florets and then die. The legless larvae or grubs, hatching from these eggs, feed within the flowers until mature. Strangely, this larval feeding does not seem to harm the legume flowers or affect their ability to set pods. Pupation takes place under debris on the surface of the ground or actually in the soil. After about 2 weeks the adult beetle is formed and flights from vetch in fields and roadsides begin. In normal seasons one may expect to find the first of the new generation in the flowers of various plants about July 4. Numbers may then build up until the last week of the month, after which the beetles start seeking hibernation quarters. Few nitidulids can be found after mid-August. There is only one generation per year and the beetles spend about 6 months in hibernation.

Studies on the relationship between nitidulids and blossom drop must be conducted largely during the 3-week period in July when populations are at their peak. This period coincides with the main blooming period of green beans and the time of the year when high temperatures are most likely to occur. In 1960 an attempt was made at the University Vegetable Farm, in the short time that is annually available, to gather information on visual stimuli which attract the flying beetles to bean plants. It was concluded that the beetles were attracted to yellow or white surfaces in a rough ratio to the amount of light falling on those surfaces. This type of finding might suggest the development of beetle traps or lures.

Before continuing research on behavior, definite establishment of the relationship between nitidulid activity and blossom drop would seem to be in order. Cage trials conducted in 1960 were so inconsistent that no conclusion could be drawn. Two attempts to determine the numbers of beetles necessary to effect blossom drop in 1961 were interesting enough to justify a summarization here.

Cage trials involve confining different numbers of nitidulids to a bean raceme from which all blossoms and buds have been removed--with the exception of one or two buds judged to be within a day or so of opening. The raceme is selected and prepared;

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beetles collected in a net are counted into a small, sleeve-type, plastic screen cage; then the cage is placed over the raceme and tied securely to its base by means of the cloth sleeve extending from the open end. Another series of prepared racemes are tagged, but left uncaged, as checks for comparison with field pod-set during the same period of time. After 4 days to a week, when pod set is complete (as determined by an examination of the uncaged checks), the cages are removed and pod counts made.

In the first 1961 trial on bush beans, two buds were left on each raceme and 10 cages were used for each level of nitidulid population. The results were as follows:

No. beetles per cage:	0	4	8	12	Uncaged
Mean no. pods set:	1.9	1.9	1.9	1.1	1.9
Percent pod set:	95	95	95	55	95

Field population of nitidulids
during test period: July 13 -- 4.1 per blossom
July 21 -- 5.9 per blossom

Max. temps. during test period: 81, 84, 82, 86, 86, 84, 84, and 76°F.

Assuming that the beetles in any one cage distributed themselves about equally on each of the two blossoms, these results again suggested that six beetles per blossom may be the limit beyond which we might expect some blossom drop.

In the second 1961 test, bush bean racemes were stripped to only one blossom bud each, judged to be within a day or two of opening. The results of this trial were as follows:

No. beetles per cage:	4	6	8	10	Uncaged
Mean no. pods set:	1.0	0.9	0.9	0.9	1.0
Percent pod set:	100	90	90	90	100

Field population of nitidulids
during test period: July 28 -- 9.5 per blossom
July 31 -- 10.1 per blossom

Max. temps. during test period (July 28-Aug. 5): 76, 83, 85, 81, 86, 90, 92, 81, and 77°F.

Thus, unless our techniques are at fault, nitidulids at populations up to 10 per blossom do not appear to be important in blossom drop. The fact that none of the uncaged blossoms failed to set with field populations estimated at 10 beetles per blossom (as determined by counts on 100 newly opened blossoms taken at random in the bean planting) helps to support this conclusion.

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Status of 1962 Snap Bean Selections

The following snap bean breeding material is being tested in 1962:

Advanced pole Blue Lake lines. OSU selections 284, 2244, 991, are being tested through courtesy of several growers and processing firms in the Willamette Valley. These lines are being increased by seedsmen for larger pilot tests in the future. A replicated test of 14 lines or varieties will be run at Corvallis.

New pole Blue Lake lines. New hybrid combinations, followed by selection, have been made, and approximately 500 of these new lines are on trial in small plots at the Vegetable Research Farm, Corvallis. A shift in emphasis to pole lines involving not only apparent yielding ability but resistance to rust, root rot, and viruses is being made. This will involve approximately 300 additional lines in the disease-test plot at Corvallis; some selections were tested in the field in 1961, and in the greenhouse during fall and winter of 1961-62.

To secure resistance to the current strains of rust occurring in western Oregon, it has been necessary to use breeding material other than Blue Lake. Backcrossing to Blue Lake pole and bush types is being done to recover desirable pod types. Of approximately 15,000 plants tested for rust in the field during 1961, 280 selections were made. Correlation between field and greenhouse rust tests has been relatively high. All rust resistant lines are being tested for root rot resistance. Distinctly high levels of resistance to root rot (approaching immunity) are not available in snap beans, but lines with varying tolerances are being selected. Some lines germinate rapidly; under certain environmental conditions they are able to make relatively good early growth.

Advanced bush bean lines derived from Blue Lake. Several of these lines are under 1962 pilot test by growers and processors. Seedsmen are increasing five lines for larger commercial plantings in 1963. None of these lines have been named or released for uncontrolled seed increase. Progeny of the 10th backcross of Blue Lake to bush segregates will be selected at the OSU Vegetable Research Farm in 1962. It is contemplated that this will be the last backcross.

At the North Willamette Experiment Station, Aurora, all advanced OSU bush lines derived from Blue Lake (available for pilot trial) will be grown in commercial-size blocks, along with Tendercrop.

New bush bean lines derived from Blue Lake. The most recent single plant selections will be grown at Corvallis. There are approximately 400 of these lines.

New bush bean lines derived from Tendercrop and/or Puregold hybridized with OSU bush lines. Approximately 1,500 selections (F3, F4, F5) will be grown at Corvallis. An unusually large planting--about 10 acres--of segregating F3 progeny involving complex crosses of Tendercrop, Puregold, and OSU Blue Lake-derived bushes will be planted at the North Willamette Experiment Station. Approximately 150 bush lines of complex parentage will be planted in the disease plot at Corvallis for selection against rust, root rot, and viruses.

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Snap Bean Selections . . . (Continued from page 4)

The most promising of the new F3, F4, F5 lines will be run through preliminary processing quality test; some expansion of this phase of the work is contemplated.

Irradiated bushes derived from Blue Lake. The R2 generation will be grown principally at the North Willamette Experiment Station. Some selections and massed progeny will be grown at Corvallis. The objective is to induce and find a mutation for improved bush habit.

Romano material. Limited numbers of selections of Romano X Blue Lake (pole or bush) derived selections and backcrosses (to Romano) will be grown at Corvallis.

Other lines or varieties. Some new breeding lines from seedsmen (bush types) will be grown for observation. Limited numbers of lines from Wisconsin and from the USDA will also be grown at Corvallis. A few lines of interspecific origin (snap, runner, lima beans) will be grown at Corvallis.

Unusually cool weather in May will likely result in relatively late maturity of snap beans this year. Even so, it is anticipated that much of the material listed here will be maturing from the last week in July to mid-August. Some late planted material should be available for observation by visitors at the science meetings in late August. Note the field day announcement in this issue of Oregon Vegetable Digest.

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Vegetable Note . . .

August 26-31 are the dates for the joint meetings of the American Institute of Biological Sciences and the Pacific Division of the American Association for the Advancement of Science on the Oregon State University campus. Scientists from many parts of the United States and Canada will be attending the national meeting of the American Society for Horticultural Science, a member society of AIBS. Papers will be be presented on various phases of vegetable research as well as research on other horticultural crops in sessions scheduled for Monday through Wednesday.

Vegetable crops sessions will be held in Cordley Hall, Room 135, morning and afternoon, Monday, Tuesday, Wednesday, August 27,28,29.

Results of Broccoli Trial Reported

Because of the current interest in uniform broccoli for more efficient harvest, a number of the latest broccoli releases and experimental hybrids were grown for observation and comparison with Northwest Waltham on the Vegetable Research Farm at Corvallis in 1961. Each variety was grown in three plots, consisting of the seed plot thinned to approximately 12 plants 24 inches apart and two transplanted plots of 12 plants, also 24 inches apart. An exception was Waltham 29, because there were only enough plants for the seed plot. Spartan Early was also deficient in number of plants, with the result that no selection for transplant uniformity could be made. The number of plants for this variety as shown in Table 1 was low due to losses. Its performance was also affected.

Broccoli was seeded June 10 and transplanted July 10. Rows were 42 inches apart. Approximately 400 lbs./acre of 8-24-8 fertilizer was banded prior to planting and an additional 500 lbs./acre was side-dressed before heading started. Water was applied every 10-14 days as needed and available.

Records were taken on each plot and later compiled into a single composite observation for each variety. Yield figures, which are at best only approximations because of the variability of this crop, were obtained by twice-weekly cutting (to 5 inch lengths) of all usable center heads and side shoots, as long as a given variety appeared to produce enough to make cutting feasible. Some later varieties were still producing some usable shoots when all cutting was terminated on October 10. Table 2 gives the total number of plants grown and composite yields for the three plots of each variety.

It should be recognized that some of the varieties grown may not be adapted to the same season as others. A single planting date trial would not allow evaluation of all varieties at their full potential.

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Vegetable Note...

Studies made in the spring of 1961 near El Centro, California, by Shadbolt, McCoy, and Little indicate that soil temperature at 1-inch depth on the top surface of lettuce beds varied with direction of orientation. On all of the beds except that oriented in a northwest-southeast direction, one side of the bed was 5 to 7^{o}F. warmer than the other. In all cases where this difference occurred, the side of the bed with a southerly or easterly exposure was warmer. The warmest bed was that oriented in a north-south direction, while the coolest bed was in a northeast-southwest direction. Results of the study indicate the possibility that wind had a greater influence on soil temperature than did the angle of the sun.
(Proc. Amer. Soc. Hort. Sci. 78:488-495. 1961.)

Broccoli Trial . . . (Continued from page 6)

Table 1. Observations of Broccoli Varieties, 1961

Variety	Source*	Unif.**	Vigor	Branch	Florets Size	Florets Unif.	Gen. color	Notes
Hybrid 62	1	3	3	4	M	3	G	Heads much too leafy with rosettes and segmentation; general head shape okay.
Hybrid 1	2	3	5	2	S	4	P	Fine florets but rough leafy heads. Too many high wrapper leaves; heads become very rough if past the very fine floret stage.
Coastal	3	3	3	1	S-M	2	V G	Neat plant; excellent color; some rosettes and open florets; too short for easy cutting of a 5" head; some bull plants.
Atlantic	3	4	2	4	S	3	F-P	Quite leafy, too many leaves close to head; many open green florets; some rosettes.
Hybrid 10	2	2	4	2	S-M	2	F-P	Few usable center heads; long heads on some, others with high leaves; too variable in plant type; side shoots better than center heads.
4638	2	2	4	3	S-M	3	G	Center heads quite leafy--too many high leaves; side shoots often thin, weak, and rough.
Hybrid 60-1	4	2	2	4	S-L	3	V G	Too many small heads with coarse florets.
Spartan Early	5	3	2	2	M	2	F-P	Many bad rosettes in heads; too short to cut a normal head without cutting down in the leafy stem; side-shoots often too short to use.
N. W. Waltham	6	3	4	2	S-M	3	F-P	Very good producer of center heads of best general form; a few rough and leafy; side shoots often large and heavy; not uniform maturity; spear color somewhat light.
Waltham 29	6	3	3	3	S	4	F	Good head form and heavy side shoots; spear color somewhat light but floret color good.

* Sources: 1--Dessert Seed Co; 2--Ferry Morse; 3--Asgrow; 4--Burpee; 5--Michigan State University; 6--W. B. Newburg, Birds-Eye.

** Uniformity, vigor, branching, and floret uniformity scores all based on 1-5 ratings, with the highest ratings for greatest vigor, best uniformity, etc. Floret size is expressed as S-small, M-medium, or L-large. Color is given as P-poor, F-fair, G-good, and VG-very good.

Broccoli Trial . . . (Continued from page 7)

Table 2. Evaluation of Broccoli Varieties, 1961

Variety	No. plants	Center heads No.	Center heads Wt.*	Center heads Av. wt.	Center heads Size range	Side shoots No.	Side shoots Wt.	Side shoots Av. wt.	% Plants** with C.H.	C.H. harvest dates*** First	C.H. harvest dates*** Last
Hybrid 62	33	19	8.9	.47	3-6"	133	11.4	.08	58	8-12	8-29
Hybrid 1	37	26	13.9	.53	2-8	162	18.8	.12	70	8-25	9-25
Coastal	36	20	7.1	.36	3-6	159	11.8	.07	56	8-12	9-6
Atlantic	33	17	5.0	.29	3-6	278	21.2	.08	52	8-21	9-9
Hybrid 10	36	12	7.0	.58	2½-7	129	13.1	.10	33	8-29	10-2
4638	37	26	8.5	.33	2-5½	260	21.1	.08	70	8-21	9-19
Hybrid 60-1	33	8	2.6	.33	3-6	147	10.4	.07	24	8-12	8-21
Spartan Early	28	19	6.2	.33	2-6	91	7.9	.09	68	8-12	9-19
N. W. Waltham	35	25	11.8	.47	2-7	211	19.6	.09	71	8-25	9-19
Waltham 29	10	7	4.4	.63	2-6	61	6.7	.11	70	8-25	9-25

* All weights in lbs.
** Percentage of plants producing usable center heads, disregarding size of the heads.
*** First and last dates of harvest of center heads. A portion of the total spread in harvest period is due to about one week's difference between the seeded plot and the two transplanted plots. Varieties differed in length of this delay period.

Effect of Irrigation and Nitrogen on Bush Bean Quality

In recent years it has been shown that a number of things affect sloughing and splitting of canned snap beans. In measuring differences that occurred in snap beans grown under different conditions, it was necessary to apply a number of objective tests to detect minor differences in quality. The tests included color, firmness, percent seed, percent fiber, percent sloughing, water-soluble pectin, and count of pollywog beans.

Effect of time and amount of application of water to beans was determined in a test on OSU-949 bush beans. The times of water application were divided into three treatments: (1) M1 -- regular irrigation; (2) M2 -- no irrigation until bloom, then irrigated; and (3) M3 -- irrigation until bloom, then no irrigation. Moisture treatments were not replicated in this test. Bean yields from two nitrogen treatments at each of the moisture levels are shown in Table 1. The pods of the M2 and M3 treatments were more crooked and shorter. Percentages of seed and fiber were higher where no water was applied after bloom. Color appeared to be comparable in beans grown under the different conditions as measured by the Hunter Color and Color Difference Meter.

Beans that were grown without irrigation after blooming were more susceptible to sloughing, and cell-wall constituents were more loosely bound (Table 1). The water-soluble pectin in the liquor of canned beans correlated with the firmness of the canned beans although these data are not shown. There were no differences in sloughing and water-soluble pectin due to nitrogen level. Wide differences were obtained between sieve sizes 3 and 6 in color, percent seed, percent fiber, percent sloughing, and water-soluble pectin. Sieve size 6 beans were more susceptible to sloughing, and they were higher in water-soluble pectin.

To compare the Blue Lake type bush bean selection, OSU-949, with a standard bush variety, Tendercrop, a test was conducted in which 1, 2, and 3 irrigations were applied in replicated plots. This test was in cooperation with personnel of the departments of Soils and Agricultural Engineering. OSU-949 beans were darker in color under all irrigation levels (Table 2). In all instances, sieve size 6 beans were lighter in color than sieve size 3 beans. Tendercrop variety had lower seed percentages in both sizes and at the three moisture levels, although the differences were not great. At the same time, OSU-949 was lower in fiber in both sieve sizes and at the three water levels.

Tendercrop beans were more susceptible to sloughing and splitting than OSU-949 beans under all conditions; yet the water-soluble pectin content was lower in the Tendercrop variety. Since the Tendercrop bean has a starchy-like taste, it was assumed that sugars were transformed into starch instead of pectin. The shear-press measurement of firmness indicated that Tendercrop was less firm than OSU-949 when packed under comparable conditions. In yield and pollywog beans, Tendercrop was superior to the OSU-949 selection, although yield differences were not too great. It was recognized prior to this test that the older selection of OSU-949 was subject to crooking and pollywogs, but the newer selections from this cross have overcome much of this weak characteristic. Shortage of irrigation water to the point where a moisture stress was imposed tended to accentuate this weakness.

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Effect of Irrigation and Nitrogen . . . (Continued from page 9)

These two experiments emphasize the importance of adequate and proper timing of irrigation applications when growing bush beans for canning. Obviously, increase in pollywog beans due to moisture stress would show up in lower case pack-outs per ton. When OSU-bush selections become available for canning, firmer canned beans with less sloughing can be expected than are presently available from commercial bush bean varieties.

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Vegetable Notes . . .

Wiseman, Hall, and Painter of Kansas State University reported that striped and spotted cucumber beetles, when permitted to choose food from among a large number of Cucurbit varieties, showed definite preferences for certain ones. From this study it would appear that the muskmelon varieties Hearts of Gold and P.M.R. 4-50 may be useful as sources of resistance to the spotted beetle.
(Proc. Amer. Soc. Hort. Sci. 78:379-384. 1961.)

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Defoliation at the three leaf stage of development or within three weeks of harvest caused relatively little loss in yield of Downing Yellow Globe onions. Defoliation at the time of maximum vegetative development and while the bulb was enlarging up to about an inch in diameter caused the greatest reduction in yield and bulb size. Work was done in Indiana by Baker and Wilcox to gain information on onion yield losses caused by different amounts of defoliation and stand reductions at different stages of plant growth.
(Proc. Amer. Soc. Hort. Sci. 78:400-405. 1961.)

Effect of Irrigation and Nitrogen . . . (Continued from page 10)

Table 1. Effect of Irrigation Time and Nitrogen Level on the Quality of OSU-949 Bush Beans

Treatment	Sieve size	Hunter color "Rd"	"a"	"b"	Seed	Fiber	Sloughing	W-S pectin
					%	%	%	Mgs/100ml
M1--35 lbs. N	3	8.3	0.8	11.7	5.10	.056	.207	153
"	6	8.8	0.3	13.9	8.87	.085	.244	228
M1--140 lbs. N	3	7.4	0.5	12.1	4.56	.042	.205	157
"	6	9.2	0.5	13.2	7.39	.093	.246	224
M2--35 lbs. N	3	7.6	0.5	11.7	5.45	.035	.218	180
"	6	9.0	0.6	12.6	8.20	.093	.255	235
M2--140 lbs. N.	3	8.2	0.8	12.8	4.79	.027	.218	180
"	6	10.2	0.5	13.8	7.97	.105	.261	235
M3--35 lbs. N.	3	9.9	0.8	14.9	7.37	.042	.233	245
"	6	9.1	0.7	13.1	12.15	.111	.299	296
M3--140 lbs. N.	3	8.2	0.5	13.2	7.91	.052	.256	245
"	6	8.4	0.5	11.8	12.34	.110	.316	299

M1 -- Regular irrigation, June 15, 23; July 3, 13, and 20.
M2 -- Dry early until bloom; then irrigated July 3, 13, and 20.
M3 -- Wet early, irrigated June 15 and 23; then dry.

Treatment	Nitrogen	Yield
	(Lbs./A)	Tons/A
M1	35	5.08
	140	5.70
M2	35	5.15
	140	5.23
M3	35	4.01
	140	4.28

Effect of Irrigation and Nitrogen . . . (Continued from page 11)

Table 2. Effect of Irrigation Levels on the Quality of Tendercrop and OSU-949 Bush Beans for Canning

Treatment	Sieve size	Hunter color "Rd"	"a"	"b"	Seed	Fiber
M2-949	3	7.9	0.7	12.4	3.30	.0266
949	6	8.3	0.5	11.3	4.49	.0446
M2-Tendercrop	3	8.7	0.6	13.0	2.80	.0411
Tendercrop	6	10.1	1.0	13.3	3.81	.0599
M3-949	3	8.9	0.7	12.8	3.67	.0257
949	6	10.7	1.0	15.1	7.35	.0584
M3-Tendercrop	3	8.2	0.6	12.7	3.57	.0397
Tendercrop	6	11.2	0.9	14.5	5.20	.0793
M4-949	3	8.2	0.7	13.0	3.96	.0248
949	6	9.9	1.1	14.3	6.29	.0346
M4-Tendercrop	3	8.8	0.8	13.4	3.25	.0427
Tendercrop	6	9.8	1.3	12.7	5.76	.0704

Table 2. (Continued)

Treatment	Sieve size	Sloughing %	W-S pectin Mgs/100ml	Shear-press Maximum force (lbs.)	Area under curve (lbs.)
M2-949	3	.185	249	64.0	64.0
949	6	.233	283	71.2	77.6
M2-Tendercrop	3	.274	199	54.4	43.2
Tendercrop	6	.436	227	57.6	53.6
M3-949	3	.196	213	76.8	80.0
949	6	.304	240	75.2	76.0
M3-Tendercrop	3	.279	143	51.2	44.0
Tendercrop	6	.438	231	55.2	49.6
M4-949	3	.218	171	70.4	72.0
949	6	.275	198	67.2	67.2
M4-Tendercrop	3	.300	156	48.0	46.4
Tendercrop	6	.436	223	57.6	53.6

Treatment	No. of irrigations	Water Inches	949 Yield/Acre	TC Yield/Acre	No. pollywog beans in 2 lb. sample 949	TC
M2	1	3.2	2.77	3.04	231	127
M3	2	6.0	4.67	4.59	115	53
M4	3	7.6	5.17	6.15	90	49