Highest Bush Bean Yield With One-Foot Spacing

Horticulture Society
Meets November 17-18

The 75th annual meeting of the Oregon State Horticultural Society will be held at Oregon State College on Thursday and Friday, November 17 and 18.

Program for the vegetable section is being planned by a committee headed by Walter E. Evonuk of Eugene. General sessions, commercial and educational exhibits, and a banquet are scheduled.

W. J. Hazeltine of Parkdale is president of the Society.

Remember the dates—November 17 and 18.

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Highest yields and dollar values of bush beans were obtained from a spacing of one foot between rows in experiments conducted in 1958 and 1960 at Corvallis.

Potentialities of increasing yield through use of closer row spacings were the basis for tests conducted on Processor bush beans in 1958 and on a Blue Lake dwarf type, OSC 412, in 1960. Row spacings were 1.0, 1.5, 2.0, 2.5, and 3.0 feet between rows with an average of seven to eight plants per foot within rows.

Plots were 25 feet long, four rows per plot, with one or two of the center rows being harvested for yield records. Yields are based on a "once-over" harvest by hand. Plants were pulled and completely stripped of pods of all sizes.

In 1958 a broadcast application of 800 pounds 11-48 fertilizer per acre was used and in 1960, 800 pounds 8-24-8 fertilizer per acre was broadcast and disked in prior to planting. Irrigation was the same for all treatments.

Differences in yields from the row spacings are highly significant (Table 1). Yields at the 3-foot row spacing were

(Continued next page)
Bush Bean Spacing . . . (Continued from page 1)

unusually high but the greatest increases in yields were obtained when row spacings were reduced from 1.5 to 1.0 feet. The yield, expressed in pounds of beans per square foot, increased as row spacings were reduced. Spacings of plants within the row were not varied in this test.

Grades of Processor bush beans in 1958 were very good and averaged approximately 60% in sieve sizes 1-2-3, 30% in sieve size 4, and the remaining 10% in sieve size 5. OSC 412 grades in 1960 were approximately 30% in sieve sizes 1-2-3, 35% in sieve size 4, 30% in sieve size 5, and 5% in sieve size 6.

Dollar returns as influenced by the row spacing treatments are presented in Table 2. Greatest values were obtained from the closer row spacings. Picking costs were estimated at $65 per ton. Seed costs were based on an estimated 40¢ per pound of seed. The quantity necessary for obtaining seven to eight plants per foot of row is based on seeding at the different row spacings at a rate of 10 seeds per foot of row (1,600 seeds per pound). These rates ranged from 90 to 270 pounds of seed per acre.

Earlier work on bush beans by Smith and Frazier at Oregon State College, reported in Oregon Vegetable Digest, Vol. I, No. 3, October 1952, showed that a spacing of one foot between rows resulted in significant yield increases over two- and three-foot row spacings. Yields were 8.1, 6.1, and 4.9 tons per acre, respectively, for the variety Top Crop.

It is now impractical to reduce row spacings below 24 to 36 inches because of harvest limitation by mechanical harvesters or by hand. Possible incidence of white mold, and possibly other factors, would also need to be considered at closer row spacings. Data are interesting, however, in indicating the possibility of a high yield potential of bush beans grown at close row spacings in this area.

--H. J. Mack and W. A. Frazier
Horticulture Department

Table 1
Effect of Row Spacing on Yield of Bush Beans in Corvallis

<table>
<thead>
<tr>
<th>Treatment spacing between rows (ft.)</th>
<th>Yield 1958</th>
<th>Lbs. per sq. ft. 1958</th>
<th>Lbs. per acre (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>11.5</td>
<td>.527</td>
<td>270</td>
</tr>
<tr>
<td>1.5</td>
<td>9.5</td>
<td>.436</td>
<td>180</td>
</tr>
<tr>
<td>2.0</td>
<td>8.6</td>
<td>.394</td>
<td>135</td>
</tr>
<tr>
<td>2.5</td>
<td>8.2</td>
<td>.375</td>
<td>110</td>
</tr>
<tr>
<td>3.0</td>
<td>8.5</td>
<td>.388</td>
<td>90</td>
</tr>
<tr>
<td>Least Signf. Diff. 1%</td>
<td>1.9</td>
<td>3.3</td>
<td></td>
</tr>
</tbody>
</table>

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Table 2
Effect of Row Spacing on Dollar Values of Various Grades of Beans and Approximate Dollar Returns

<table>
<thead>
<tr>
<th>Row spacing (ft.)</th>
<th>Sieve sizes</th>
<th>Picking cost</th>
<th>Total minus picking cost + seed cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-2-3 4 5 6 Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1958</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>1,019 440 59 --</td>
<td>748</td>
<td>660</td>
</tr>
<tr>
<td>1.5</td>
<td>922 304 46 --</td>
<td>618</td>
<td>580</td>
</tr>
<tr>
<td>2.0</td>
<td>767 319 56 --</td>
<td>559</td>
<td>525</td>
</tr>
<tr>
<td>2.5</td>
<td>705 314 56 --</td>
<td>533</td>
<td>500</td>
</tr>
<tr>
<td>3.0</td>
<td>724 345 47 --</td>
<td>553</td>
<td>530</td>
</tr>
<tr>
<td>1960</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>548 581 291 25 1,445</td>
<td>806</td>
<td>530</td>
</tr>
<tr>
<td>1.5</td>
<td>471 405 214 23 1,113</td>
<td>618</td>
<td>420</td>
</tr>
<tr>
<td>2.0</td>
<td>426 388 227 30 1,071</td>
<td>605</td>
<td>410</td>
</tr>
<tr>
<td>2.5</td>
<td>344 354 233 29 960</td>
<td>553</td>
<td>365</td>
</tr>
<tr>
<td>3.0</td>
<td>345 329 207 29 910</td>
<td>520</td>
<td>355</td>
</tr>
</tbody>
</table>

Figures based on the following arbitrary values: $145 per ton for sieve sizes 1-2-3, $115 per ton for sieve size 4, $92.50 per ton for sieve size 5, and $65 per ton for sieve size 6; $65 per ton for picking cost; and 40¢ per lb. for seed. In 1958, the variety Processor was used; in 1960, OSC 412.

Dr. H. H. Crowell Returns From World Tour

For the past year Dr. H. H. Crowell, in charge of vegetable insect work, has been on leave in Spain. There he spent most of his time in Valencia and worked part time at the nearby truck crop experiment station.

During the year Dr. Crowell and his family traveled around the world visiting Japan, Hong Kong, Thailand, India, Italy, England, Germany, and Austria. In Austria he attended the recent International Congress of Entomology. In both England and Germany he conferred with research workers in entomology at many of the research stations.

Mr. Robert Arias, research fellow in entomology, looked after Dr. Crowell's vegetable project work. Much of his time was spent in research on control of slugs, onion maggots, and aphids.

--Paul O. Ritcher
Entomology Department
Onion Maggot Under Control Again

The onion maggot appears to be under control again.

A strain of the insect which is resistant to the chlorinated hydrocarbon insecticides took a heavy toll of Oregon onions a few seasons ago. Since the Oregon maggot outbreak, most onion-growing areas of the northern United States and Canada have experienced the same troubles. By 1958, some of the newly developed organic phosphate insecticides gave excellent control of these resistant maggots and research was narrowed down to adapting control measures to specific regions and horticultural practices.

Research in eastern Oregon has shown that three readily available materials are outstanding when applied in granular formulation in the seed furrow at planting time. Both Trithion and Ethion, at 1 pound of actual toxicant per acre, were recommended for use in the Ontario, Oregon area last year. Diazinon insecticide, although effective against the maggots, produced severe injury to the onion plants when used in the granular formulations available. These materials give almost perfect maggot control for an entire growing season with only the single furrow treatment.

The control situation was found to be different in the peat soil of Lake Labish in western Oregon. Here it is necessary to control onion smut, a fungus attacking seedling plants, and attempts to combine maggot and smut treatments have not yet met with complete success. The same insecticides that were effective in eastern Oregon have given good maggot control at Lake Labish. Because of closer planting of rows, and the organic nature of the soil, dosages of at least two pounds of active ingredient per acre are necessary.

It is too early to know the onion maggot conditions throughout the U. S. and Canada during the 1960 season. In December 1959, however, Dr. W. H. Luckmann, researcher at Urbana, Illinois and secretary of the Root Maggot Cooperative Research Program, wrote a summary from reports received from other workers in the U. S. and Canada. Insecticides found to be effective in Oregon had also performed well in other areas, with some workers favoring one and some another, according to the conditions in their areas. Most of the country, including Oregon, reported greatly lowered maggot fly populations. This situation was brought on partly by a fungus, Empusa muscae, which killed the flies in great numbers during the spring months. Other factors, such as weather and effects of grower adoption of the new chemical control measures, also helped to make 1959 a low maggot year.

Reports on this past season from growers at Lake Labish indicate that maggots were again of minor importance in western Oregon. Many growers omitted maggot control programs in 1960 and apparently suffered little loss. Others used Diazinon in liquid formulation with their formaldehyde drench as an effective maggot and smut combination treatment, thus verifying success of earlier experiments at the lake. Although attempts were not conclusive in 1959 to determine effectiveness of "dry" maggot-smut treatments (combinations of granular insecticides with fungicide powder concentrates), some growers tried Ethion or Trithion mixed with captan with apparent success.

The insect control research program on Oregon onions in 1961 will not be confined to the study of the maggot-smut combination treatment, however. Other insecticides of different chemical constitution have shown promise in past trials and these should be tested.
Onion Maggot . . . (Continued from page 4)

Further if we are to keep ahead of resistance development in the onion maggot. Of more immediate concern was the appearance last summer of another injurious insect, the pea leaf miner, Liriomyza langei Frick. Considerable yield loss occurred in western Oregon due to leaf destruction caused by the larval feeding of this tiny fly. Maggots feed between the leaf surfaces of a number of different food plants, but do not usually occur in numbers sufficient to destroy the leaf. Leaf miner damage to onion leaves this past season was so intense in some areas that leaves wilted, and fields looked as if they were suffering severe blight. It is not possible to predict whether the leaf miner will constitute a threat to next year's or other future onion crops.

--H. H. Crowell
Entomology Department

Vegetable Notes . . .

Hybridization of species is often difficult because of various types of incompatibilities. In some cases, however, one species within a genus may serve as a "bridge." That is, the one species may hybridize with most or all of the species in the genus, and these hybrids can then be intercrossed to secure three- or four-way hybrids involving various species combinations. This has recently been done in the squash (Cucurbita) genus. Many new combinations of characters involving the various squash species may be seen in the next few years. (Rhodes, A. M., Proc. Amer. Soc. Hort. Sci., 1959, 74:546-51.)

... From Germany it has been reported that some varieties and strains of cauliflower are more resistant than others to whiptail caused by molybdenum deficiency.

... A high positive correlation—-not unexpected—-has been shown between vigor of asparagus brush (tops) in summer and yield the following spring. In asparagus breeding it has been suggested that selection for high brush vigor may be a highly efficient way of selecting for yielding ability. (Ellison, J. H., and Scheer, D. F., Proc. Amer. Soc. Hort. Sci., 1959, 73:339-44.)
Observations Made on Snap Bean Varieties

Analyses of yield and other data collected in the 1960 snap bean season have not been completed, but it is now possible to report on certain observations made during the summer.

**Pole beans:** Among new pole bean lines, selections 991 and 1654 show some promise for earliness, pod set, yield, and pod refinement. They are sister lines, with Florida Purple Pod as one parent. Critical evaluation for processing quality must be carried out before they can be recommended for pilot testing. The 284, 2244, and 1489 lines performed relatively well in the OSC replicated test. Seedsmen's increases of these lines appear to be satisfactory—and lots for pilot trials will be available next spring. Several new single plant selections (sub-lines) have been made in these materials.

The two heaviest yielding lines of pole beans again appeared to be 2243 and 2247, but both have weaknesses which must confine them to use only for further hybridization. They have been crossed with 284, 2244, and other lines with the object of combining the best yielding ability of various Blue Lake pole types.

OSC 284 was crossed with Romano in order to secure segregating progeny in 1961 for resistance to rust and increased vigor. Many other pole bean crosses—most of them highly complex—have been made in order to combine vigor, yielding ability, pod characters, and resistance to diseases.

High temperatures in early August again caused losses to bean growers. It has not been easy to explain differences in blossom drop which occur between yards and various localities. To the total environment of soil, water, temperature, insects, and diseases should be added the stage of development of plants when high temperatures occur. A heavy pod load on the basal portion of plants, for example, would add to physiologic stress during high temperatures. We have not observed major differences in varieties or breeding lines of Blue Lakes for pod-setting ability. There appears to be greater differences in pod-setting ability among bush beans.

Two pole wax beans with growth habit and time of maturity closely paralleling FM-1 were included in the replicated test. Pods were picked only in the "wax" stage which is somewhat late in pod development for these lines. Yields were excellent. Seeds are available for limited trials. Processed samples will be displayed this fall and winter.

**Bush beans:** Small pilot tests of bush beans derived from continued crosses to Blue Lake revealed more clearly some of the problems with these beans but their ultimate value must be shown by more wide scale testing. All tests were affected by the early August high temperatures, although yields in two of the tests were in the 3 1/2 to 4 1/2 ton per acre range. The machine harvested beans are trashier than Tendercrop and until improved cleaning machinery is available this will be a problem. It was evident, also, that the first lines to be made available for limited trial will produce pods of relatively small diameter and must not be left on the vines to reach large sieve sizes. Otherwise, seediness and pithiness will occur.

A bush bean plant, with heavy set of pods, must be given good culture up to the very day of harvest to reduce the "physiologic stress" we mentioned for pole beans. Lack of good care results in pod-fill, pollywog, and internal quality troubles characteristic of mature pole bean plants with a heavy pod load. In the bush bean plant, with a limited leaf surface, the problem is exaggerated.
Snap Bean Varieties . . . (Continued from page 6)

Many new bush selections for fleshier pods were made. Crosses within OSC lines of bushes, and between White Seeded Tendercrop and other bush types were secured.

A cool, wet, period of weather in late August promoted development of considerable white mold in a late planting of OSC bush types. This factor should be watched carefully in future pilot tests.

The variety Tendercrop showed considerable pod roughness and hollowness following the cool, wet, late August weather. Earlier in the season it had performed well. The White Seeded strain is similar except early observations indicate that pods may be lighter in color.

Seed increases of a few of the OSC lines have been made by seedsmen in California and Idaho. In general, reports indicate fairly good increases. Observation of lines previously increased without roguing showed that the small, flat, and other mutations occurring in Blue Lake poles will be found also in the bushes.

Late this fall or early winter the total seed picture on these beans will be available and a meeting with representatives of the bean industry appears desirable in order to discuss seed distribution and other problems.

More complete reports on snap beans will be made in future issues of the Vegetable Digest.

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--W. A. Sistrunk
Food and Dairy Technology Department

--J. B. Rodgers
Agricultural Engineering Department

Vegetable Note . . .

Most American varieties of snap beans used in recent years have been resistant to the common mosaic virus (the seed-borne virus which was destructive to FM-65 beans here a few year ago). A new strain of the virus has been reported in Idaho. It will attack some, but not all, of the varieties heretofore considered resistant. Fortunately neither this strain nor others varying from the usual type have as yet become serious factors in seed-borne transmission of the virus to major snap bean production areas. (Dean, L. L., and Wilson, V. E., Plant Dis. Repr., 1959, 43:1108-10.)
Residue Analysis Protects You

Everyone using agricultural pesticides knows that today the tail almost wags the dog when it comes to the influence of residue measurements on the overall problem of pest control with chemicals.

Pest control biologists frequently spend more time setting up experiments from which to gather residue data than they do developing new information on pest control. Needless to say, this is not done out of choice. Why the emphasis on residue work? Why is it so often the bottleneck in the development of new materials for pest control? Why does it cost so much time and money? Let's review the various answers to these questions.

No matter where you begin your inquiry into the complexities and problems of pest control with chemicals you soon run into the necessity of knowing how much of a chemical residue is present at a given time. Residue laws and the registration requirements require this. No real evaluation of the hazard to consumers from residues is possible without a knowledge of how much and when a residue is present. Hence, the need for residue information.

Next, consider the question of bottlenecks. It is probable that more use registrations are being held up today because of a deficit in residue data than for all other causes combined. The primary reason behind this is the analytical method, or lack of it. When a new pesticide gets through the initial screen and hits the road for field tests, it is almost certain that only time stands in its way.

This is not so when industry, research, and development personnel call for the supplementary residue information. No one can tell for certain whether an analytical method can ever be developed, at least for all possible crop-pesticide combinations. A method may ultimately be developed but no one can predict when this will be.

Let's assume, in order to get to the next problem, that industry chemists find a method in a reasonable time and get it introduced into files of cooperating chemists around the country. Can we begin collecting the much needed data now? Perhaps after 1 to 3 to 6 months.

Recipe or no recipe, details or no details, a chemist can tell you that it takes a good while to make one man's method work in another man's lab. The crop used in the original development of the method will almost certainly be different from the crop being studied. Analytical tools used by large chemical corporations may be far too expensive for the small experiment station or commercial lab. Or, since chemists are individualists, the newcomer can't bring himself to doing things exactly like the originator of the method. The urge to "tinker" is a strong one.

Another reason for the slowdown in new product development is the problem of metabolites, or breakdown products. Embarrassing questions are now being asked about the fate of a pesticide once it enters a plant or animal system. These organisms don't necessarily "break" the original product down to carbon dioxide and water or other simple, harmless byproducts. The opposite can happen as, for example, in the case of heptachlor converting into its epoxide and aldrin into its epoxide, dieldrin. So the hunter must stop chasing the rabbit and take out after the bear. After all that work on the analytical method for the parent compound, the chemist must now measure a new one.
Residue Analysis . . . (Continued from page 8)

Even if the metabolite is less toxic than the original compound, as is usually the case, the scientist must learn what happens to it so he can balance the ledger. The metabolic process of downgrading the toxicant has a tendency to make it look more and more like normal plant or animal constituents. This makes the analytical method progressively more difficult. More time may be spent in developing ways and means of measuring the nontoxic byproducts of a residue than in searching for the original material. Excellent pesticides stagnate in the "development" stage, and wide-awake farmers and fieldmen wonder what is going on.

With good sensitive methods developed, metabolic fates understood, sprays applied at 0, 3, 7 days before harvest, and samples in the freezer, what else can the chemist complain about? And how does he get away with charges like $50 per sample? For one thing, there is labor involved--several hours per sample. It takes an analyst three days to measure one of our common insecticides in milk or meat. He can handle six samples at a time but two of these are control and recovery samples (to keep him honest and accurate) so only four are paying customers. Thus it requires about six hours per sample. He must spend time for maintenance--dishwashing, preparing reagents, building equipment, keeping notes, calculating results, and writing reports. On a weekly basis the time per sample can easily mount to 8 or 10 hours. Chemists enjoy no more than modest wages but the labor bill does assume real size.

The physical plant of a residue chemist may seem almost goldplated. A two-man lab, with basic equipment and furniture costs around $15,000. Fume hoods, necessary for protection against noxious gases, run $250 per foot. Ordinary benches with chemically resistant tops are estimated $100 per foot. Even common glassware with ground glass joints start at $2.50 per item and go up from there. Ordinary spectrophotometers (used at the end of the analysis to measure the amount of pesticide present) sell at $1,000 or more, and ultraviolet or infrared spectrophotometers cost from $5,000 on up. The latter are used primarily in method development. Residue labs must also be equipped with or have available centrifuges ($1,000), balances ($500 to $1,000) refrigerators and deep freeze boxes, hot plates, water baths, steam baths, and hundreds of chemicals costing from 25 cents to several dollars a pound.

So it costs money and takes time to get the residue information necessary for full-fledged use of chemical pest control. At least 18 laboratories, federal, state, commercial, and industrial are engaged in this work on the west coast. Have we reached the plateau? Most experts say no, not in pressure for analyses, not in prices, not in the time factor, and not in numbers of workers. What about the bottleneck? We chemists are working hard to eliminate that.

--L. C. Terriere
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