and fungicides for chrysanthemums. Proc. Florida State Hort. Soc. 71:392-394.
5. Madsen, H. F. and Stanley C. Hoyt. 1962. Compatibility chart of spray chemicals. Western Fruit Grower 16(2):26-29.
6. McBride, J. J., Jr. 1958. Reaction of zineb with copper compounds, oil deposits when applied with zineb and deposits of zineb when applied with a variety of materials. Proc. Florida State Hort. Soc. 71: 118-122.
7. Natti, J. J., W. T. Schroeder, G. E. R. Hervey, and F. L. McEwen. 1958. Value of insecticide-fungicide combination treatments as protectants for seed of cucumber and winter squash. Plant Disease Reptr. 42:127-133.
8. Richardson, Lloyd T. 1960. Effect of insecticide-fungicide combinations on emergence of peas and growth of damping-off fungi. Plant Disease Reptr. 44:104-108.

PROGRESS REPORT ON POLE BEAN BREEDING AT THE SUB-TROPICAL EXPERIMENT STATION

ROBERT A. CONOVER

Sub-Tropical Experiment Station

Homestead

Pole bean acreage in Dade County has increased steadily during the past decade so that pole beans are now the second most important vegetable crop grown in the county. About 7,000 acres were planted during the 1960-61 season with production valued at $4,000,000. Dade's crop accounts for about 85% of Florida's pole bean acreage and 20% of the value of all green beans produced in Florida.

The principal hazard to successful pole bean production is bean rust caused by the fungus *Uromyces phaseoli typica Arth.* Rust makes its appearance in the fall, gradually builds up during the winter, and reaches a peak of destructiveness during the spring. Sulfur dust provides adequate control during the fall and early winter, but is inadequate when rust is severe. Dusts containing sulfur plus 3.5% maneb will control rust under severe conditions but twice weekly applications may be required. These dusts are expensive and close attention must be paid to details, especially timing of applications, if satisfactory control is to be obtained.

There are several other diseases and disorders which may affect certain pole bean varieties. The common bean mosaic and the Southern bean mosaic viruses are sometimes devastating in susceptible varieties. Resistances to both viruses are available in present day varieties. Yellow bean mosaic is sometimes a problem in Dade County, particularly in small plantings near groves and residences. Resistance to this virus is not known in beans. Intumescence and black suture, two physiological disorders thought to be induced by environmental factors, are occasionally severe in pole beans.

McCaslan is the only pole bean variety grown to any extent in Dade County. It is well adapted to the winter-growing conditions and to the calcareous soils of Dade County, is resistant to the common bean mosaic virus, black suture and intumescence, but it is very susceptible to rust. The pods of McCaslan are too light in color, and are also criticized for being flat and rough. Other varieties, such as U.S. No. 4 (No. 191) and Florigreen, have not found favor with Dade County growers, although the latter is rust resistant, and both have features which are desirable in pole beans. Both Florigreen and U.S. No. 4 are susceptible to black suture and intumescence. Florigreen is resistant to the common and Southern bean mosaic viruses.

The Florida Agricultural Experiment Stations initiated a state-wide pole bean breeding project* in 1957 to coordinate work being done at several locations in the state. The main objective of this project, as it applies to the Sub-Tropical Experiment Station, has been to develop a high yielding, rust resistant pole bean adapted to Dade County conditions, and producing good quality pods able to withstand the rigors of marketing. The immediate and primary aim has been to develop a high yielding pole bean combining the vigor and adaptability of McCaslan with the rust resistance and pod color of Florigreen. Uniformity in length, straightness, and smoothness of pod was sought in every selection. This paper is a report of the progress made toward developing a pole bean variety with these features.

Most of the work at the SES has been primarily concerned with selections from a cross of McCaslan and Florigreen made by Dr. A. P. Lorz of the Main Station, Gainesville. Selections from this cross have proved to be highly resistant to rust, and to produce yields that equal or exceed the yields of either parent. In addition these stocks possess, in varying degree, most of the features considered desirable in a

*Project 887: Breeding of Improved Pole Bean Varieties for Commercial Production in Florida.

pole bean for fresh market. Results to date give every indication that pole bean varieties can be developed for Florida which will be not only disease resistant and high-yielding, but will be improved in other qualities as well.

Major emphasis during the past two years has been on the evaluation of three stocks. These have been compared with McCaslan and Florigreen in replicated yield trials on both Rockdale and marl soils. The results of these trials, presented in Table 1, show that SES No. 1 was the best in average yield. Fungicides were not used in these tests, thus the low yields of McCaslan in the winter and spring tests were attributable in part to rust. However, rust was not a factor in the rockland test in the fall of 1961. The capacity of these stocks to produce high yields under commercial conditions is shown by the results presented in Table 2. Rust was quite severe in this planting and, in spite of better-than-average efforts to control it, caused a severe reduction in yield of McCaslan. These results also demonstrate two things: 1) the value of rust resistance, and 2) that rust is a serious problem to the pole bean grower.

TABLE 1. Yields of pole beans in four replicated plantings.

Pole Bean Stock	Rockland Spring 1961	Rockland Fall 1961	Marl Winter 1961-62	Rockland Spring 1962	Average
SES #1	502	403	457	566	477
SES #2	416	371	391	467	412
SES #3	389	368	439	460	414
McCaslan	294	377	154	377	301
Florigreen	418	374	349	598	435

In evaluations of the last two years, the SES stocks have not only been outstanding in yield, but have excelled in other ways also. The stocks have proved to be well adapted to the soils of Dade County. The plants were vigorous and the foliage has equalled that of McCaslan in tolerating the cold, harsh winds of winter. SES stocks matured about 4 to 8 days earlier than McCaslan and U.S. No. 4, and 2 days earlier than Florigreen. Measurements and evaluations of pod characteristics from one representative test are summarized in Tables 3 and 4. It is evident that pods of the SES stocks equalled or excelled McCaslan and Florigreen in most features. SES No. 1 was the outstanding stock in pod length, straightness, and smoothness, and it ranked first in over-all attractiveness.

It was mentioned earlier that a pole bean for Dade County should have resistances to common and Southern bean mosaic viruses, and to black suture and intumescence. The reaction of the SES stocks to the two physiological disorders is presented in Table 4. SES No. 1 has equalled McCaslan in resistance to these defects. According to determinations made by Dr. W. J. Zaumeyer, Agricultural Research Service, United States Department of Agriculture, all SES stocks were resistant to both the common bean mosaic virus and the Southern bean mosaic virus.

Three types of studies were made to evaluate the so-called "shelf life" of the beans following harvest. Samples for these tests were carefully

TABLE 2. Yields of SES #1, SES #3 and McCaslan from plantings made on marl soil by Bill Cornelius Farms.

Pole Bean Stock	1st Picking	2nd Picking	3rd Picking	4th Picking	5th Picking	Total
SES #1	218*	74	161	56	33	542
SES #3	228*	63	163	55	25	534
McCaslan	92	61	73	23	0	249

* First picking made 2 days earlier than McCaslan. Actually these stocks were ready to pick 4 days earlier than McCaslan, but this date fell on a Saturday and the picking was delayed until the following Monday.

TABLE 3. Comparison of length and curvature of pods of pole bean stocks grown during spring on Rockdale soil.

Pole Bean Stock	Length			Curvature		
	7.5" or less %	7.5" to 8.5" %	over %	straight %	slight %	excessive %
SES #1	8	76	16	48	48	2
SES #2	26	66	8	22	70	8
SES #3	58	40	2	20	58	12
McCaslan	82	9	0	26	66	8
Florigreen	26	58	16	22	76	2

TABLE 4. Comparisons of certain pod characteristics of pole bean stocks grown in spring on Rockdale soil.

Pole Bean Stock	Rank (1=best) according to			Resistance to	
	pod color	smoothness	over-all attractiveness	Black Suture	Intumescence
SES #1	3	1	1	good	good
SES #2	2	1	2	intermediate	intermediate
SES #3	2	2	4	intermediate	intermediate
McCaslan	4	3	4	good	good
Florigreen	1	4	3	poor	poor

selected to be as uniformly mature as possible. In one test, the pods were allowed to remain uncovered on a laboratory bench for 7 days. SES No. 2 was the most attractive bean followed by Florigreen. SES No. 1 and McCaslan reacted similarly, both showing considerable shrivelling and fading of color. In another test, samples of pods were placed in a filled bean hamper and stored at 40 to 45° F for seven days, after which they were removed and left uncovered on a laboratory bench for 3 days. All stocks survived this treatment in good shape and did not rank differently than when picked. In the third test, samples were sealed in polyethylene bags, and left in storage at 40 to 45° F for two weeks. There was little color loss or shrinkage from this treatment, but a rusty-appearing, superficial flecking developed on the pods. This was especially evident on U.S. No. 4 and Florigreen but also was present on SES No. 2 and SES No. 3. McCaslan and SES No. 1 had no flecking and were the most attractive beans following this treatment. These studies were inconclusive since a different stock was favored by each storage condition. These results do suggest the need of studies on the effect of post-harvest conditions on pole beans.

The reactions of bean brokers and shippers to the SES stocks were favorable, and when asked to make a choice, most chose SES No. 1. Efforts were made to find out how the beans survived shipping and to obtain the reactions of

people in the retail trade. Most of these reports were vague, such as "They liked them," or "They had no complaints." All the SES stocks have a fine flavor and comments from consumers were favorable.

It is clear from the combined results that SES No. 1 was the best of the three rust resistant stocks tested extensively during the past two years. Its points of superiority over McCaslan include rust resistance, yield, color, fleshiness of pod, and maintainence of pod length under adverse conditions. It equals McCaslan in adaptability to Dade County conditions, post-harvest characteristics, and in resistance to virus diseases, black suture and intumescence. SES No. 1 has not been inferior to McCaslan in any respect in any test.

SES No. 1 will be released as a new pole bean variety under the name of DADE. It is expected that the formalities of release will be completed about December 15 with the publication of a circular describing the new variety in detail. Seedsmen will probably have small amounts of seed available for trial plantings by late January. It is hoped, and believed, that DADE will be a real help to the pole bean growers of Dade County.

STRAWBERRY NURSERY WEED CONTROL

S. J. LOCASCIO

Assistant Horticulturist

Florida Agricultural Experiment Station

Gainesville

Weed control in nurseries producing strawberry plants is performed largely by non-mechanical means. Before any number of plants are produced, hand hoeing at two- to three-week intervals is common. Later, hand pulling of the weeds becomes necessary to avoid disturbing the rooted plants. The use of herbicides offers promise in control of grasses and weeds in strawberry plant beds, a reduction in hand-labor requirements, and a lower cost of production.

The use of sesone (sodium 2,4-dichlorophenoxyethyl sulfate) for the control of annual weeds in strawberries has been reported by a number of workers (3,4,5); however, weed control is of rather short duration (1,3).

The experiment reported here was conducted to evaluate several different herbicides for their effectiveness in strawberry plant nurseries.

EXPERIMENTAL PROCEDURE

An experiment was conducted in the summer of 1961 at Gainesville on a Kanapaha fine sandy soil. Florida Ninety strawberries that had grown through the fruiting season were used in this experiment. Polyethylene mulch was removed from the strawberry beds in mid-May, and one row of the double-set strawberry plants was removed. The beds were then cultivated to remove all weeds, and beds were reshaped.

The herbicides, rates, and dates of application, shown in Tables 1 and 2, were arranged in a randomized block design with three replications. Herbicides were applied non-directed as a water spray at the rate of 20 gallons per acre to freshly cultivated plots on May 17, 1961. Plots consisted of two beds each four feet wide and 22 feet long.

Two months after the first application, all plots were cultivated and weeds removed before the herbicides were reapplied on July 17.

The effect of the various herbicides on weed control was determined by visual ratings made monthly by comparison with the unhoed check plots. Herbicide effects on runner plant production were determined by comparison with a hoed check.

RESULTS

Weed-control ratings were made on June 16, July 16, August 18 and September 18. In the first two months, crabgrass (*Digitaria sanguinalis*) was the principle grass. In the latter two months, sedges (*Cyperus compressus* and *Bulbostylis barbatus*) were also a problem.

Table 1 shows that dacthal (2,3,5,6-tetrachloroterephthalate) at both rates, diphenamid (*N*,*N*-dimethyl-2,2-diphenylacetamide),[1] sesone (sodium 2,4-dichlorophenoxyethyl sulfate), 2,4-DEP [(tris-2-4 dichlorophenoxyethyl) phosphite] and the higher rate of EPTC (ethyl *N*,*N*-di-*n*-propylthiocarbamate) gave good crabgrass control at the June and July ratings. Simazine

Florida Agricultural Experiment Stations Journal Series, No. 1558.

[1]Chemically identical to Upjohn 4513.