

FINAL REPORT FROM:  
**Pau hana Vegetable Crops Field Day**

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University of Hawaii, College of Tropical Agriculture and Human Resources,

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Waimanalo Research Station  
October 30, 1998, 4:00 PM  
(final results added Jan. 1999, see pg. 16-17)

**INTRODUCTION:**

Welcome to the University of Hawaii Waimanalo Research Experiment Station. The Station consists of 130 Acres of land at 60 feet elevation. Research work in the station is with fruit, ornamental, agroforestry and vegetable crops. Today we will show the results of recent and ongoing bush bean variety trials. Overall we evaluated 35 bean varieties. We will also visit an organic basil variety trial, as well as the five-year old organic research plots. Other highlights will include: a) observe the results of bone-meal and chicken manure amendments on bush bean yields; and b) display of the newly released disease resistant UH sweet basil variety.

**Climate in Waimanalo Station:**

Mean Annual Temperature: 75 F (24.6C), monthly range 70-80F (22-27C)

Mean annual rainfall 55 in (1380 mm). Annual Range= 500-1800 mm

Soil type- Vertic Haplustolls, derived from lava and coral

pH about 6.5, good base status, low organic matter

Soil fertility of the bean plots prior to planting on March 1998 was: pH 7.2, EC= 0.29 mmhos, P= 55, K= 234, Ca= 4904, Mg= 952, and organic matter content= 1.35%.

Typical soil fertility for soils on the bean plots (2<sup>nd</sup> planting) is organic matter content of 1.12%, pH= 5.6, and soil nutrient levels (in ppm) of P= 52, K=480, Ca= 2600, and Mg= 800.

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\*\*Final results added pn Jan. 1999

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## Results and Discussion

### Spring 1998 Experiment: Overall yields

For the first experiment bean was planted on February 26. For most varieties the first harvest was conducted on April 13, 46 days after planting. Later varieties were Shade (48 days after planting); Tavera, Corumba, and Nickel (53 days); KY bush (55 days); and Xera (62 days). Pests in this experiment included aphids, thrips, Chinese rose beetle, the podborer, birds, and leafhoppers. The crop was harvested 22 times for a period of 7 weeks. Overall yields were greatest for Magnum (see Table 1, pg. 3). Other varieties with overall high yields included 93-RS-13, Espada, XP-346, and Bronco. However some growers may wish to consider some of the specialty bush bean varieties (see pg. 10-12) that had somewhat lower yields.

### Spring 1998. Varieties adapted to Mechanical harvesting

For mechanical harvesting, growers are interested in varieties that have a concentrated yield for an once-over harvest. Varieties that in this experiment showed high concentrated yields included: Dorabel (a specialty yellow bean), XP-346, Rushmore, Magnum, and 93-RS-13. Varieties with an upright or erect growth habit may be more desirable for mechanical harvesting. Some of this varieties included XP-346, Espada, Bronco, EX-344, Sequoia (purple pods), and Magnum. Other varieties that are adapted for mechanical harvesting include Hystyle, Prosperity, Rushmore, Shade, and Xera.

### Fall 1998 Experiments.

From the spring trials, 10 varieties that showed potential for once-over harvest were selected for the fall experiments. Each variety was grown on 10-foot double rows, with 4 replications per variety. Seed for this experiment was sown on August 28. For most varieties the first harvest was conducted on October 9, while Magnum (planted on Aug 31) and Bronco were first picked on October 12. Thus the first harvest for all varieties was conducted from 42-45 days after planting, which reflects the warmer soil conditions, compared to the spring plantings. To date the crop has been harvested 9 times for a period of 3 weeks. The greatest yields to date have been obtained by Magnum, Rushmore, and EX-323.

### Bone Meal Experiment

A bone meal and chicken manure observational experiment was superimposed on the bush bean fall trials. Each of the four blocks or replications received a separate nutrient amendment regime. The treatments included a) chemical fertilizer alone (120 lb/Acre of Nitrogen); b) 60 lb N chemical fertilizer plus 4 tons/Acre chicken manure; c) 60 lb N chemical fertilizer plus 1 ton/Acre bone meal (which contains approx. 10-10-10 NPK); and d) 60 lb N chemical fertilizer plus 4 tons/Ac bone meal. As indicated in Table 4 (pg. 8) the highest bush bean yields after 3 weeks of harvest were obtained by treatment 3 (chemical fertilizer plus 1 ton/Acre bone meal). It is plausible that bean yields were somewhat depressed by the excessive Nitrogen content released with high (4 tons/Acre) applications of either chicken manure or bone meal. Direct seeding of the crop immediately after the high rate bone meal application actually resulted in substantial plant stand losses.

Table 1. Marketable yields from 22 harvests (7 weeks) of bush bean varieties grown at the UHM Waimanalo Experiment Station, Spring (Feb.-May), 1998.

| Cultivar   | Grade A Wt. (lb/Acre) | Grade A no. (no./Acre) | Pod size A (grams) | Off-Grade (lb/Ac) | Total Wt (lb/Acre) | Misshappen pod wt. (lb/Ac) | Insect damage (lb/Ac) | Bird damage (lb/Ac) | Pod length (inches) |
|------------|-----------------------|------------------------|--------------------|-------------------|--------------------|----------------------------|-----------------------|---------------------|---------------------|
| 93-RS-13   | 15814b                | 1,293,754a             | 5.54               | 2568c-f           | 18,382bc           | 2021                       | 305cd                 | 1626b               | 7.8-8.7             |
| Espada     | 14766bc               | 1,298,528a             | 5.16               | 1800e-h           | 16,566bcd          | 1626                       | 332cd                 | 210                 | 5-6                 |
| XP-346     | 14719bc               | 959,574abc             | 6.96               | 1410              | 16,129b-e          | 1084                       | 274cd                 | 58                  | 5-5-6.3             |
| Bronco     | 13867bcd              | 976,283abc             | 6.44               | 1547              | 15,414b-f          | 1142                       | 305cd                 | 100                 | 5-5.5               |
| Rushmore   | 12825b-e              | 670,747b-f             | 8.67               | 1663e-h           | 14,488b-h          | 1310                       | 195                   | 158                 | 6-6.3               |
| Fandango   | 12172b-f              | 773,388b-e             | 7.14               | 2415d-g           | 14,588b-g          | 2110                       | 232                   | 74                  | 5-6                 |
| Zodiac     | 12125b-f              | 852,159a-e             | 6.45               | 2047e-h           | 14,177b-h          | 1737                       | 205                   | 105                 | 5.5-6               |
| Dorabel    | 12009b-g              | 876,029a-d             | 6.22               | 1484              | 13,503b-i          | 1410                       | 42                    | 32                  | 4.3-5               |
| Or. Wonder | 11825b-g              | 491,722                | 10.91              | 14,267a           | 26,097a            | 2394ab                     | 10141a                | 1731b               | 17-19               |
| EX-393     | 11509b-g              | 549,010b-h             | 9.51               | 2137e-h           | 13,651b-h          | 1442                       | 579c                  | 1210                | 6-6.3               |
| RX-1386    | 11225b-g              | 1,047,893ab            | 4.86               | 2005e-h           | 13,230b-i          | 1726                       | 184                   | 95                  | 4.7-5.5             |
| Opus       | 10914b-g              | 692,230b-f             | 7.15               | 1337              | 12,256c-j          | 1005                       | 242                   | 89                  | 5.5-6               |
| Probe      | 10262b-h              | 754,292b-f             | 6.17               | 1884e-h           | 12,146c-k          | 1547                       | 226                   | 105                 | 6-7                 |
| Seville    | 10193b-h              | 759,066b-f             | 6.09               | 1542              | 11,735d-k          | 1131                       | 84                    | 326cd               | 6-7                 |
| Prosperity | 9962b-h               | 618,233b-g             | 7.31               | 1289              | 11,256d-k          | 1126                       | 100                   | 58                  | 6-6.7               |
| Sable      | 9909b-h               | 978,670abc             | 4.59               | 2158e-h           | 12,067c-k          | 2068                       | 5                     | 84                  | 4.3-4.7             |
| EX-323     | 8999c-h               | 420,112                | 9.72               | 1363              | 10,367d-k          | 1068                       | 121                   | 174                 | 5.5-6               |
| Maxibel    | 8730c-h               | 549,010                | 7.21               | 2116e-h           | 10,846d-k          | 1794                       | 142                   | 179                 | 6.5-7.5             |
| Mirada     | 8709c-h               | 575,267b-h             | 6.87               | 1326              | 9,999d-k           | 942                        | 268                   | 116                 | 5.5-6               |

Experiment: The experiment consisted on growing each variety on a 10-foot long double row bed, one replication per variety.

Spacing was 3 inches between plants in the row, and 1 foot between rows. The crop was drip irrigated.

Data analysis: The data was run through a statistical analysis using the harvesting dates (22 dates) as replications. This is not a true replicated experiment, so the analysis may only provide insight on general trends in terms of yields. Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence interval ( $P < 0.05$ ).

Yields: Yields per acre were based on an estimate of 21,700 linear foot row per acre. In our experiment we grew each variety on 20 a foot row length, so a direct conversion was used to estimate yields per acre.

Table 1. continues.

| Cultivar length | Grade A Wt. (lb/Acre) | Grade A no. (no/Acre) | Pod size A (grams) | Off-grade (lb/Acre) | Total Wt (lb/Acre) | Misshapen pod wt. (lb/Acre) | Insect wt. (lb/Acre) | Bird Wt. (inches) | Pod     |
|-----------------|-----------------------|-----------------------|--------------------|---------------------|--------------------|-----------------------------|----------------------|-------------------|---------|
| Kentucky bush   | 8262d-h               | 737,583b-f            | 5.08               | 2958cde             | 11,220d-k          | 2452 a                      | 153                  | 353cd             | 6.5-7   |
| 14.5            | 8173d-h               | 398,629               | 9.30               | 11,283b             | 19,455b            | 1547                        | 9399b                | 332cd             | 13.5-   |
| Benchmark       | 7699e-h               | 546,623               | 6.39               | 2037e-h             | 9,741e-k           | 1716                        | 95                   | 226               | 5-6     |
| EX-345          | 7662e-h               | 484,561               | 7.17               | 1658e-h             | 9,325              | 1205                        | 232                  | 226               | 5.5-7   |
| Shade           | 7557e-h               | 618,233b-g            | 5.54               | 1174                | 8,920              | 816                         | 95                   | 258               | 4.5-5.5 |
| Tavera          | 7499e-h               | 603,911b-g            | 5.63               | 1358                | 8,862              | 1105                        | 189                  | 58                | 4.3-4.7 |
| Xera            | 7436e-h               | 728,035b-f            | 4.63               | 2615c-f             | 10,051d-k          | 2263abc                     | 300                  | 53                | 4.5-5.5 |
| EX-344          | 7225e-h               | 341,341               | 9.60               | 3694c               | 10,920d-k          | 1252                        | 158                  | 2284a             | 7-7.5   |
| Dragon Tongue   | 7173e-h               | 23,870                | 136.30             | 2158e-h             | 9,336              | 2142a-d                     | 16                   | 5                 | 6.3-6.7 |
| Corumba         | 6683e-h               | 649,264b-g            | 4.67               | 1137                | 7,825              | 953                         | 147                  | 37                | 4.5-5   |
| Sequoia         | 6431fgh               | 150,381               | 19.40              | 1894e-h             | 8,325              | 1595                        | 300                  | 0                 | 4.5-5   |
| Nickel          | 5894ghi               | 389,081               | 6.87               | 974                 | 6,868              | 747                         | 163                  | 63                | 6-6.7   |
| Narbonne        | 4278hi                | 305,536               | 6.35               | 1195                | 5,473              | 753                         | 184                  | 253               | 5.5-6   |
| Hystyle         | 4152hi                | 341,341               | 5.52               | 1810e-h             | 5,962              | 1400                        | 100                  | 310               | 5-5.5   |
| Early Bush      | 4131hi                | 379,533               | 4.94               | 2010e-h             | 6,141              | 1495                        | 79                   | 437c              | 5-5.5   |

Table 2. Early marketable yields (first two weeks= 6 harvests) of bush bean varieties grown at the UHM Waimanalo Experiment Station, Spring (Feb.-May), 1998.

| Cultivar   | Grade A Wt. (lb/Acre) | Grade A no. (no/Acre) | Unmkt wt (lb/Ac) | Total Wt (lb/Acre) | Misshaped pod wt. (lb/Ac) | Insect damage (lb/Acre) | Bird damaged pods (lb/Acre) |
|------------|-----------------------|-----------------------|------------------|--------------------|---------------------------|-------------------------|-----------------------------|
| XP-346     | 8364ab                | 270,165a-g            | 660efg           | 9,025ab            | 591bc                     | 46d                     | 14ef                        |
| Rushmore   | 8314ab                | 156,240               | 840efg           | 9,155ab            | 377bc                     | 263cd                   | 19ef                        |
| Magnum     | 7836abc               | 47,523                | 2114cd           | 9,950a             | 544bc                     | 195d                    | 102d-f                      |
| 93-RS-13   | 7793abc               | 318,990a-e            | 1191d-g          | 8,984ab            | 301bc                     | 309cd                   | 1504b                       |
| EX-393     | 7488abc               | 97,650                | 1282d-g          | 8,769ab            | 880abc                    | 280cd                   | 32ef                        |
| Bronco     | 7193a-d               | 184,233               | 617fg            | 7810abc            | 607bc                     | 574c                    | 100d-f                      |
| Dr. Tongue | 7143a-d               | 20,832                | 1734cde          | 8,870ab            | 294bc                     | 291cd                   | 32ef                        |
| EX-323     | 6781a-e               | 130,200               | 751efg           | 7532a-d            | 1719a                     | 12d                     | 3ef                         |
| Fandango   | 6588a-e               | 0                     | 699efg           | 7287a-d            | 499bc                     | 115d                    | 136c-f                      |
| Tavera     | 6506a-e               | 405,573a              | 914efg           | 7420a-d            | 553bc                     | 108d                    | 39ef                        |
| Zodiac     | 6380a-f               | 169,260               | 822efg           | 7202a-d            | 682bc                     | 191d                    | 40ef                        |
| Prosperity | 6161a-f               | 187,488               | 593fg            | 6756a-d            | 553bc                     | 204d                    | 67ef                        |
| Espada     | 6085a-f               | 351,540a-d            | 677efg           | 6763a-d            | 499bc                     | 79d                     | 14ef                        |
| Probe      | 5932a-g               | 289,695a-f            | 883efg           | 6814a-d            | 593bc                     | 52d                     | 32ef                        |
| Opus       | 5903a-g               | 112,623               | 672efg           | 6576a-e            | 639bc                     | 205d                    | 39ef                        |
| Sequoia    | 5817a-g               | 57,288                | 1200d-g          | 7018a-d            | 390bc                     | 237cd                   | 46ef                        |
| RX-1386    | 5643a-g               | 359,352abc            | 854efg           | 6497a-e            | 904abc                    | 297cd                   | 0f                          |
| Seville    | 5382a-g               | 214,30                | 656efg           | 6031a-e            | 639bc                     | 177d                    | 39ef                        |
| Benchmark  | 5272a-g               | 242,823               | 1244d-g          | 6516a-e            | 309bc                     | 67d                     | 273c                        |
|            |                       |                       |                  |                    | 1016abc                   | 89d                     | 139c-f                      |

Experiment: The experiment consisted on growing each variety on a 10-foot long double row bed, one replication per variety.

Spacing was 3 inches between plants in the row, and 1 foot between rows. The crop was drip irrigated.

Data analysis: The data was run through a statistical analysis using the harvesting dates (22 dates) as replications. This is not a true replicated experiment, so the analysis may only provide insight on general trends in terms of yields. Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence interval (P<0.05).

Yields: Yields per acre were based on an estimate of 21,700 linear foot row per acre. In our experiment we grew each variety on 20 a foot row length, so a direct conversion was used to estimate yields per acre.

Table 2. Early yields, cont.

| Cultivar      | Wt Grade A<br>lb/Acre | Grade A no.<br>(no./Acre) | UnmktWt<br>(lb/Acre) | Total Wt<br>(lb/Acre) | Misshape wt.Insect wt.<br>(lb/Acre) | Bird Wt.<br>(lb/Acre) |
|---------------|-----------------------|---------------------------|----------------------|-----------------------|-------------------------------------|-----------------------|
| Corumba       | 4931a-g               | 238,917                   | 755efg               | 5688a-e               | 422bc                               | 227cd                 |
| Mirada        | 4827a-g               | 258,447a-g                | 700efg               | 5528a-e               | 534bc                               | 19ef                  |
| Maxibel       | 4774a-g               | 76,167                    | 712efg               | 5485a-e               | 377bc                               | 70ef                  |
| Xera          | 4748a-g               | 113,925                   | 1023efg              | 5772a-e               | 736bc                               | 161cde                |
| Or. Wonder    | 4571a-g               | 272,769a-g                | 1495c-f              | 6067a-e               | <b>1183ab</b>                       | 36ef                  |
| Nickel        | 4169a-g               | 151,032                   | <b>3516b</b>         | 7686a-d               | 555bc                               | 148c-f                |
| EX-345        | 3934a-g               | 90,489                    | 455fg                | 4387b-e               | 270bc                               | 47ef                  |
| Kentucky bush | 3789b-g               | 84,630                    | 772efg               | 4561b-e               | 395bc                               | 154c-f                |
| Jade          | 3434c-g               | 164,703                   | <b>4547a</b>         | 7983abc               | 520bc                               | 0f                    |
| Hystyle       | 3226c-g               | 255,192a-g                | 972efg               | 4198b-e               | 720bc                               | 100d-f                |
| Narbonne      | 3168c-g               | 201,810                   | 1338d-g              | 4505b-e               | 956abc                              | 281c                  |
| EX-344        | 2572d-g               | 65,100                    | 603fg                | 3175c-e               | 320bc                               | 141c-f                |
| Early Bush    | 2128e-g               | 14,322                    | <b>2473c</b>         | 4603b-e               | 165c                                | 2150a                 |
| Sable         | 1758gf                | 111,972                   | 797efg               | 2555de                | 471bc                               | 244cd                 |
|               | 1273g                 | 100,905                   | 273g                 | 1546e                 | 224c                                | 43ef                  |

Table 3. Marketable yields from 9 harvests (3 weeks) of bush bean varieties grown at the UHM Waimanalo Experiment Station, Fall (Aug.- Oct.), 1998.

| Cultivar      | Grade A Wt.<br>(lb/Ac) | Unmkt Wt<br>(lb/Ac) | Total Wt<br>(lb/Ac) | Unmkt<br>(Percent) | Grade A Wt.<br>(lb/100 ft) | Total Wt.<br>(lb/100 ft) | Pod Size<br>(grams) | Pod length<br>(inches) |
|---------------|------------------------|---------------------|---------------------|--------------------|----------------------------|--------------------------|---------------------|------------------------|
| Rushmore      | 10,047b                | 807a                | 10,857b             | 7                  | 46                         | 50                       | 8.4a                | 7.5-9                  |
| EX-323        | 9,879c                 | 670a                | 10,549bc            | 6                  | 46                         | 49                       | 4.9d                | 5.5-6.3                |
| EX-393        | 8,684d                 | 583a                | 9,268c              | 6                  | 40                         | 43                       | 5.2b                | 5.7-6                  |
| XP-346        | 8,125e                 | 635a                | 8,762ef             | 7                  | 37                         | 40                       | 5.1c                | 5.9-6.7                |
| Dorabel       | 7,916f                 | 999a                | 8,913de             | 11                 | 36                         | 41                       | 4.7d                | 5.3-6                  |
| Bronco        | 7,571g                 | 570a                | 8,142efg            | 7                  | 35                         | 38                       | 3.5h                | 4-5                    |
| Dragon Tongue | 6,775h                 | 891a                | 7,664g              | 12                 | 31                         | 35                       | 4.1f                | 5.5-5                  |
| Mirada        | 6,689h                 | 1,102a              | 7,791fg             | 14                 | 31                         | 36                       | 4.6e                | 6-6.7                  |
| Sequoia       | 6,204i                 | 381a                | 6,585h              | 6                  | 29                         | 30                       | 4.6e                | 5.3-6.3                |
|               |                        |                     |                     |                    |                            |                          | 4.2f                | 4-5                    |

**Experiment:** The experiment consisted on growing each variety on a 10-foot long double row bed, four replication per variety. Spacing was 3 inches between plants in the row, and 1 foot between rows. The crop was drip irrigated.

**Data analysis:** Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence interval (P<0.05).

**Yields:** Yields per acre were based on an estimate of 21,700 linear foot row per acre. In our experiment we grew each variety on 20 a foot row length, so a direct conversion was used to estimate yields per acre and yields per 100 ft row.

Table 4. Effect of bone meal, chicken manure, and chemical fertilizer on the yield of bush bean varieties grown at the UHM Waimanalo Experiment Station, Fall (Aug.-Oct.), 1998.

| Treatment plants           | Wt Grade A (lb/Ac) | UnmktWt (lb/Ac) | Total Wt (lb/Ac) | Unmkt Percent | Wt Grade A (lb/100 ft) | Wt Total (lb/100 ft) | Pod Size (grams) | No.  |
|----------------------------|--------------------|-----------------|------------------|---------------|------------------------|----------------------|------------------|------|
| 10 ft                      |                    |                 |                  |               |                        |                      |                  |      |
| row)                       |                    |                 |                  |               |                        |                      |                  |      |
| F & Chicken manure 4 ton/A | 9,218b             | 913a            | 10,131b          | 9             | 42b                    | 47b                  | 5.1a             | 29.0 |
| F & Bone Meal-1 ton/A      | 10,247a            | 868a            | 11,115a          | 8             | 47a                    | 51a                  | 5.2a             | 28.7 |
| F & Bone Meal-4            | 6,170d             | 648a            | 6,816d           | 10            | 28d                    | 31d                  | 4.6b             | 16.5 |

**Experiment:** This non-replicated experiment was superimposed on a bush bean variety trial. Each block received a different fertilizer treatment, as follows: Block 1 received 120 lb/A of Nitrogen in the form of 10-20-20 and calcium nitrate fertilizers split at planting and one month after planting; Block 2 received at planting 30 lb/Acre N chemical fertilizer plus chicken manure at a rate of 4 tons/Acre; Block 3 received at planting 30 lb/Ac chemical fertilizer plus bone meal (approx. 10-10-10) at rate of 1 ton/Acre; block 4 received at planting 30 lb/Ac chemical fertilizer plus bone meal at a rate of 4 tons/Acre.

**Data analysis:** Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence interval (P<0.05).

**Yields:** Yields per acre were based on an estimate of 21,700 linear foot row per acre. In our experiment we grew each variety on 20 a foot row length, so a direct conversion was used to estimate yields per acre and yields per 100 ft row.



Table 5. Marketable yields from 16 harvests (5 weeks) of bush bean varieties grown at the UHM Waimanalo Experiment Station, Fall (Aug.- Nov.), 1998.

| Cultivar      | Grade A Wt.<br>(lb/Ac) | Unmkt Wt<br>(lb/Ac) | Total Wt<br>(lb/Ac) | Grade A<br>(Percent) | Grade A Wt.<br>(lb/100 ft) | Total Wt.<br>(lb/100 ft) | Pod Size<br>(grams) | Pod length<br>(inches) |
|---------------|------------------------|---------------------|---------------------|----------------------|----------------------------|--------------------------|---------------------|------------------------|
| Rushmore      | 12,025bc               | 2,599ab             | 14,620bc            | 72.1ab               | 55                         | 67                       | 8.4                 | 7.5-9                  |
| EX-323        | 12,840ab               | 2,855a              | 15,696ab            | 71.2ab               | 59                         | 72                       | 4.9                 | 5.5-6.3                |
| EX-393        | 10,521bcd              | 1,768bcd            | 12,289bcd           | 74.5a                | 48                         | 57                       | 5.2                 | 5.7-6                  |
| XP-346        | 10,647bcd              | 1,975bc             | 12,622bc            | 74.5a                | 49                         | 58                       | 5.5                 | 5.9-6.7                |
| Dorabel       | 10,138bcd              | 1,451cd             | 11,593b-e           | 72.1ab               | 47                         | 53                       | 4.7                 | 5.3-6                  |
| Bronco        | 9,400bcd               | 1,554cd             | 10,954b-e           | 73.9a                | 43                         | 50                       | 3.5                 | 4-5                    |
| Dragon Tongue | 6,774d                 | 926de               | 7,700de             | 42.2c                | 31                         | 35                       | 4                   | 5.5-5                  |
| Mirada        | 7,873cd                | 2,625ab             | 10,536cde           | 60.2b                | 36                         | 49                       | 4.6                 | 6-6.7                  |
| Sequoia       | 6,598d                 | 566e                | 7,165e              | 60.7b                | 30                         | 33                       | 4.6                 | 5.3-6.3                |
|               |                        |                     |                     |                      |                            |                          | 4.2                 | 4-5                    |

**Experiment:** The experiment consisted on growing each variety on a 10-foot long double row bed, four replication per variety. Spacing was 3 inches between plants in the row, and 1 foot between rows. The crop was drip irrigated.

**Data analysis:** Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence interval ( $P < 0.05$ ).

**Yields:** Yields per acre were based on an estimate of 21,700 linear foot row per acre. In our experiment we grew each variety on 20 a foot row length, so a direct conversion was used to estimate yields per acre and yields per 100 ft row.

Table 6. Effect of bone meal, chicken manure, and chemical fertilizer on total yields (16 harvests for 5 weeks) of bush bean varieties grown at the UHM Waimanalo Experiment Station, Fall (Aug.-Oct.), 1998.

| Treatment plants      | Wt Grade A (lb/Ac) | UnmktWt (lb/Ac) | Total Wt (lb/Ac) | Grade A Percent | Wt Grade A (lb/100 ft) | Wt Total (lb/100 ft) | Pod Size (grams) | No. (per 10 of row) |
|-----------------------|--------------------|-----------------|------------------|-----------------|------------------------|----------------------|------------------|---------------------|
| Bone Meal-1 ton/Acre  | 11,160a            | 2,220a          | 13,380a          | 67.6a           | 51                     | 62                   | 5.1              | 29                  |
| Bone Meal-4 tons/Acre | 12,144a            | 2,040a          | 14,188a          | 70.5a           | 56                     | 65                   | 5.2              | 28.7                |
|                       | 7,417b             | 1,282b          | 8,699b           | 66.5a           | 34                     | 40                   | 4.6              | 16.5                |

**Experiment:** This non-replicated experiment was superimposed on a bush bean variety trial. Each block received a different fertilizer treatment, as follows: Block 1 received 120 lb/A of Nitrogen in the form of 10-20-20 and calcium nitrate fertilizers split at planting and one month after planting; Block 2 received at planting 30 lb/Acre N chemical fertilizer plus chicken manure at a rate of 4 tons/Acre; Block 3 received at planting 30 lb/Ac chemical fertilizer plus bone meal (approx. 10-10-10) at rate of 1 ton/Acre; block 4 received at planting 30 lb/Ac chemical fertilizer plus bone meal at a rate of 4 tons/Acre.

**Data analysis:** Numbers followed by the same letter within each column are not statistically different according to Duncan's New multiple range test at a 95% confidence interval ( $P < 0.05$ ).

**Yields:** Yields per acre were based on an estimate of 21,700 linear foot row per acre. In our experiment we grew each variety on 20 a foot row length, so a direct conversion was used to estimate yields per acre and yields per 100 ft row.

**Results:** The data shows a trend towards greater yields for the treatments that received a startup application of synthetic N (at 30 lb/Acre rate), plus a 1 ton/Acre rate of bone meal. However no statistical significant difference was found between the lower bone-meal rate and the synthetic N and chicken manure treatments. A trend was also observed for greater total yields and a higher percentage of Grade A pods for the low rate bone-meal treatment, but again, no significant differences were found with the fertilizer or chicken manure treatments with respect to these variables. In summary, with respect to yields and productivity alone, the bone-meal organic material, may be a viable alternative to replace or supplement the use of synthetic fertilizers for bean production in Hawaii. The highest bone-meal rates caused significant stand reductions on the bean, because the material was applied on the same day that the seed was sowed. When applying high bone-meal rates, it is thus recommended to apply it during bed preparation, a few weeks prior to sowing bean in the field.

## Bush Bean Variety Descriptions

UHM Bean Variety Trials, 1998

- Benchmark** (Roger's/Sandoz) A standard green/snap variety in Texas. Had high total yields in 1996 trials in Kentucky. In Fall 1996 trials in Kentucky (cool and wet weather) Benchmark had high total yields, was attractive and had good uniformity, straightness and high pod fill ratings.
- Bronco** (Asgrow) Med dark carries I gene common mosaic virus. Very similar to Strike (Strike is a vigorous upright plant, outstanding yield, very straight, smooth slender pods. Seed form very late and pods hold small size for a long time. Good shipper) but pods are darker green and shiny, 49-50 days(N. Carolina).
- Cloudburst** (XP 345) (Asgrow)Maturity similar to Hialeah or Opus. Upright plant with pods set high. Slightly longer pods. Has the I gene for Bean Common Mosaic Virus resistance.
- Corumba** (Petoseed) Bush bean, pods at about 4.4 inch length, sieve in 3's. Resistant to BCMV and Antracnose.
- Dorabel**, Snap bean 460-N (Cook's Garden) This vigorous yellow bush bean that we found at the home of the oldest seed firm in France colors up early and stay slim, which makes it ideal for a yellow filet type bean. Exceptional flavor when large or small makes it a great choice for all around use. Stringless wax bean with concentrated set. Pods are 5 inches long, very straight and with gold color that develops early. Resistant to anthracnose and common mosaic virus.
- Dragon Tongue**, Snap bean 452-L, (Cook's Garden) Stocky bush plants bear a profusion of flat wax beans mottled with bronze tiger stripes. Even when harvested large they are crisp, juicy and stringless. At a garden market, they were universally rated by our customers as one of the tastiest beans around. They are also one of the highest yielding.
- Early Bush** (Snap bean), (Known-You Seed) Plant is a compact early bush. Green pods are 12 cm (4.7") long, smooth, round, straight and stringless.
- Espada**, (Harris Moran) Slender, smooth pods with attractive deep green color, slow seed development and excellent yields. Rel. Maturity: Mid Season; Pod Color: Dark Green; Seed Color: White; Pod Shape: Round; Espada has shown promise for several different markets. For processors, its ability to hold color well when blanched and its slender pod diameter have made it look promising for frozen product. For fresh market use, Espada's refined, long straight pods and smooth deep green color, convey a sense of freshness when displayed at roadside stands. Consistently a high yielder, as well as its fine pod characteristics, are making Espada popular internationally as well as domestically. Recommended in Michigan for hand pick. Disease: R-BCMV, R-CT, R-BNS, TGM, Resistant to halo blight and anthracnose.
- Ex 344**- (Asgrow) XPB 344, is a KY-type that Asgrow introduced in 1997. Primarily for shipping, the plant has excellent standability and high pod placement. XP 344 is a flat podded type similar to Greencrop. A bush Kentucky Wonder type. Maturity similar to Greencrop. Plant is more upright with pods higher in the plant. Pre-commercial product. Contains the I gene for Bean Common Mosaic Virus resistance.
- EX 393**. (Asgrow), Experimental variety. Very early maturity, earlier than Rushmore or Storm by a couple of days. Large plant with high pod set. ( May be rust resistant, I don't remember for sure.) Has the I gene for Bean Common Mosaic Virus resistance.
- Fandango** (Petoseed)- mid-season snap bean with slightly more slender pods than Xera. plant very erect about 20" tall, relative small leafs, pods dark green, straight, sieve size in the 3 and 4's (using the USDA sieve size scale)and about 6 inch long. Relative Maturity at about 59 daysTolerant/resistant to halo blight, common blight, anthracnose, and bean common mosaic virus.
- Hystyle** (Harris Moran) High yielding, lodge resistant plants, well suited to mechanical harvest. Rel. Maturity: E Mid Season; Pod Color: Med. Dark Green; Seed Color: White; Pod Shape: Round. Performed well in Indiana summer 1996 trials.
- Jade**- (Roger's/Sandoz), 60 days This revolutionary, fresh market green bean features long, round, straight pods with excellent color and flavor. Its strong, large, upright bush is easy to pick. Average Pod Length: 6-7" (14-16 cm), Type: Green Rod; Pod Color: Dark green; Resistant to bean common mosaic virus strains 1 and NY 15, and curly top virus. Tolerant to rust.

**KY Bush** (Asparagus/Yardlong bean), (Known-You Seed) Rel. Early and Resistant to virus. Plants are very vigorous, dwarf, around 50 cm (19.7") tall, and well-branched. Flowers are blue-purple and have two to four pods per cluster. Pods are slender, light green, 25-30 cm (9.8-11.8") in length, and 0.6-0.8 cm (0.2-0.3") in width, weighing 12-18 g (0.4-0.6 oz.), tender and stringless. Seeds are red.

**Magnum**, (Asgrow) Med light, Performed above average in 1996 summer trials in Indiana. Carries I gene with resistance to Common Mosaic Virus.

**Maxibel** (Filet bean), (Johnny's): 50 days. Long and Stringless, concentrated set bean. The very slender 7" round green beans are firm-textured, tender, uniform and a good tasting. Maxibel can be classed as a Morgane-style bean with the advantage of being stringless for more flexibility in harvest schedule. High yield. For specialty market and growers wanting a very slender, long green bean with high eating quality. Brown mottled seeds. In Kentucky trials it did not yield as well as other varieties but "was a very attractive long thin bean that would market well." (also sold by Vilmorin).

**Mirada** (Roger's/Sandoz), 55-days. A fresh market bean that has performed very well in the Southeastern U.S. especially in the spring. Very good bush habit, has straight 5-6 inch pods held high in upright bush. Upright plants hold Mirada's 5.5 to 6-inch pods above the ground allowing them to grow straight and long, and reducing the risk of tip rot. Growers in all major bean producing areas report high yields from this variety. In about 54 days, Mirada produces a plentiful crop of high quality beans that can be machine harvested or hand picked. Bean common mosaic resistance.

**Narbonne** (Green bean) (Johnny's): 52 days. Tender and firm with rich color. The round, slim, 5 1/2-6" beans are a deep green color like Jade (Rogers), and the taste and the texture are excellent. Very heavy yields. White seeds. Fresh market/processing, diameter is medium/slim, Disease tolerance: Bacterial Blight, Halo Blight, bean common mosaic virus, anthracnose (also produced by Royal Sluis).

**Nickel**, Filet bean 464-N, (Cook's Garden). This exciting French filet is one of a new breed of long holding filets that can provide first rate, thin yet flavorful baby beans. The concentrated harvest period considerably lowers the labor in having first rate filets because you only have to harvest once or twice. Each plant may bear 1/4 lb. or more over two pickings a week apart. Yield is concentrated for machine harvest and pods are uniform, bearing straight, dark-green, fleshy beans. Dual purpose fresh market/processing variety. Sturdy plant that exhibits disease and stress tolerance. (from Vilmorin).

**Opus**, (Asgrow). Med Lt resistant to, mod rest to 10r more bean rust. High yielding, resistant to rust, resistant to CBMC, 52-56 days; Grown as one standard in Florida (1995), N. Carolina (1994).

**Orient Wonder** (Sakata). Rich green colored beans are slender and long, from 15-18" (38-48 cm). Seeds are slow to develop so pods stay smooth. Thrives in heat, but sets better in cool or drier weather than similar varieties.

**Probe** (Harris Moran)

**Prosperity** (HMX 8956), (Harris Moran). Long, smooth, straight pods, slow seed development, concentrated pod set: upright bush, excellent yields. Rel. Maturity: Mid Season; Pod Color: Med Lt. Green; Seed Color: White; Pod Shape: Round; A concentrated pod set on an erect plant which is well suited for mechanical harvest. Performed above average in trials in Indiana (summer 1996). Disease: BCMV, Br Spot. Has performed well in trials in Florida and in the SE U.S.

**Rushmore**, (Asgrow). A medium-green fresh market snap bean. Colored seed. It has potential for improved cold soil emergence and is adapted to either mechanical or hand harvest. Can produce high yields of slender pods that are normally 5-5.5 inches long. The bush holds pods well above the ground. It has the "I" gene for resistance to bean common mosaic virus.

**RX 1386** (Petoseed) Bush bean, pods medium green about 5 to 5.5 inch long sieve size in the 4's and 5's. Maturity in about 54 days

**RS 1384** (93) (Petoseed)- Grading in the 4-5 sieve size, a Royal Sluis brand from Petoseed, is a cut bean type that has strong tolerance to heat and drought. Medium green bush bean, pods about 5 inch long, Maturity 52 days resistant to BCMV.

**Sable** (HMX 2974), (Harris Moran). Dark Green, very straight, mainly 4 sieve that fits the Japanese and Italian fresh markets. Rel. Maturity: Mid Season; Pod Color: Dark Green; Seed Color: White; Pod Shape: Round; Disease: BCMV, Halo, Anth.

- Sequoia, 463-L, (Cook's Garden)** A rich beany flavor characteristic of flat podded types, solid texture, and deep purple color.
- Seville, (Roger's/Sandoz)** 56 days Seville is the odds-on favorite for flavor, texture, appearance and in-field performance. Seville produces rich green, six inch, straight pods high on a upright bush. South-eastern growers are very pleased with it's vigor, germination and disease resistance particularly when planted in the December-February slot. Type: Tendercrop; Avg. Pod Length: 6-6.5 inch (14-16 cm); Avg. Pod Diameter: 9-10 mm; Resistant to bean common mosaic virus (races 1 and NY 15); Disease Res.: BV1 & NY15.
- Shade (HMX 2976), (Harris Moran)** A new dark green, glossy, very straight variety with high disease resistance on a medium size bush that will mechanically harvest. Rel. Maturity: Mid Season; Pod Color: Dark Green; Seed Color: White; Pod Shape: Round; Disease: R-BCMV, R-CT, R-BNS, TGM
- Stallion (XP 346), (Asgrow)** Maturity similar to Strike or Bronco. Darker pod color. Plant large and a little floppy. Pods set medium high. Intermediate resistance to halo blight. All have the I gene for Bean Common Mosaic Virus resistance.
- Storm (XP 323) (Asgrow)** Maturity the same as Rushmore or a day earlier. Large plant with pods lower in the plant. Commercial product. Has the I gene for Bean Common Mosaic Virus resistance.
- Tavera (Filet bean): (Johnny's)** 54 days. Stringless and extra slender. "Extra fine" grade beans. Short, 4-5" medium dark green round pods. Medium sized plants. Small white seeds. Disease tolerance: Anthracnose and one or more races of Bean Mosaic Virus.
- Xera, (Johnny's)** New in 1997. High yielding and heat tolerant. A widely adapted high yielder for fresh market. Beautiful, avg 5 1/2" pods are slender, straight, dark green, and have slow seed development. Good, tender eating quality. Ability to set pods during heat a plus. Hand or mechanical harvest. White seeds. Disease tolerance: Halo Blight and one or more races of Bean Mosaic Virus.
- Xera (Petoseed)** A fresh market snap bean that produces straight smooth and shiny dark-green pods about 6 inches long. The variety's upright plant habit is conducive to hand or machine harvest. Pods dark green shiny, attractive, sieve in mainly 4's.resistant to BCMV and Antracnose
- XP-345:** see Cloudburst
- XP-346:** see Stallion
- Zodiac, (Asgrow).** A fresh market hybrid with excellent standability, has a relatively large frame. Adapted to Homestead, Florida (South Fl) for late-winter and spring harvest.

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