

1997 Progress Report

1997 CALIFORNIA STATEWIDE DRY BEAN TESTING

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and UC Drybean Workgroup Members Statewide

The main objective of the statewide dry bean support activity is to support all sponsored research activities of the workgroup members. These activities include planting, managing and harvesting field trials. The statewide research support program involves in a wide range of activities which are recommended by growers and the bean industry.

The main focus of the program is to evaluate and develop varieties and improved production practices for yield, canning quality, disease and insect and nematode resistance, and explore the market potential of less traditional grain types that have the potential to expand the total acreage of California drybeans.

The UC drybean workgroup continues to evolve toward increasingly collegial working relationships that benefit the state's bean growers, and which enhance the efficient utilization of scarce resources to support research and extension activities. For any specific activity discussed in this statewide testing section, a large number of people from diverse backgrounds collaborate to achieve the results presented and discussed. All UC supported research now originates in the annual workgroup meetings, where growers and industry leaders interact with researchers to set priorities.

Field trials of preliminary and advanced breeding lines were conducted on blackeye, , lima, garbanzo and common beans. Strip trials of pre-release lines were tested in commercial bean fields. This 1997 progress report seeks to compliment and integrate specific trials reported by other authors, and especially for evaluations of common sets of genetic materials tested in more than one county or location or planting date, and often by researchers from different disciplines. In the pages that follow, we try to recognize contributions from workgroup members, but often the amount of support we provided is very unique/specific to the trial and location, and as such varies considerably.

We again want to especially acknowledge the great collaboration of staff at the CSU-Chico, UC KAC, UC WSREC, UC Davis farm, UC Shafter, Gene Caffese, UCCE staff statewide, and the many growers and industry people who helped so much during 1997 to facilitate the very large number of field experiments and strip trials that we provided logistical support for.

Materials and Methods:

Preliminary and advanced yield trials were conducted at UC Davis, KAC, Stockton, Chico and WS&REC. For most yield trials, seeds were planted on 30 inch beds in 4 rows x 30 feet length with 4 replications. Plots were trimmed to 25 feet after plant emergence. Only the center two rows were harvested. An specialized extension belt/cone planter and belt thresher were used for planting and harvesting, respectively. For strip trials of the pre-release lines, local commercial planters and harvesters were used. Seeds were cleaned by seed cleaners. Samples for canning quality tests were taken and seed yield was obtained.

Blackeye Results:

The main support activities in 1997 Blackeye research consisted of planting, harvesting, and seed processing/scoring for the multisite uniform variety trial, and similar support for trials on weed control and management of leafminer and Lygus. We particularly respect the collegial effort between UC blackeye breeders at Davis and Riverside.

The 1997 statewide yield summary is very well covered in the contribution of Ehlers et. al. in the blackeye section of this UC report, and particularly in Tables 2 and 5 of that report. Since each of the three UC field stations located in or near the blackeye growing area have production characteristics that limit their representativity and sufficiency for varietal testing, it is very critical that we benefit from the expert assistance of UC farm advisors to test with growers in commercial fields. This serves as a necessary compliment to data from field station trials. The 1997 results, as summarized by Ehlers, again begs the question of our "strategy" with respect to the numbers and kinds of varieties that the Bean Workgroup seeks to develop, and most particularly over how broad or narrow a range of environmental growing conditions. How many different varieties should a 30,000 acre industry carry? It is very important that the industry and research group amass sufficient data of high quality, in order to make wise decisions.

Insect challenges in drybeans, and blackeyes in particular, have become a great production concern. Even as growers become more aware of the implications of specific chemical and/or cultural controls of each limiting pest, the complexity of season-long, multi-species/multi-crop insect management (Lygus, whitefly, leafminer, aphids) has become larger and more challenging. For that reason, a second major area of blackeye research support and testing has focused on host plant resistance and integrated control of insect pests. This is likely to continue at a high level for the foreseeable future. Specific results, detailing progress from research on one or more insect pests, are presented in no less than five different sections of this annual report. Part of this is due to the unpredictability of many insect infestations, which means that a trial might be grown in several seasons and/or locations to find the level and distribution of insect pressure to successfully perform the work. This is especially true of Lygus research.

In addition to the mentioned activities, the statewide program supported other blackeye research through providing equipment, planting, harvesting, cleaning the seeds, and gathering the data for the following activities (responsible researchers in parentheses):

- Cultural practices and genetic control of Lygus in dry beans (T. Bensen and S. Temple).
- Nematode field screening (P. Robert, B. Mathews and J. Ehlers).
- Cultural practices and leaf miner control (C. Frate and S. Mueller).
- Uniform yield trials and variety evaluation in Tulare (C. Frate, D. Helms and J. Ehlers), WSFS (J. Ehlers and D. Helms) and Shafter (B. Sanden, D. Helms and J. Ehlers).
- Insecticide evaluation for Lygus (S. Temple, L. Sanchez, T. Bensen and N. Bellaloui)
- Seed increase for the pr-release advanced breeding lines at Davis (S. Temple and D. Helms).
- Canning Evaluation for advanced lines (UCD and S&W).
- *Fusarium* screening at Davis (S. Smith and D. Helms)

Lima Results:

As discussed in the UCD lima breeding section of this report, lima bean production is adversely affected by two main species of root knot nematodes, and by Lygus and leafminer activity. Uniform trials of nematode-resistant, vine baby lima pre-varietal candidates were planted in a nematode-infested field near Mendota, but nematode pressure was not high enough to reduce the yield of susceptible (check) lines.

A second site was planted near Farmington, again in collaboration between the UC Davis breeder and San Joaquin County UCCE. The yields from this trial (in cwt/A) were disappointing also, with mean yields well below those representative of baby limas:

Line V8	17.5	Line V12	14.8
Line V7	15.7	Line V3	10.8

(CV= 25.0, p= 0.1)

It appeared that *Lygus* bugs were largely responsible for the high CV at that site, and yield differences were not statistically significant. The choice of sites where resistance factors demonstrate their value is especially important in baby limas because of the very high yield potential of nematode-susceptible check varieties like Mezcla, in the absence of the pest.

Garbanzo Results:

Support for garbanzo research activities focused on the main production-limiting factors: management of *Ascochyta* blight and the development and testing of public and/or private varieties with resistance to this and other pathogens that represent the principle constraints to garb production. Plant pathologists Shirley Smith and Carol Frate have cooperated with breeders at UCD and UCR to develop genetic materials and production practices that allow economically viable garb production in spite of the many disease pressures recently experienced by the California garb crop.

The UC Dry Bean Work Group has initiated 1) testing of introduced *Ascochyta*-resistant varieties as a short term solution, 2) modification of existing cultural practices, and implementation of new ones to better allow the production of susceptible commercial varieties, 3) recombine *Ascochyta* resistance onto commercial California genetic backgrounds as a long term solution, and 4) monitoring the spread and dynamics of the disease in garbanzo growing areas of the state. As noted in reports from Frate and Waines and Temple in this volume, the weather was extremely non-cooperative for 1996-97 *Ascochyta* testing and research.

A variety trial, planted under non-protected conditions to compare the performance of introduced public and private lines believed to carry resistance to *Ascochyta*, is described in Table 4 of the UCD breeding report of Temple et. al. in this volume. Both the severe virus pressure observed, and the virtual absence of *Ascochyta* (in spite of repeated attempts to artificially inoculate the trial) were representative of extensive 1997 commercial acreage. Of the 19 lines evaluated, the variety Helm HS9319 was clearly superior yield-wise, and also scored very well in seed quality evaluations (size, color, skin texture, and uniformity). The USDA/ARS release Dwelley was equally superior in terms of grain quality (Table 4). Many of the introduced germplasm lines had unacceptable seed characteristics, and a number of the lines are still quite variable for seed size or color or skin texture.

Common Bean Results:

Following nine years of parental selection, crossing, and progeny selection for BCMV resistance, plant architecture, yield, grain quality, and preliminary canning tests, the UC Davis breeding program had by 1997 developed extensive yield data for a large group of advanced breeding lines representing most of the common bean classes grown commercially in California. 1997 marked the significant point at which we proceeded from experiment station yield testing to on-farm strip trials in growers' fields. The main rationale for this step is the very high priority the kidney industry places on improved canning quality, and the widely-held belief that our UCCE belt thresher is exceedingly gentle with

our lines, compared to the mechanical beating that beans are subjected to in growers' fields where a very different kind of harvesting equipment is used.

These lines originated from crosses made between California commercial types and introduced lines with very diverse genetic backgrounds, many of tropical or sub-tropical origin. Breeding lines having at least one previous yield test were grouped together in 1997 and tested in Advanced Yield Trials (AYT) and those with no yield history were tested as Preliminary Yield Trials (PYT). Among the AYT candidates, a very few lines with several seasons of positive yield data, very good dry grain quality, and acceptable preliminary canning results, were selected for genetic multiplication and simultaneous strip testing under commercial management conditions. Earlier experience with canning tests showed us that we would lose large numbers of high-yielding kidney lines on the "altar" of canning quality in the initial canning tests, and that continues to be very true.

1997 yield testing was conducted at Stockton (Farmington), Chico (CSUC farm) and the UC Davis agronomy farm. Only the Advanced Yield Trials are covered in this section of the 1996 Annual Report. Observation nurseries, F2 populations, progeny tests, Preliminary Yield Trial results and early generation breeding activities are discussed in the UCD Grain Legume Improvement Program section of this volume.

Generally, an effort was made to test lines in the location most representative of its respective grain class, and following our habit of rotating progeny selection and yield testing across locations from year to year. In response to industry directives, greater emphasis was given to the selection, planting and evaluation of our 1996 elite kidney lines. Some of those lines had undergone three consecutive yield tests, and others had already passed one canning test. All lines of every grain class are believed to be true-breeding BCMV-resistant. A few have proven to carry recessive, partial resistance, but most carry the "I" or dominant, hypersensitive resistance.

Dark Red Kidney AYT:

Advanced dark red yield trials were conducted at Chico and Stockton (Table 1). The Chico nursery was planted early (May 8th) and late (June 26th) to mimic the wide range of practices used by growers, and to heighten possible canning differences that may be attributable partly to environmental conditions. Also, strip trials of the 4 elite, pre-released lines, were conducted in Davis, Stockton, and Chico. Those results are shown in tables 9 and 11. Farm advisors in Tehama and San Joaquin counties provided local leadership for the kidney strip trials.

In the Chico early planting, data show that 4 lines performed better than the CDRK check, and that yields ranged from 23.1 to 27.5 cwt/A. The overall results of Chico late planting showed that, although the yields of advanced selections were low compared to those of the early trial, three advanced lines performed better than the check (CDRK). At Stockton, most experimental lines outyielded the CDRK check, and yields ranged from 15.0 to 23.8 cwt/A (Table 1). These results are quite similar to earlier seasons, at least to the extent that it has been easier to beat the CDRK check in Stockton than at Chico. Also, the distribution of yield differences in Chico late-planted germplasm is often "tight" in terms of range of variability.

In the strip trials, which were managed commercially by the growers, there were no significant varietal differences in yields (Table 9). We may conclude that, for Chico-area DRK growers, the bottom line, at least for this group of progenies, will be in canning quality. In the Davis strip trial (planted May 21), line 9652 looked especially promising. At the Stockton strip trial, in a manner that mirrors several years of yield testing, all three experimental lines substantially bettered the CDRK check.

It is of course very important to remember that, with the exception of the Stockton strip trial, data for canning quality of strip trials and AYT yield trials are still pending. In previous years, a large number of high-yielding kidney lines have been eliminated because of poor canning results, sometimes after fair to good canning results in an earlier (preliminary) test. Nonetheless, the canning data from Stockton (Table 11) are extremely positive for lines 9604 and 9638 (both with two year's replicated data), and 1997 was NOT a benevolent season for DRK canning quality in the Stockton kidney district. Plans are underway, in cooperation with UCR researchers, to increase a few of the very best DRK lines during the winter-spring season at the Coachella field station.

It is also encouraging to see that, in addition to lines like 9604 and 9638 from the strip trials, we have a small pool of very good candidates that, with further testing for yield and canning quality, show great promise. Lines 9649 and 9654 are good examples, and several other lines from the 1997 PYT seem to be nearly as interesting. All these lines are also I-gene resistant to BCMV, which gives them a substantial advantage over the commercial CDRK check variety.

Light Red Kidney AYT:

Advanced light red yield trials were conducted at Chico (early and late) and Stockton, and strip trials for the pre-release lines were conducted at Davis, Chico, and Meridian. Tehama and Yuba County farm advisors managed those field tests. The results are shown in tables 2, 9, and 11. It is immediately clear that, with the notable exception of BCMV susceptibility for the LRK commercial check "Red Kidney", it is much more difficult to equal or beat the LRK checks in yield, and most particularly CELRK in the Stockton area. The only reason to release one or more of these new LRK candidates, based on yield data to date, is if the line proves to be markedly superior to the three high-yielding check varieties in canning quality.

Over the course of the last three years, with extensive field and experiment station yield tests of experimental lines with commercial check varieties, we have observed that many of the LRK advanced lines "jump around" in terms of (site x season) interactions on yield. As a group, our light red progenies are more sensitive than our dark red lines, and especially if we measure the stability of our lines against CELRK or Red Kidney, as opposed to CDRK as a reference for the DRK's. It also appears that one feature of new LRK varieties requested by the growers (lateness/ full season), may require location-specific study and "fine-tuning" to obtain consistent high yields and quality from the new LRK lines.

As in the case of DRK, we are encouraged by the excellent performance of many new LRK lines that recently entered the PYT, but many of them are also expected to be discarded when we apply rigorous criteria for canning quality in the selection and testing process.

Preliminary dark and light red kidney yield trials, conducted at Davis and Chico, are reported in the UCD breeding section. The overall results showed the following: at Davis, 6 out of 10 dark red kidney lines yielded better than the check (CDRK) and the range of yield was from 29.7 cwt/A to 33.7 cwt/A. Also, 10 out of 10 light red kidney lines performed better than the check (CELRK) and the yield ranged from 25.6 cwt/A to 39.1 cwt/A. At Chico late planting, 6 out of 10 dark red kidney lines outyielded the check (CDRK), and 8 out of 10 light red kidney lines performed better than the check (CELRK). Happily, those lines which performed better than the check at Davis also performed better at Chico, although yields at Chico were higher than those at Davis.

Pink AYT:

UCD variety Yolano is an exceptionally high-yielding variety in the Davis area, but it is a prostrate vine habit, has a relatively narrow adaptive range, a mediocre root system, and is

resistant to only a few of the most common strains of BCMV. With the goal of overcoming these shortfalls, a series of hybrid lines with diverse genetic backgrounds have been selected and tested for several seasons. Our objective is to release a BCMV-resistant pink variety that can be grown throughout the Sacramento Valley and Northern San Joaquin Valley, and with yields and seed/canning quality equal to or better than those of Yolano. A 1997 advanced yield trial with 11 entries was conducted at Chico and Davis. The overall results (Table 3) show that all advanced lines yielded much better at Davis than at Chico. It may be difficult to move a new variety whose major advantages do not include improved yield.

Canning evaluations are in progress. Other advantages of the new varietal candidates, according to growers, is the convenience of managing plants with a very erect plant architecture, strong petioles that elevate pods above the soil, and stronger root systems. A modest group of non-kidney elite lines were evaluated in 1997 in strip trials (Table 10), and the 2 pinks, which were planted in a commercial field of Sutter Pinks near the town of Arbuckle, were remarkably upright and erect in spite of a heavy pod load. These and many other non-kidney grain types (Table 10) have been distributed to small farm farm advisors in Humboldt and Fresno Counties for evaluation by local bean growers who direct market "heirloom" bean types.

Small Red Yield Trials:

The U.S. and California Hispanic markets comprise a significant portion of the domestic common bean trade, especially for pintos, small reds and blacks. Although California bean growers have grown pintos and black beans, a lack of information on locally adapted varieties of small red and other Central American types suggested we put a modest amount of work into these classes, which segregated from crosses designed to improve California pinks and other types. A group of such types, mostly hybrids of Central American lines with California commercial types, has been assembled by the UC Davis breeding project during the last eight years. Most of these lines carry dominant BCMV resistance.

Since the very delicate-flavored bean "Flor de Mayo" is in high demand in some regions of Mexico, it is likely that a niche could be developed in the domestic U.S. market, and most particularly the local, direct marketing producer. Lines 9623 and 9696, and 9697 (Tables 4 and 10) are Flor de Mayo with excellent visual seed quality, and yielded more than 26 cwt/A. Line 9623 yielded 32.5 cwt/A at Stockton in 1995, and also ranked first at Chico and Davis that year.

The yield of advanced small red and Flor de Mayo lines grown at Chico and Stockton is shown in table 4. As mentioned in the Breeding PYT section, the new UI239 is very tough to beat yieldwise as a check (but color isn't particularly appealing).

At Chico, early planting (5/8/97), 7 out of 9 lines were grouped as good yielders and their yield ranged from 25.2 to 28.3 cwt/A. The highest yield was achieved by 96103 (28.3 cwt/A) and 9623(28.3 cwt/A). At Chico, late planting (6/26/97), the yield of the experimental lines was slightly lower compared to those of the early planting. Again, both 96103 and 9623 were grouped among the best yielders (from 24.6 cwt/A to 26.5 cwt/A). At Stockton, the test lines showed a higher yield than at Chico. The highest yield was achieved by 9623 (29.5 cwt/A), although 96103 was still in the top yielding group.

Data of strip trials of advanced small red and Flor de Mayo lines at Davis and Chico are presented in table10. At Davis, the same pattern of yield was observed, i.e. 96103, (31.7cwt/A), then 9623 (25.7cwt/A), followed by 9696-op (27.6 cwt/A) and 9696-br (27.2 cwt/A) were classified among the high yielding lines. All are Flor de Mayo grain types. The yield data from Chico early strip trial were higher than those of the late strip

trial. It can be concluded that there is a group of advanced Flor de Mayo lines which are competing close to yield of check UI239. These lines are classified as pre-release lines. Canning quality of these lines is in progress. Pressure is being put on the PYT to select more Red Mexican or small red types with BCMV resistance and high yield.

Canario (Yellow) Results

Table 6 shows that the yield data of canario yellows at Stockton. Canario, like the Flor de Mayo, is an ethnically popular bean that is of interest for California's growing Hispanic consumer population, and for small producers who direct market locally. The canario check Mayacoba (BCMV-susceptible) performed extremely well (23.3 cwt/A) followed by CAP 7 (21.0 cwt/A, and resistant). 96102 was very poor. CAP 7 performed better at Stockton than at Chico (14.9 cwt/A).

Small White Results:

A strip trial of small white lines was conducted on 6 entries at Davis. The highest yielding line was 9625 (19.3 cwt/A), one of two small white lines tested in a strip trial in a grower's field near Dixon (Table 10), and which is currently being evaluated for canning quality.

Black Turtle Soup Results:

The yield of advanced black lines, grown at Chico, are illustrated in table 8. It can be seen from the data that all experimental lines performed similar to the check (BTS39) in this particular trial. In a strip trial at Davis (Table 10) the test lines did not show a big difference in yield and they were close to each other. Similarly, the two UCD lines looked similar to the commercial variety "Black Jack" in a strip canning study near Dixon. Many Black Turtles genotypes are difficult to evaluate in a breeding nursery or yield trial in Davis or Chico, because, compared to most other bean types, the BTS are very prone to shattering/dehiscence.

White Kidney:

Several white kidney lines were evaluated in AYT (Table 5), and two were quite high in yield. the line 96162 was evaluated in a 1997 strip trial at Tracy, and had very high yields in Tracy and in the UCD strip increase (Table 10), but the white seed was judged to be too small for the specific market that had been targeted.

Other Common Bean Research Activities

The statewide program involved in supporting other research activities which included the following (responsible researchers in parentheses):

- Preliminary and advanced DRK and LRK yield trials at Chico (S. Temple, L. Sanchez and N. Bellaloui)
- Preliminary and advanced DRK and LRK yield trials at Stockton (M. Canevari and S. Temple)
- Advanced DRK and LRK uniform yield trials at Stockton (M. Canevari and S. Temple).
- Advanced LRK strip trials for yield and canning evaluation at Sutter/Yuba (M. Cahn and S. Temple).
- Common bean strip yield trials at Chico (S. Temple, L. Sanchez and N. Bellaloui), at Stockton (M. Canevari and Steve Temple).
- Genetic increase of advanced lines at Davis (S. Temple and D. Helms)
- Canning evaluation of elite common bean lines (UCD and S&W)
- BCMV evaluation at Davis (S. Temple)
- Lygus control at Davis (S. Temple and T. Bensen)
- Advanced pink, small red and Flor de Mayo, and black turtles yield trials at Chico and Davis (S. Temple, Luis Sanchez, D. Helms and N. Bellaloui)

Table 1: 1997 Advanced Dark Red Kidney Yield Trial

	Chico Early Planting		Chico Late Planting		Stockton		
Line	Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity	Mean
9649	27.5 a	M	15.1 bac	L	23.8 a	ML	22.1
9654	20.6 bdc	M	17.3 ba	L	19.1 ba	L	19.0
9606 (Strip)	22.6 bdac	ME	15.0 bac	M	18.4 bac	ML	18.7
9604 (Strip)	22.0 bdac	M	15.6 bac	M	16.0 bc	ML	17.9
9605	25.2 ba	ML	12.4 c	ML	16.2 bc	ML	17.9
9638 (Strip)	22.5 bdac	M	14.1 bc	ML	15.7 bc	ML	17.4
9603	23.1 bdac	E	12.5 c	ML	16.5 bc	M	17.4
CDRK (Check)	22.7 bdac	ME	15.2 bac	ME	13.4 bc	ML	17.1
9653	19.6 bdc	ME	14.3 bac	M	13.2 bc	L	15.7
9607	17.7 dc	ME	14.1 bc	M	15.0 bc	ML	15.6
9652 (Strip)	23.5 bac	ML	-	-	-	-	-
Montcalm (Check)	17.2 d	M	6.7 d	VL	11.8 c	Lvar.	11.0

CV=16.8, p=0.02.

CV=14.3, P=0.0001

CV=23.7, P=0.03

Means followed by different letter within a column are significantly different at 0.05 level using Duncan's Multiple Range Test. Strip=Strip Trial. ME=Medium Early; M= Medium; ML= Medium Late; L=Late; Lvar.= Late Variable.

Table 2: 1997 Advanced Light Red Kidney Yield Trial

Line	Chico Early Planting		Chico Late Planting		Stockton		Mean
	Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity	
CELRK (Check)	23.0 ba	ME	16.1	E	20.6 a	VE	19.9
Red Kidney (Check)	25.7 a	M	15.8	M	17.9 a	M	19.8
Linden (Check)	25.5 a	ML	17.1	ML	14.7 ba	ML	19.1
9674 (Strip)	19.8 b	ML	17.6	L	14.8 ba	L	17.4
9680 (Strip)	24.7 a	M	13.6	ML	10.0 b	L	16.1
9681	14.8 c	L	12.4	VL	8.2 b	VL	11.8

CV=14.0, p=0.001

CV=11.2 , ns

CV=26.9,p=0.03

Means followed by different letter within a column are significantly different at 0.05 level using Duncan's Multiple Range Test. VE=Very Early; ME=Medium Early; M= Medium; ML= Medium Late; L=Late; VL= Very Late.

Table 3: 1997 Advanced Pink Yield Trial

Line	Chico Late Planting		Davis	
	Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity
9634	23.6 a	M	34.cb	L
9689 (Strip)	23.5 a	M	34.0 cb	ML
Yolano (Yolano)	23.0 ac	M	42.4 a	ML
96140	22.5 bdac	ML	28.0 e	ML
9688 (Strip)	22.3 bdac	ML	33.0 cb	L
96151	21.7 bdac	ML	35.5 b	L
96146	20.9 bdc	VL	29.3 ed	M
96149	20.9 bdc	M	27.7 e	ML
96142	20.6 dc	M	31.5 cd	M
96148	20.0 d	VL	29.1 ed	M
96145	19.9 d	L	29.2 ed	M

CV=7.3, p=0.01

CV=6.7, p=0.03

Means followed by different letter within a column are significantly different at 0.05 level using Duncan's Multiple Range Test. ME=Medium Early; M= Medium; ML= Medium Late; L=Late; VL=Very Late

Table 4 : 1997 Advanced Small Red Yield Trial

Line	Grain Type ¹	Chico Early Planting		Chico Late Planting		Stockton	
		Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity
UI239	RM	30.7 a	E	27.3 a	L	30.1 a	M
96103	F	28.3 ba	E	26.5 a	M	26.2 ba	ML
9623	F	28.2 ba	ME	23.1 bc	M	29.5 a	ME
9697	F	27.6 ba	ME	24.6	ML	25.7 ba	M
9698(Strip)	RM	26.2 bc	ME	19.3 d	ML	26.1	M
9696 (Strip)	F	26.2 bc	E	25.5 bac	ME	28.3 ba	ML
96156(Strip)	RM	25.6 bc	ML	18.1 d	VL	28.3 ba	ML
96100	F	25.2 bc	E	26.3 ba	M	25.8 ba	ME
96101(Strip)	RM	22.0 dc	ME	22.3 c	ML	23.3 b	ML

CV=10.2, p=0.0005

CV=8.6, p=0.0001

CV=10.1, 0.1

Means followed by different letter within a column are significantly different at 0.05 level using Duncan's Multiple Range Test. E=Early ;ME=Medium Early; M= Medium; ML= Medium Late; L=Late

¹ F= Flor de Mayo, RM= Red Mexican

Table 5: 1997 Advanced White Kidney Yield Trial

Line	Stockton		Chico Early Planting		Chico Late Planting	
	Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity
96136	20.7 a	ML	25.0 a	ML	16.8 a	ML
96134	18.6 a	M	28.6 a	M	16.3 ba	M
Lassen Check)	-	-	20.1 c	M	15.0 bac	ML
White Kidney (Check)	14.5 b	ML	-	-	-	-
2204	13.6 b	ML	20.3 c	M	12.8 c	ML
96137	12.4 b	M	24.8 ba	ML	15.6 ba	ML
96135	11.0 cb	L	19.7 c	VL	14.1 bc	VL
96162	7.9 c	L	22.3 bc	ML	16.7 a	L

CV=13.0, p=0.0003

CV=12.4, p=0.002

CV=8.0, p=0.01

Means followed by different letter within a column are significantly different at 0.05 level using Duncan's Multiple Range Test. M= Medium; ML= Medium Late; L=Late

Table 6: 1997 Advanced Yellow Yield Trial

Line	BCMV	Stockton		Chico Early Planting		Chico Late Planting	
		Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity	Yield (cwt/A)	Maturity
Mayacoba (Check)	SU	23.3 a	ME	35.6	ME	18.2 a	ME
CAP7 (Strip)	DR	21.0 a	ML	28.1	ML	16.7 a	ML
96102	DR	8.1 b	L	-	-	9.3 b	VL

CV=10.1, p=0.0005

CV=12.6 ,ns

CV=20.0, p=0.03

Means followed by different letter within a column are significantly different at 0.05 level using Duncan's Multiple Range Test. ME=Medium Early; ML= Medium Late; L=Late Variable; VL=Very Late; SU= Susceptible; DR= Dominant Resistance.

Table 7: 1997 Chico Advanced Small White Yield Trial, Late Planting

Line	BCMV	Yield (cwt/A)	Maturity
96132	DR	18.5 a	M
9627	DR	17.6 a	ML
96127	-	17.2 a	L
Aurora (Check)	DR	15.0 b	ML
96118	-	13.4 b	VL

CV=8.2, p=0.001

Means followed by different letter within a column are significantly different at 0.05 level using Duncan's Multiple Range Test. M= Medium; ML= Medium Late; L=Late; VL=Very Late. DR=Dominant Resistance.

Table 8: 1997 Chico Advanced Black Yield Trial, Late Planting

Line	BCMV	cwt/A	Maturity
96116	DR	19.0	M
BTS39 (Check)	DR	18.7	ML
96130	DR	18.7	L
96113	DR	18.3	M
96114	DR	17.8	L

CV=12.4, ns

DR=Dominant Resistance. M= Medium; ML= Medium Late; L=Late.

Table 9: Yields (cwt/A) of UCD Elite Kidney Bean Lines in 1997 Strip Tests

Line	Davis	Chico1	Chico2	Chico3	Sut	Stk1	Stk2
9604	-	25.0	22.0			20.2	16.0
9606	13.1	30.7	22.6			22.7	18.4
9638	15.6	29.4	22.5			21.9	15.7
9652	18.1	25.9	23.5				
CDRK	16.1		22.7			15.9	13.4
CDRK'82	-	26.5 29.1					
9674	17.7	21.3	19.8	17.6	Sutter Can		14.8
9680	17.6	26.6	24.7	13.6	Sutter Can		10.0
CELRK	19.0	-	23.0	16.1			20.6
RK	-	26.5	25.7	15.8	Sutter Can		17.9

Davis= Davis Strip and Genetic Increases

Chico1=Strip Trials at Nichols; Chico2 CSUC Early Planting;

Chico3= CSUC Late Planting; Stk1= Strip trial at Stockton; Stk2= Farmington

Sut= Canning Strip Sample (Sutter County)

Table 10: Yields (cwt/A) of Assorted UCD Common Bean Beans in 1997 Strip Trials

Line	Type Grain	Davis	Chico1 Chico2	Humboldt Obsvn	Fresno Obsvn
9688	Pink	19.2 Arbuckle	22.3	✓	✓
9689	Pink	24.2 Arbuckle	23.5	✓	✓
Yolano	Pink		23.0		
9622	Andino	20.0	19 12.6	✓	✓
96156	RM	21.2	16.9	✓	✓
9698	RM	17.3	27 18.8	✓	✓
9696	F	27.5	26 17.2	✓	✓
96129	SW	18.3 Dixon		✓	✓
9625	SW	19.3 Dixon		✓	✓
96114	BTS	15.7 Dixon		✓	✓
96131	BTS	17.9 Dixon		✓	✓
CAP7	Canario		14.9	✓	✓
96162	Lg W	27.1 Tracy			

Davis= Davis Strip and Genetic Increase

Chico1= Chico Early Planting; Chico2=Chico Late Planting;

RM=Red Mexican (Small Red); F=Flor de Mayo; SW=Small White; Lg W =Large White.

Table 11: Summary of 1995-1997 data for DRK and LRK Release Candidates

	95 Yield ¹	96 Yield (cwt/A)		97 Yield					96 Canning ⁴				97 Canning ⁴					
ID	Rank	Chico	Stockton	Chico Early	Chico Late	Stockton	Chico Strip	Stockton Strip	C1	C2	S1	S2	C1 ⁵	C2 ⁵	C3 ⁵	D1 ⁵	S1	S2
9604	14/28	20.2	24.7	8/12 ¹ 97 ²	2/11 105	6/11 119	25.0 ³ 94	20.2 127	1	1	1	1						1
9606	2/7	19.4	24.0	6/12 100	5/11 99	3/11 137	30.7 105	22.7 143	1	1	1	1					2	2
9638	20/27	22.7	28.8	7/12 99	7/11 93	7/11 117	29.4 101	21.9 138	1	1	1	2					1	1
9652	12/27	-	24.8	3/12 104	-	-	25.9 98	-	1	1	2	1						
9653	13/27	-	28.3	10/12 86	6/11 95	10/11 98	-	-	-	-	1	1						
CDRK	2/5	21.4	22.1	-	-	-	-	15.9 100	2	2	2	1						2
9674	3/25	21.0	24.0	5/6 77	1/6 111	3/6 83	21.3 80	Sutter Canning	1	1	1	1						
9680	5/25	22.4	29.0	3/6 96	5/6 86	5/6 56	26.6 100		2	2	1	1						
CELRK	-	22.9	30.6	-	-	-	-		1.5	1	2	2						

¹Yield Ranking; ²% of check variety; ³ cwt/A; ⁴ :1=S&W Label, 2=Private Label, 3= Rejected; ⁵ In Progress.

C1=Chico Early Planting; C2=Chico Late Planting; C3= Chico Strip; S1=Stockton ; S2=Stockton Strip; D1=Davis.