

19794

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## Progeny Evaluation in Uniform Nurseries

EV  
T/C/C/M

The Bean Team uses a three-phase system for evaluation and distribution of experimental lines

- 1 The Bean Team Nursery (VEF) is the first uniform and multidisciplinary evaluation for adaptation and disease and insect resistance Starts on July 1 and concludes on December 31
- 2 The Preliminary Yield Trial (EP) is the second uniform and multidisciplinary trial Only selected materials from the previous year's VEF proceed to this nursery Starts on January 1 and finishes on December 31
- 3 The International Bean Yield and Adaptation Nursery (IBYAN) is the third phase of the progeny evaluation scheme Materials selected from the previous year s EP trial are included in this nursery Starts on January 1 and concludes on December 31

The following section includes discussions on the 1981 VEF grown between July 1 and December 31 1981 the 1981 EP selected from the correspondent VEF reported last year and the 1980 IBYAN whose entries were selected from the 1980 EP

### 1981 VEF Bean Team Nursery

The 1981 Bean Team Nursery (VEF) was formed by 1110 entries 235 of these being climbers almost a 50% increase over last year's VEF Most of the material came from the CIAT bean germplasm bank or improvement program but other institutions from different countries forwarded bean germplasm for evaluation as well (Table 1)

Entries were distributed within the 16 groups of beans in Latin America based on growth habit and grain characteristics Table 2 shows the allotment of VEF entries in each group

As stated previously the main objectives of the VEF nursery are

- 1 To evaluate multiple-factor lines for overall agronomic merit
- 2 To evaluate specific character lines to determine their value as parents in crosses
- 3 To assess the annual progress for specific factors and in the recombination/reselection of multiple factors

Results in 1981 for reactions to bean common mosaic virus (BCMV) rust anthracnose angular leaf spot common bacterial blight and leafhopper are summarized in the following paragraphs

Table 1 Sources of bean germplasm for the 1981 VEF

Institution	Country	No of entries
CIAT Bean Program		1024
CIAT Germplasm Bank		65
INIA	Mexico	6
IAC	Brazil	4
ICTA	Guatemala	4
INTA	Argentina	4
Cornell University	U S A	2
CENDA	Dominican Republic	1
	Total	1110

Resistance to BCMV is a precondition for materials entering the VEF. Further tests on VEF entries confirmed this resistance in all 1981 entries.

A total of 22% of each of the bush and climbing bean entries showed resistant reaction to rust and another 21% of the bush and 25% of the climbers were intermediate. The highest proportion of resistant entries among bush beans was found among lines of groups 7 (51%) and 4 (46%) i.e. the large-seeded yellow cream red and red-mottled grains for temperate and moderately tropical climates. Among climbing beans with the exception of the large-seeded entries for the Andean Zone (group 15) each of the rest of groups showed more or less one-fourth of the lines with resistant reaction to rust (Table 3).

Of 1086 entries tested only five showed some degree of resistance (2-5 rating on a 1 to 5 scale) to common bacterial blight. A small percentage (4.3%) showed an intermediate reaction among the large number of entries with a variable reaction; many plants showed resistance reaction. In general however the large numbers of bean lines tested turned out to be susceptible. All resistant and intermediate reactions were found among bush entries (Table 4).

The best entries for rust or common bacterial resistance under Palmira conditions are listed in Table 5.

Table 2 Distribution of 1981 VEF entries within the basic groups of beans in Latin America

Basic group	Grain characteristic		Representative varieties within each group	Production regions	No of VEF entries	Growth habit
	Color	Size				
1	Black	Small	Jamapa Porrillos ICA Pijao Turrialbas Tacarigua Rio Tibagi Iguacu Moruna	Coast of Mexico Central America Caribbean Venezuela Southern Brazil	161	Bush
2	Red <sup>a</sup>	Small	Zamorano Mexico 80 Rojo de Seda Honduras 46	Central America	190	Bush
3		Medium	Pompadour Decayette	Dominican Republic Haiti	71	Bush
4		Large	Calima Andino Uribe Liborino Cargamanto Mocho	Andean Region	46	Bush
5	White	Small	Panamito Arroz Blanquillo	Peru Ecuador Colombia Chile	51	Bush
6		Medium	Caballero Cristal	Peru Chile	12	Bush
7		Large	Alubia	Argentina	10	Bush
8	Cream <sup>a</sup> Brown <sup>a</sup>	Small	Carioca Rosinha Chumbinho Roxao Mulatinho	Brazil	205	Bush
9	Pink <sup>a</sup> Cream <sup>a</sup>	Medium	Flor de Mayo Pinto Ojo de Cabra Bayos	Mexico temperate semi arid zone	70	Bush
10	Yellow <sup>a</sup>	Large	Tortolas Bayos Canarios Azufrados	Chile Coast of Peru Coast of Ecuador Mexico	59	Bush
11	Black	Small	San Martin	Guatemalan highlands Venezuelan Andes	21	Climbing
12			Negro Puebla Mexico 27	Coast of Mexico Central America	18	Climbing
13	Red*	Med/large	Mortino Bolon Rojo	Andean Sierra	79	Climbing
14		Small	Nahuizalco Rojo Alajucla 1	Central America	69	Climbing
15	Cream* Brown* Yellow	Med/large	Bolon Amarillo Canario Caballero Cargamanto	Andean Sierra	25	Climbing
16	White	Small	Carioca Panamito	Brazil Ecuador and Peru	23	Climbing
Total					1110	

a Includes solid as well as mottled striped and speckled types

Table 3 Number and proportion of bean entries within each basic group showing different reactions to rust 1981 VEF

Group	Growth habit	Climatic description of growing region	Grain characteristic		Rust reaction <sup>a</sup>			Total
			Color	Size	Resistant	Intermediate	Susceptible	
1	Bush	Tropical warm	Black	Small	48 (29 8)	9 (5 6)	97 (60 2)	161
2	Bush	Tropical warm	Red <sup>b</sup>	Small	27 (14 2)	70 (36 8)	81 (42 6)	190
3	Bush	Tropical warm	Red <sup>b</sup>	Small/med	4 (5 6)	20 (28 2)	46 (64 8)	71
4	Bush	Tropical cold	Red <sup>b</sup>	Large	21 (45 6)	17 (37 0)	7 (15 2)	46
5	Bush	Temperate	White	Small	13 (25 5)	7 (13 7)	29 (56 9)	51
6/7	Bush	Temperate	White	Med/large	6 (27 3)	6 (27 3)	10 (45 4)	22
8	Bush	Temperate	Cream light tan <sup>b</sup>	Small	52 (25 4)	34 (16 6)	91 (44 4)	205
9	Bush	Temperate	Cream light tan <sup>b</sup>	Medium	10 (14 3)	9 (12 9)	44 (62 9)	70
10	Bush	Temperate	Yellow light tan gray	Large	30 (50 8)	11 (18 6)	13 (22 0)	59
11	Climbing	Temperate	Black	Small	6 (28 6)	3 (14 3)	4 (19 0)	21
12	Climbing	Tropical warm	Black	Small	3 (16 7)	1 (5 6)	7 (38 9)	18
13	Climbing	Tropical cool	Red <sup>b</sup>	Med/large	19 (24 0)	26 (32 9)	19 (24 0)	79
14	Climbing	Tropical warm	Red	Small	19 (27 5)	17 (24 6)	30 (43 5)	69
15	Climbing	Tropical cool	Cream white yellow	Med/large	1 (4 0)	5 (20 0)	18 (72 0)	25
16	Climbing	Temperate	Cream white	Small	5 (21 7)	6 (26 1)	6 (26 1)	23
Totals					264 (23 8)	241 (21 7)	502 (45 2)	1110
For bush entries (Group 1 to 10)					211 (22 6)	183 (20 9)	418 (47 8)	875
For climbing entries (Group 11 to 16)					53 (22 6)	58 (24 7)	84 (35 7)	235

a Numbers in parentheses indicate percentage of entries within the group

b Includes solid as well as mottled striped and speckled types

Table 4 Number and proportion of bean entries within each basic group showing different reactions to common bacterial blight 1981 VEF

Group	Common bacterial blight reaction <sup>a</sup>				Total
	Resistant	Intermediate	Susceptible	Variable	
<u>Bush beans</u>					
1	3 (19)	19 (119)	115 (719)	23 (143)	160
2	2 (10)	24 (126)	90 (474)	74 (390)	190
3			55 (775)	16 (225)	71
4			39 (848)	7 (152)	46 <sup>b</sup>
5		2 (48)	39 (929)	1 (23)	42 <sup>b</sup>
6/7			15 (938)	1 (62)	16 <sup>b</sup>
8		1 (05)	163 (795)	41 (200)	205
9			50 (714)	20 (286)	70 <sup>b</sup>
10		1 (17)	47 (810)	10 (173)	58 <sup>b</sup>
<u>Climbing beans</u>					
11			20 (952)	1 (48)	21 <sup>b</sup>
12			16 (941)	1 (59)	17 <sup>b</sup>
13			70 (897)	8 (103)	78 <sup>b</sup>
14			64 (941)	4 (59)	68 <sup>b</sup>
15			21 (913)	2 (87)	23 <sup>b</sup>
16			19 (905)	2 (95)	21 <sup>b</sup>
Total	5 (05)	47 (43)	823 (758)	211 (194)	1086

a Numbers in parentheses indicate percentage of entries within the group

b Some entries were not tested due to poor germination

Table 5 Bean lines that showed the best resistance rating to rust and common bacterial blight at Palmira Colombia 1981 VEF

Entry	Basic group	Seed		Reaction <sup>a</sup>	
		Color	Size	Rust	Bacterial blight
<u>Bush beans</u>					
G 1757	1	Black	Small	1	
BAC 87	1				2 5
BAC 112	1				2 5
BAC 116	1				2 5
BAT 1500					2 5
BAT 1501	2				2 5
<u>Climbing beans</u>					
VNA 81014	11	Black	Small	1	
VRA 81066	13	Red	Med/large	1	
VRB 81008	14	Red	Small	1	
VRB 81044	14	Red	Small	1	
VCB 81003	16			1	
VCB 81004	16			1	

a Scale 1 immune 2 resistant 5 highly susceptible

## 1981 EP - Preliminary Trials

The 1981 EP trials consisted of 191 lines selected from the 542 entries evaluated in the 1980 VEF. Of these 56 were climbing beans. Table 6 shows the frequency of the different growth habits, seed sizes and maturity in each class of beans. Type II beans formed the most numerous group, likewise small-seeded and early materials predominated over the rest.

### Resistance to Diseases and Insect Pests

As previously determined all materials entered into the EP must be resistant to the Florida and New York 15 strains of BCMV. The frequency of materials with resistance to common bacterial blight, rust, anthracnose, ascochyta, angular leaf spot, root-rot complex, and web blight are shown in Table 7. For common bacterial blight, ascochyta and anthracnose, only intermediate and susceptible reactions were found. For rust, root-rot complex, angular leaf spot, and even for web blight, a good number of entries showed resistance.

The frequency of materials with different degrees of resistance to insect pests is shown in Table 8.

### Bush Beans

The 135 bush and 56 climbing bean lines of the 1981 preliminary yield trials were evaluated for yield at CIAT-Palmira and CIAT-Popayan. Some changes were introduced into the yield evaluation method from last year. The most important one was to have more than one semester of yield testing to provide more reliable yield data. Experience from the past 2 years showed that when the advanced breeding lines were tested only in one semester, there is a yield inconsistency over years. This was shown clearly in the elite checks of 1979 that were retested in 1980; the best-yielding elite check of the previous year was only slightly above average in the following year. The superior materials, however, maintained their above-average yield levels. The yield data of the second semester planting is shown elsewhere in this report.

The second change was to regroup the entries with their standard checks. In previous years the materials were grouped according to growth habit and seed color, but seed size was ignored. This year the advanced breeding lines and their checks were divided into 10 groups (for bush lines). Bean types such as Caballero or Cristal and Alubia were not represented this year. Yield trials were conducted again under both chemically protected and nonprotected conditions.

At CIAT-Popayan, disease pressure in the nonprotected field was so severe that only those materials with anthracnose resistance produced

Table 6 Frequency of occurrence by basic bean group of growth habit seed size and days to flowering and maturity evaluated in the 1981 EP

Characteristic	No. lines																Total
	1	2	3	4	5	8	9	10	11	12	13	14	15	16	Other colors		
	Black Small	Small	Red <sup>a</sup> Medium (small)	Large (med)	White Small	Cream <sup>a</sup> Small/ medium	Brown <sup>a</sup> Medium Large	Large (med)	Black Small	Small	Medium	Red <sup>a</sup> Small	Cream <sup>a</sup> etc	15		16	
Entries/group	9	16	12	24	7	47	6	2	11	11	11	3	15	5	12	191	
Growth habit I			4	14		2	1	2							3	26	
II	8	10	8	9		29	2								8	74	
III		6		1	6	16	3			4		1			1	38	
IV									11	7	11	2	15	5		51	
VAR	1				1											2	
Seed size Small	9	16	6	5	6	41	3		7	10	2	3	3	2	9	122	
Medium			5	19	1	6	3		4	1	4		6	3	2	54	
Large			1					2			5		6		1	15	
Days to flowering range	34-36	34-37	33-37	32-37	35-37	33-37	34-36	33-34									
Days to maturity																	
66-70				1			1										
71-75	1	1	3			1											
76-80	3	6	4	1		18	1								2		
81-85	4	6	1	3	5	19									6		
86-90		3	3	3	2	6	3								3		
91-95	1		1	11		2	1								1		
96-100				5		1		2									

<sup>a</sup> Include solid as well as mottled striped and speckled types

Table 7 Frequency of the reaction by basic bean group to first priority diseases evaluated in the 1981 EP

Disease	Rating <sup>a</sup>	No lines																Total
		1	2	3	4	5	8	9	10	11	12	13	14	15	16	Others		
Common bacterial blight	R																	0
	I	3	5	6	11	3	36	4	2								3	73
	S	6	11	6	13	4	11	2									9	62
Rust	IMM									4	1		1	1				7
	R						5	2		6	6	1	1	5	4	1	31	
	I	3	3	1		5	2		1	1		3		1			20	
	S	6	13	11	24	2	40	4	1		4	7	1	8	1	11	133	
Anthracnose	R																	0
	I		2	3	7	2	18	2			3	3		5			6	51
	S	9	14	9	17	5	29	4	2	11	8	8	3	10	5	6	140	
Ascochyta	R																	0
	I									6	1	1		1				9
	S	9	16	12	24	7	47	6	2	5	10	10	3	14	5	12	182	
Angular leaf spot	R	2	7	5	18	1	10	2	2	2	1	3	1	3	1	4	62	
	I	4	2	1	14	4	18			1	4	4	1	6		4	63	
	S	3	7	6	2	2	19	4		8	6	4	1	6	4	4	66	
Rhizoctonia Fusarium complex	R	7	7	2	1	3	28	4									1	53
	I	2	4	5	7	4	15	2									10	71
	S		5	5	16		4		2								1	33
Web blight At San Isidro del General Costa Rica	R	2	2	4			8	1						2			3	22
	I	4	6	2	1	3	19	2		3	6	1	1	4	2	3	3	57
	S	3	8	6	22	3	19	3	2	8	5	10	2	8	3	6	6	108
At Esparza Costa Rica	R						2											2
	I	2	4	5	1	1	11	1		3	3	4	1	1		2	2	39
	S	7	12	7	23	6	34	5	2	8	8	7	2	14	5	10	150	

a R resistant I intermediate S susceptible IMM immune



Table 8 Frequency of the reaction by basic bean group to some insect pests evaluated in the 1981 EP

Insect	Rating <sup>a</sup>	No lines															
		1	2	3	4	5	8	9	10	11	12	13	14	15	16	Others	Total
Empoasca	R																0
	I						8						1		1	1	11
	S	9	16	9	13	7	37	5	2	8	11	4	1	7	4	10	143
Mites	R																0
	I	1					1	1									3
	S	8	16	9	14	7	44	4	2							11	115
Bruchids	R	2		1		1	2							1			7
	I	1	2		4	3	7	1		1	3		1	1	1	2	27
	S	5	5	4	10	2	29	3	2	10	7	4	2	6	3	9	101

a R = resistant I = intermediate S = susceptible

reasonable yields. Ascochyta and anthracnose were the two diseases prevalent at CIAT-Popayan whereas at CIAT-Palmira bacteriosis and tropical mites (Polyphagotarsonemus latus Banks) were the principal production problems. Fertilization at the Palmira station was limited to one foliar application of microelements at 21 days after germination to control possible boron and zinc deficiencies. On the CIAT farm in Popayan where the EP trials were conducted the soil characteristics are as follows: organic matter 38%, pH around 5.0 and aluminum content relatively high. The calcium content is also high and no aluminum toxicity symptoms were observed. Available soil manganese, phosphorus and magnesium are low: only 9.2 ppm, 1.7 ppm (Bray II) and 0.60 meq/100 g soil respectively. Phosphorus-fixation capacity of the soil is high. In order to reduce the P fixation, 2 t/ha of dolomitic lime and 500 kg complete fertilizer (10-30-10) were added. Rainfall distribution was good this year and no water stress occurred in these trials.

The improved performance of the breeding lines was more obvious at CIAT-Popayan than at CIAT-Palmira (Table 9). Only a few breeding lines were resistant to bacterial blight (the BAC series) and since CIAT does not breed for tropical mite resistance, only a few materials were resistant to P. latus. The highest yielders at both testing sites were the breeding lines and the difference with the highest yielding check was largest under nonprotected conditions at CIAT-Popayan. Under the heavy pressure of anthracnose and ascochyta in Popayan, line A 114 produced more than 2 t/ha under nonprotected conditions whereas most checks produced less than 100 kg/ha. The international checks performed slightly better.

Under protected conditions, physiological maturity was delayed more than under nonprotected conditions at CIAT-Popayan; the growth cycle was more prolonged than at Palmira. This was also expressed in yield performance. Table 10 lists the breeding lines and their checks showing the lowest yield losses in Popayan and Palmira in both protected and unprotected plots. The percentage of yield reduction at CIAT-Palmira was much lower than at CIAT-Popayan, representing the disease pressure of the testing sites. Only a few materials showed less than 30% yield reduction at CIAT-Popayan whereas at CIAT-Palmira more than 10 breeding lines showed less than 10% yield reduction. The only check materials with less than 30% yield loss at Popayan were Zamorano 2 (29%) and the elite check BAT 445 (8%). None of the international checks showed less than 30% yield reduction. At CIAT-Palmira the five checks showed less than 10% yield reduction.

#### CIAT-Palmira trials

Group 1: Black, small seed size for Central America, Mexico, Brazil, Cuba and Venezuela (Table 11). Only nine entries were tested this year and their yield ranged from 1510 to 2092 kg/ha. The lowest yield (1500 kg/ha) of the breeding lines was above the average yield (1415 kg/ha) of the standard checks under nonprotected conditions. The average of the breeding lines of this group was 363 kg/ha higher than the average of the standard checks while the average of the international checks was slightly higher than that of the standard.

Table 9 The highest and lowest yielder of the materials tested in the 1981A Preliminary Yield Trials (EP) at two testing sites and under chemically protected and unprotected conditions

	Rank	Palmyra				Popayan			
		Unprotected		Protected		Unprotected		Protected	
		Entry	Yield (kg/ha)	Entry	Yield (kg/ha)	Entry	Yield (kg/ha)	Entry	Yield (kg/ha)
<u>Breeding materials</u>									
Highest yielder	1	DOR 62	2092	BAC 78	2768	A 114	2075	A 176	3062
	2	EMP 84	2070	A 83	2643	CATU	1495	A 114	2784
Lowest yielder	1	A 193	658	A 153	690	BAT 1155	60	BAT 1209	632
	2	BAC 77	671	A 193	857	EMP 86	85	BAC 42	782
<u>Standard checks</u>									
Highest yielder	1	Iguacu	1970	Gualı	1451	Zamorano 2	1491	Carioca	2528
	2	Carioca	1826	Ex Rico 23	1437	Carioca	1439	Tortolas x Diana	2493
Lowest yielder	1	Rojo de Seda	495	Zamorano 2	518	Ex Rico 23	34	Titan	630
	2	Flor de Mayo	505	Flor de Mayo	782	Titan	60	Black Marvel	767
<u>International checks</u>									
Highest yielder	1	Carioca	1826	Carioca	2179	Carioca	1439	Carioca	2528
	2	Porrillo Sintetico	1798	Iguaçu	2164	Jamapa	741	Jamapa	1642
Lowest yielder	1	Ex Rico 23	923	Calıma	1392	Ex Rico 23	34	Brazil 2	872
	2	Dıacol Calıma	1116	Ex Rico 23	1437	Calıma	386	Ex Rico 23	1094

Table 10 Selected bush bean materials that performed well under chemically protected and unprotected conditions in the 1981A Preliminary Yield Trials (EP) at two locations

Entry	Palmyra				Entry	Popayan			
	Rank	Yield (kg/ha)		Yield loss (%)		Rank	Yield (kg/ha)		Yield loss (%)
		Protected	Unprotected				Protected	Unprotected	
<u>Breeding lines</u>					<u>Breeding lines</u>				
BAC 57	1	2091	2049	2 0	A 116	1	804	851	5 8
A 176	2	1997	1917	3 9	A 154	2	1596	1463	8 3
BAT 1206	3	1922	1845	4 0	A 152	3	1725	1369	21 0
A 175	4	1931	1845	4 5	CATU	4	1955	1495	24 0
A 99	5	1991	1885	5 3	A 114	5	2784	2075	25 0
BAC 40	6	2154	1972	8 4					
BAC 58	7	1923	1770	8 0					
APN 18	8	2162	1989	8 0					
BAT 1280	9	1893	1745	8 0					
EMP 86	10	2083	1902	8 6					
<u>Checks</u>					<u>Checks</u>				
ICA Gualı	1	1451	1422	2 0	Zamorano 2	1	2108	1491	29 0
BAT 93	2	1637	1526	7 0					
Porrillo Sintetico	3	1935	1798	7 0					
IPA 79 19	4	1694	1565	8 0					
Iguaçu Lote 4	5	2164	1970	8 9					
					<u>Elite checks</u>				
					BAT 445	1	1210	1302	8 0

Table 11 Yields of black bush beans (g o p l) test d 1981A Prelim a y Yie ld T als (EP) at CIAT Palmira nde chemically p o tected and u protected  
co d t o s

U p o tected							Protected						
E t y	Ra k	Colo	Hab t	Size	Y eld (kg/ha)	Phys iological maturity (days)	E t y	Rank	Colo	Hab t	Size	Yield (kg/ha)	Physiological maturity (days)
DOR 62	1	Black	2	S all	2092	78	BAC 78	1	Black	2	Small	2768	79
EMP 84	2	Black	2	S all	2070	78	EMP 84	2	Black	2	Small	2359	81
BAC 40	3	Bl ck	2	Small	1972	75	DOR 62	3	Black	2	Small	2324	85
BAC 72	4	Black	2	Small	1922	72	APN 6	4	Black	2	S all	2246	81
BAT 1191	5	Black	2	Small	1581	77	BAC 40	5	Black	2	Small	2154	78
APN 6	6	Black	2	Small	1766	75	EMP 60	6	Black	2	S all	2132	84
BAC 25	7	Black	V	S all	1565	87	BAC 25	7	Black	2	S all	2022	93
EMP 60	8	Black	2	Small	1524	73	BAT 1191	8	Black	2	Small	1959	77
BAC 19	9	Black	2	Small	1510	71	BAC 19	9	Black	2	Small	1607	73
A e ag of 9 best					1778	76	Ave age of 9 best					2175	81
A age of 9 EP material					1778		A e age of 9 EP mate rials					2175	
Ma 2092 M1 1510							Max 2768 M 1607						
Standa d ch k vari t es							St da d ch ck varieties						
Ig acu Lote 4 G4821	1	Black	2	S all	1970	75	ICA Pijao G4525	1	Black	2	S all	2060	71
Po rillo Sintetico G4495	2	Black	2	Small	1798	76	Iguacu Lote 4 G4821	2	Black	2	Small	2164	88
ICA Pij o G4525	3	Black	2	S all	1631	78	Tamapa G4456	3	Black	2	S all	1990	90
Tamapa G4456	4	Black	2	S all	1541	73	Pecho Amarillo G2959	4	Bl ck	2	Small	1978	79
Pecho Ama illo G2959	5	Black	2	S all	1509	72	Po rillo S tetico G4495	5	Black	2	Small	1935	77
C C G B 44 G3607	6	Black	2	Small	1229	79	C C G B 44 G3607	6	Bl ck	2	S all	1838	82
P ebla 152 G3353	7	Bl ck	2	S all	1215	87	Puebl 152 G3353	7	Black	2	S all	1758	90
R o Tibaji G4830	8	Black	2	Small	1056	76	Rio T baji G4830	8	Bl ck	2	Small	1702	81
Black Mar ell G3742	9	Black	2	S all	758	73	Black Ma ell G3742	9	Black	2	Small	1351	77
Av age					1415	77	A age					1864	82
I te ational checks							I nte ational checks						
Po rillo S i tetico G4495	1	Black	2	Sm ll	1798	76	ICA Pija G4525	1	Black	2	Sm ll	2060	71
ICA Pijao G4525	2	Black	2	S all	1631	78	Ta pa G4456	2	Black	2	S all	1990	90
Tamapa G4456	3	Black	2	S all	1541	73	Por llo Sintetico G4495	3	Black	2	Small	1935	77
Ave age					1657	76	A e age					1995	79
C V %	11.4						C V %	7.8					
LSD	0.05						LSD	0.05					

checks Under protected conditions the best yielding line reached 2768 kg/ha and the lowest 1607 kg/ha This means that in general the yield potential of the breeding lines of the black-seeded materials was high With no fertilizers used on the CIAT farm the yield could be increased by an average of about 400 kg/ha by providing adequate plant protection

Group 2 Red small seed size for Central America (Table 12) This group showed the greatest improvement this year All breeding lines outyielded the best check by at least 500 kg/ha under both protected and nonprotected conditions BAT 1206 and BAT 1102 were the highest yielders under nonprotected conditions and WIS 784134 and BAT 1289 under protected conditions Yields of the checks almost doubled through protection against bacterial blight and tropical mite but they were still far below the yields of the breeding lines

Group 3 Red mottled small to medium seed size for Caribbean Islands (Table 13) Yields of the breeding lines of this group were variable The lowest yielded 914 (not shown) and the highest 2049 kg/ha under unprotected conditions Only six out of 12 lines tested could outyield the standard check variety (Pompador 2) for this group under nonprotected conditions Under protected conditions three lines yielded better than the check BAC 57 showed the value of bacterial blight resistance since the yield was about the same under both protected and nonprotected conditions

Group 4 Red or mottled large seed size for Andean regions (Table 14) Although the average yield of the 10 best breeding lines was higher than that of the check average only two breeding lines out of 25 tested outyielded the best of the standard check group Cuarenteño (G 0118) under both levels of protection This shows the difficulty of improving this grain type The international check Diacol-Calima was inferior to ICA L-24

Group 5 White small seed size for Chile and Peru (Table 15) This year only seven lines entered yield testing and five were better than the checks while BAC 38 and BAC 77 yielded less than the checks under both protected and nonprotected conditions

Groups 6 and 7 were not represented in the 1981 EP

Group 8 Cream-striped brown, yellow small seed size for Brazil (Table 16) The 10 best lines of 47 materials tested showed higher yields than the average yield of the standard checks but only a few (9 out of 47 under unprotected conditions and 2 under protected) outyielded the Carioca check These materials also showed their high yielding ability which is almost similar to the black small-seeded group 1 under protected conditions This group of materials came from the screening for acid soil tolerance intended for production areas in Brazil

Group 9 Cream-striped speckled gray small to medium seed size for Mexico (Table 17) The average yields from protected and nonprotected plots were higher than those of their checks Only

Table 12 Yields of red bush beans (group 2) test d 1981A P elimination Yield Trials (EP) at CIAT Palmira de chemically protected and protected conditions

Unprotected							Protected						
Entry	Rank	Color	Habit	Size	Yield (kg/h)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
BAT 1206	1	Red	2	Small	1845	95	WIS 784134	1	Red	2	Small	2143	98
BAT 1102	2	Red	3	Small	1783	77	BAT 1289	2	Brown	3	Small	2009	84
BAC 58	3	Pink	2	Small	1770	71	BAC 58	3	Pink	2	Small	1923	75
WIS 784134	4	Red	2	Small	1697	72	BAT 1206	4	Red	2	Small	1922	76
BAT 1155	5	Red	2	Small	1599	72	BAT 1155	5	Red	2	Small	1859	80
BAT 1289	6	Brown	3	Small	1594	76	BAT 1192	6	Brown	2	Small	1725	82
BAT 1192	7	Brown	2	Small	1312	74	BAT 1252	7	Brown	3	Small	1679	83
BAT 1252	8	Brown	3	Small	1265	72	BAC 36	8	Red	3	Small	1676	78
BAT 1217	9	Red	2	Small	1191	78	BAT 1220	9	Pink	2	Small	1647	83
BAT 31	10	Red	2	Small	1174	79	BAT 1215	10	Red	3	Small	1570	81
Average of 10 best					1523	75	Average of 10 best					1815	80
Average of 16 EP materials					1367		Average of 16 EP materials					1661	
Max 1845 Min 957							Max 2143 Min 1247						
Standard check varieties							Standard check varieties						
Hulla 14 51 G3619	1	Red	2	Small	655	81	Rojo de Seda G4090	1	Red	3	Small	1034	69
Zaonano 2 G4482	2	Red	3	Small	567	79	Hulla 14 51 G3619	2	Red	2	Small	1330	75
Nahizalco Rojo G7932	3	Red	3	Small	548	73	Nahizalco Rojo G7932	3	Red	3	Small	901	71
Rojo 011 G2957	4	Red	3	Small	512	77	Rojo 011 G2957	4	Red	3	Small	829	72
Rojo de Seda G4090	5	Red	3	Small	495	76	Zaonano 2 G4482	5	Red	3	Small	518	80
Average					555	77	Average					922	73
C V % 59.7							C V % 40.5						
LSD 0.05							LSD 0.05						

Table 13 Yields of red mottled small to medium seed size bush beans (group 3) tested 1981A P l m a y Y ld T l (EP) at CIAT P l a de  
chemically protected and non protected conditions

Unprotected							Protected						
Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
BAC 57	1	Other	2	Small	2049	72	BAC 57	1	Other	2	Small	2091	71
BAT 1250	2	Purple	1	Big	1696	75	BAT 1238	2	Purple	2	Small	1762	81
BAT 1232	3	Purple	2	Small	1640	73	BAT 1250	3	Purple	1	Big	1732	90
BAT 1238	4	Purple	2	Small	1574	79	BAT 1232	4	Purple	2	Small	1614	74
BAT 1209	5	Purple	1	Big	1352	80	BAT 1234	5	Purple	2	Small	1471	75
BAT 1234	6	Purple	2	Small	1263	74	BAT 1230	6	Purple	2	Small	1430	78
BAT 1231	7	Purple	2	Small	1202	74	BAT 1231	7	Purple	2	Small	1407	77
BAT 1230	8	Purple	2	Small	1096	76	BAT 1235	8	Purple	2	Small	1326	76
BAT 1225	9	Purple	2	Small	1030	72	BAT 1225	9	Purple	2	Small	1224	73
BAT 1147	10	Purple	2	Small	1198	80	A 179	10	Purple	1	Medium	1219	95
Average of 10 best					1410	76	Average of 10 best					1527	79
Average of 12 EP materials					1334		Average of 12 EP materials					1639	
Max 2049 Min 914							Max 2091 Min 967						
Standard check varieties							Standard check varieties						
Pompadour 2 G4460	1	Red	1	Medium	1210	75	Pompadour 2 G4460	1	Red	1	Medium	1639	76
Average					1210	75	Average					1639	76
C V %	6.9						C V %	8.4					
LSD	0.05						LSD	0.05					



T bl 14 Y l d s f d o t t l e d l g s e d s z e b s h b s (g o p 4) t t d 1981A P e l i m n a y Y l d T 1 (EP) a t C I A T P l r u d e c h e m i l l y p o t e c t e d a d p r o t e c t e d c o d i t i o s

U p o t e c t e d							P o t e c t e d						
E t y	Rank	Color	H b t	Size	Yield (kg/ha)	Physiological maturity (days)	E t y	Rank	Color	H b t	Size	Yield (kg/h)	Physiological maturity (days)
BAT 1249	1	Bro n	1	B g	1727	80	BAT 1253	1	Pu ple	1	B g	1963	95
BAT 1222	2	P rple	1	B g	1725	77	BAT 1249	2	Brow	1	Big	1770	93
BAT 1251	1	Purple	1	Big	1478	79	BAT 1222	3	P pl	1	Big	1709	95
A 186	4	C ea	1	Med	1468	99	A 185	4	R d	2	Med u	1682	87
BAT 1258	5	Pu ple	1	Big	1262	79	BAT 1254	5	Purple	1	B g	1661	94
BAT 1275	6	Bro n	1	B g	1255	79	BAT 1276	6	Bro n	1	B g	1590	95
BAT 1254	7	Purple	1	B g	1246	82	A 186	7	Crea	1	Medium	1587	77
BAT 1253	8	Pu ple	1	Big	1208	79	BAT 1275	8	B o	1	B g	1566	96
A 185	9	Red	2	Med u	1700	84	BAT 1274	9	B own	1	Big	1503	94
A 109	10	P r k	1	Small	1200	69	BAT 1258	10	Pu ple	1	Big	1477	93
Ave age of 10 best					1377	79	Ave age of 10 best					1651	92
A e age of 25 EP t als					1133		A e age of 25 EP te als					1399	
Max 1727 M	658						Max 1963 M	857					
Sta dard check arieties							Sta d d check variet s						
Cua e teño G0118	1	Red	2	Medium	1483	71	Cuarenteño G0118	1	Red	2	Mediu	1745	74
ICA Gualı G4452	2	Red	1	Big	1422	83	ICA L 24	2	Red	1	Big	1713	94
Windso Long Pod G0687	3	Red	1	Big	1324	94	ICA Gualı G4452	3	R d	1	Big	1451	93
ICA L 24	4	Red	1	B g	1176	87	Diacol Calıma G4494	4	Red	1	B g	1392	93
Diacol Calıma G4494	5	Red	1	Big	1116	82	Sangre Toro G5708	5	Red	1	Big	1186	83
Sa gre Toro G5708	6	Red	1	Big	1026		Windso Lo g Pod G0687	6	Red	1	Big	1166	76
Average					1258	80	Ave age					1442	86
Inte national checks							Inte national checks						
Diacol C l a G4494	1	Red	1	B g	1116	82	D aco l Calıma G4494	1	Red	1	Big	1392	93
Average					1116	82	Average					1392	93
C V %	6 6						C V %	1 9					
LSD	0 05						LSD	0 05					

Table 15 Yields of white small seed size bush beans (g o p 5) tested 1981A Preliminary Yield Trials (EP) at CIAT Palmira under chemically protected and unprotected conditions

Unprotected							Protected						
Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
BAT 1280	1	White	3	Med	1745	79	BAT 1280	1	White	3	Medium	1893	85
BAT 1282	2	White	3	Small	1536	84	BAT 1257	2	White	3	Small	1737	87
BAT 1281	3	White	3	Small	1435	78	BAT 1282	3	White	3	Small	1716	85
BAT 1198	4	White	3	Small	1142	77	BAT 1198	4	White	3	Small	1566	83
BAT 1257	5	White	3	Small	1073	80	BAT 1281	5	White	3	Small	1544	84
BAC 38	6	White	3	Small	798	84	BAC 38	6	White	3	Small	1200	87
BAC 77	7	White	3	Small	671	74	BAC 77	7	White	3	Small	1017	81
Average of 7 best					1200	79	Average of 7 best					1525	85
Average of 7 EP materials					1200		Average of 7 EP materials					1525	
Max 1745 Min 671							Max 1893 Min 1017						
Standard check varieties							Standard check varieties						
NEP 2 G4459	1	White	2	Small	1009	81	Ex Rico 23 G4445	1	White	2	Small	1437	92
Ex Rico 23 G4445	2	White	2	Small	923	76	NEP 2 G4459	2	White	2	Small	1197	84
Average					966	79	Average					1317	88
International checks							International checks						
Ex Rico 23 G4445	1	White	2	Small	923	76	Ex Rico 23 G4445	1	White	2	Small	1437	92
Average					923	76	Average					1437	92
C V %	14.5						C V %	7.3					
LSD	0.05						LSD	0.05					

Table 16 Yield of coffee bushes (group 8) tested in 1981. A list of yield trials (EP) that are nationally protected and protected conditions

Upoted							Protected						
Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
A 90	1	C a	3	S all	2052	77	A 83	1	Crea	3	S all	2643	83
APN 18	2	B ow	2	S all	1989	75	A 140	2	Cream	3	Small	2189	81
A 176	3	Ca ary	3	S all	1917	76	A 118	3	C eam	3	Sm ll	2167	87
EMP 86	4	C eam	2	Small	1902	76	A te 3	4	Cream	2	Small	2165	76
A 99	5	C ea	2	S all	1885	79	APN 18	5	Ca ary	2	S all	2162	83
Aete 3	6	Cre	2	Small	1875	79	EMP 87	6	Crea	3	Small	2119	83
EMP 87	7	C eam	3	S ll	1868	7	BAT 1224	7	C eam	2	Small	2085	80
A 74	8	C e	3	Small	1851	76	EMP 86	8	Crea	2	S all	2083	84
A 175	9	C a y	3	Sm ll	1845	79	A 147	9	C ea	3	Small	2062	87
BAT 1211	10	C eam	2	S all	1811	73	A 176	10	Canary	3	Small	1997	82
Average of 10 best					1890	79	Average of 10 best					2167	83
Average of 47 EP trials					1436		Average of 47 EP trials					1658	
Max 2052 M 682							Max 2643 M 690						
Standard characteristics							Standard characteristics						
Cioca G4017	1	Cre	3	Small	1826	76	Carioca G4017	1	Crea	3	Small	2179	81
Brazil 2 G3807	2	Cr a	1	Small	1576	73	Aroa G7951	2	C eam	2	Small	1971	81
IPA 74 19 G11893	3	C eam	3	S all	1565	83	Brazil 2 G3807	3	Crea	1	Small	1797	69
BAT 93	4	C am	2	Sm ll	1526	72	IPA 74 19 G11893	4	C eam	3	Small	1694	85
Aoan G7951	5	C eam	2	S all	1354	74	H1 Mulatinho G5054	5	Crea	2	Small	1643	85
H6 Mulatinho G5059	6	Cre	2	Small	1193	80	BAT 93	6	Cream	2	Small	1637	77
Rosinha G6970	7	C eam	2	S all	959	73	Rosinha G6970	7	Cream	2	Small	1532	75
H1 Mulatinho G5054	8	C a	2	Small	841	77	H6 Mulatinho G5059	8	Cream	2	Small	1399	86
Average					1355	76	Average					1732	80
International checks							International checks						
Carioca G4017	1	C ea	3	S all	1826	76	Carioca G4017	1	Cream	3	Small	2179	81
Brazil 2 G3807	2	Crea	1	Small	1576	73	Brazil 2 G3807	2	C eam	1	Small	1797	69
Average					1701	75	Average					1988	75
C V %	12.1						C V %	9.7					
LSD	0.05						LSD	0.05					

Table 17 Yield of cream speckled gay b sh b s (g o p 9) tested 1981A P el a y Y1 ld T al (EP) at CIAT P l d che a ly  
 protect d d protecte d co dit o s

U p o t e c t e d							P r o t e c t e d						
E t y	R a k	C o l o	H a b i t	S i z e	Y e l d (kg/ha)	Phy s i o l o g i c a l a t t e n t i o n (day)	E t y	R a k	C o l o	H a b i t	S i z e	Y e l d (kg/h)	Phy s i o l o g i c a l a t t e n t i o n (day)
BAT 1203	1	G a y	3	S m a l l	1547	76	BAT 1203	1	G a y	3	S a l l	2063	87
A 59	2	B	2	S l l	1518	70	A 114	2	C a	3	S l l	1046	69
A 114	3	C e a	3	S m a l l	1366	79	A 174	3	C e a	1	M e d u	1700	86
A 171	4	C e a	3	M e d	1239	72	A 171	4	C e	3	M e d m	1645	80
A 174	5	C e a m	1	M e d u	1146	75	A 59	5	B o	2	S a l l	1644	90
A 67	6		2	M e d	113	80	A 67	6		2	M d	1480	91
A e a g e o f 6 b e s t					1325	75	A e a g e o f 6 b e s t					1763	83
A e a g e o f 6 E P m a t e r i a l s					1325		A e a g e o f 6 E P m a t e r i a l s					1763	
M a 1547 M 1131							M a 2063 M 1480						
S t a n d a r d c h e c k v a l u e s							S t a n d a r d c h e c k v a l u e s						
S e d i s h B o w G1540	1	C e a	1	S a l l	1274	78	S e d i s h B o w G1540	1	C a m	1	S l l	1829	89
F l o r d e M a y o G5877	2	C e a m	3	M e d u	505	78	F l o r d e M a y o G587		C	3	M d i	782	79
A v e a g e					889	78	A v e a g e					1306	84
C V %	27.8						C V	21.1					
LSD	0.05						LSD	0.05					

BAT 1203 and A 59 under nonprotected and BAT 1203 and A 114 under protected conditions had a significantly higher yield than the best check Flor de Mayo did not perform well because of lack of adaptation to CIAT-Palmira conditions

Group 10 Gray yellow and light tan medium to large seed size for Chile and Peru (Table 18) The two breeding lines were resistant to BCMV but the yield performance of the lines needs to be improved Lack of adaptation was the main problem

Group for diverse color and seed sizes for breeding purposes (Table 19) Only a few materials could outyield the check G 4000 but all these materials have multiple disease resistance and will be used for breeding purposes only

Popayan testing In general yields under unprotected field conditions were low due to high anthracnose and ascochyta pressure In addition to these diseases angular leaf spot gray spot and Oidium also heavily attacked some lines The average yield under these two testing conditions differed more than in CIAT-Palmira This difference was also observed last year

Group 1 Black small seed size (Table 20) Under nonprotected conditions the highest yielder was the standard check Puebla 152 The best breeding line yielded slightly better than the average check EMP 60 gave the highest yield under both conditions By providing adequate plant protection the average yield increased trifold This indicates that this group needs resistance to anthracnose more than other groups

Group 2 Red small seed size (Table 21) Only BAT 1252 gave an equivalent yield to the best check Zamorano 2 under nonprotected conditions under protected conditions BAT 1252 1192 and 1217 and BAC 37 were superior to Zamorano 2 The average yield of the 16 breeding lines in this group was lower than the average of the standard checks under both nonprotected and protected conditions

Group 3 Red-mottled small to medium seed size (Table 22) The results from this group are comparable to those from CIAT-Palmira Under nonprotected conditions only five lines outyielded the check but under protected conditions nine lines yielded more than the check

Group 4 Red or mottled large seed size (Table 23) The average of the 10 best materials was higher than the best yielder of the standard check group under nonprotected conditions The yield of most checks was low due to severe anthracnose and ascochyta incidence Under protected conditions line A 185 yielded more than 2700 kg/ha and outyielded the best check by more than 1100 kg/ha

Group 5 White small seed size (Table 24) Yields of all the breeding lines were inferior to the check Nep 2 under both nonprotected and protected conditions

Table 18 Yields of gay yellow light tan bush beans (group 10) tested 1981A Preliminary Yield Trials (EP) at CIAT Palmarquero chemically protected and unprotected plots

Up t t d							P o t t d						
Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Phys' logical maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Phys' logical maturity (days)
A 195	1	Cream	1	B g	1154	85	A 195	1	Cream	1	B g	1249	96
A 197	2	Cream	1	B g	988	86	A 197	2	Cream	1	B g	1114	96
Average of 2 best					1071	86	Average of 2 best					1182	96
Average of 2 EP trials					1071		Average of 2 EP trials					1182	
Ma 1154 M	988						Ma 1249 M	1114					
Standard check varieties							Standard check varieties						
Totals Diana G7160	1	Other	3	Big	1405	81	Totals Diana G7160	1	Other	3	Big	1906	86
Bayome G5896	2	Yellow	1	Medium	1333	76	Bayomex G5896	2	Yellow	1	Medium	1683	82
Titan G4473	3	Cream	1	Big	<u>918</u>	<u>76</u>	Titan G4473	3	Cream	1	Big	<u>982</u>	<u>79</u>
Average					1218	78	Average					1524	82
CV %	9.1						CV %	17.9					
LSD	0.05						LSD	0.05					

Table 19 Yields of a 10 s seed colo g o ps f bush bea b di g pu poses test d 1981A P el a y Y ld T als (EP) at CIAT Pal a nde  
 chemically p o tected a d u p o tected co d t o s

U p o tected							P o tected						
Entry	R a k	Colo	Hab t	Size	Yield (kg/h)	Phys iologi cal ma t u r i t y (days)	Entry	R a k	Colo	Habit	S	Yield (kg/h)	Phys iologi cal ma t u r i t y (days)
EMP 81	1	Othe	3	S all	1843	74	BAT 1266	1	Yello	2	Small	1889	81
BAT 1266	2	Yellow	2	S all	1631	78	EMP 81	2	Othe	3	S ll	1831	82
BAC 63	3	Cr	2	S all	1434	82	BAC 24	3	Other	2	S all	1618	81
BAC 44	4	Othe	2	M d	1361	78	A 117	4	P rple	1	Medi	1598	87
BAC 24	5	Other	2	Small	1350	76	BAT 1 70	5	Othe	2	S all	1549	81
DOR 161	6	Gray	2	Small	1236	79	BAC 44	6	Othe	2	Medi m	1496	85
BAC 81	7	White		Small	1231	73	BAC 63	7	C ea	2	S all	1455	85
A 117	8	P rple	1	M d	1154	83	BAC 81	8	White	2	Small	1390	87
BAT 1270	9	Othe	2	S all	1110	76	DOR 161	9	Gray	2	S ll	1385	81
A 167	10	Othe	2	Small	849	84	A 167	10	Other	2	S all	1181	91
Average of 10 best					1320	78	Average of 10 best					1539	84
Average of 12 EP ate als					1236		Average of 12 EP t ls					1447	
Max 1843 Min 787							Max 1889 M 938						
St d d check et es							St d d check a i t						
Nep Bayo 22 G4000	1	B o	2	S all	1272	81	Nep Bayo 22 G4000	1	B o	2	S all	1584	87
Ca ioca	2	C eam			<u>1826</u>	<u>77</u>	Ca ioca	2	C eam			<u>2149</u>	<u>81</u>
Average					1549	79	Average					1882	84
C V %	2 0						C V %	6 4					
LSD	0 05						LSD	0 05					

Table 20 Yields of black bush beans (group 1) tested in 1981A Pel m a y Y ld Trials (EP) at CIAT Popaya nde che ically p oteded a d nprotected co d tions

Unprotected							P oteded						
E t y	Rank	Col r	Hab t	Si	Y eld (kg/ha)	Physiological maturity (days)	E try	R k	Colo	Hab t	Size	Y eld (kg/ha)	Physiological maturity (d ys)
EMP 60	1	Black	2	S all	888	101	EMP 60	1	Black	2	S all	2355	101
BAC 25	2	Black	Va	Small	663	100	DOR 62	2	Black	2	Small	1995	100
BAC 40	3	Black	2	Small	633	99	EMP 84	3	Black	2	S ll	1859	100
BAT 1191	4	Black	2	Small	606	99	BAC 25	4	Bl ck	Va	S all	1842	101
EMP 84	5	Black	2	S all	587	99	BAC 78	5	Black	2	S all	1840	99
APA 6	6	Black	2	Small	524	99	BAT 1191	6	Black	2	Small	1773	103
BAC 19	7	Black	2	S all	522	98	BAC 40	7	Black	2	S all	1766	99
DOR 62	8	Black	2	S all	517	99	APN 6	8	Black	2	Small	1653	101
BAC 78	9	Black	2	S all	369	95	BAC 19	9	Black	2	S all	1240	98
A erage of 9 best					590	99	Ave age of 9 best					1813	100
A ge of 9 EP materials					590		Average of 9 EP ate ls					1813	
Ma 888 M 369							Ma 2355 Min 1240						
St ndard che k a eties							Standard check a et s						
P ebla 152 G3353	1	Black	3	S all	1116	99	R o T baj G4830	1	Black	2	Small	2128	99
R o Tibaji G4830	2	Black	2	Small	884	99	Puebla 152 G3353	2	Black	3	Small	2114	99
C C G B 44 G3607	3	Black	2	S all	851	99	Pecho Ama llo G2959	3	Black	3	Small	1857	99
Ja apa G4456	4	Black	2	Small	741	99	C C G B 44 G3607	4	Black	2	Small	1761	100
Pecho A a llo G2959	5	Black	3	Small	522	99	Ta p G4456	5	Black	2	S all	1646	99
Por llo S t tico G4495	6	Black	2	S all	460	99	Iguaçu Lote 4 G4821	6	Black	2	Small	1355	98
ICA P jao G4525	7	Black	2	Small	449	98	Porrillo S tet co G4495	7	Black	2	S ll	1336	99
Iguaçu Lote 4 G4821	8	Black	2	S all	301	100	ICA P ja G4525	8	Black	2	S all	1333	100
Bl k Marvel G3742	9	Black	2	Small	154	95	Black Mar el G3742	9	Black	2	Small	767	95
Average					609	98	Ave age					1588	99
Inter at o al checks							I te atio al checks						
Jamapa G4456	1	Black	2	Small	741	99	Jamapa G4456	1	Black	2	S all	1646	99
Porr llo S t tico G4495	2	Bl a k	2	Small	460	98	Por llo S t tico G4495	2	Bl ck	2	Small	1336	99
ICA P jao G4525	3	Black	2	Small	449	98	ICA P jao G4525	3	Black	2	S all	1333	100
Average					550	98	A ge					1438	99
C V %	5 1						C V %	11 7					
LSD	0 05						LSD	0 05					



Table 21 Yields of red bush beans (group 2) tested in 1981A Preliminary Yield Trials (EP) at CIAT Popayán under chemically protected and unprotected conditions

U protected							P tected						
Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
BAT 1252	1	Brown	3	Small	1482	99	BAT 1252	1	Brown	3	Small	2602	99
BAT 1220	2	Pink	2	Small	1206	98	BAT 1192	2	Brown	2	Small	2500	98
BAC 37	3	Other	2	Small	1007	99	BAC 37	3	Other	2	Small	2471	98
BAT 1206	4	Red	2	Small	992	97	BAT 1217	4	Red	2	Small	2174	99
BAT 1192	5	Brown	2	Small	825	99	BAT 1220	5	Pink	2	Small	2102	100
BAC 36	6	Red	3	Small	784	98	BAT 1102	6	Red	3	Small	1992	97
BAT 1217	7	Red	2	Small	515	99	BAT 1206	7	Red	2	Small	1918	99
BAC 33	8	Red	3	Small	514	98	BAC 33	8	Red	3	Small	1686	99
BAT 1215	9	Red	3	Small	380	97	BAC 36	9	Red	3	Small	1686	100
BAT 1102	10	Red	3	Small	376	99	BAT 1244	10	Pink	2	Small	1674	99
Average of 10 best					809	98	Average of 10 best					2081	99
Average of 16 EP materials					570		Average of 16 EP materials					1274	
Max 1482 Min 604							Max 2642 Min 1123						
Standard check varieties							Standard check varieties						
Zamorano 2 G4482	1	Red	3	Small	1491	99	Zamorano 2 G4482	1	Red	3	Small	2108	97
Rojo 011 G2957	2	Red	3	Small	733	101	Rojo 011 G2957	2	Red	3	Small	1787	97
Rojo de Seda G4090	3	Red	3	Small	351	97	Rojo de Seda G4090	3	Red	3	Small	1761	100
Huila 14 51 G3619	4	Red	2	Small	343	98	Nahuizalco Rojo G7932	4	Red	3	Small	1390	97
Nahuizalco Rojo G7932	5	Red	3	Small	151	99	Huila 14 51 G3619	5	Red	3	Small	1330	100
Average					614	99	Average					1675	98
C V % 5.2							C V % 6.0						
LSD 0.05							LSD 0.05						

Table 22 Yield of field trials of all to be established by bush beans (group 3) in 1981A. Plant yield trials (EP) at CIAT Popayán. Chemically protected and unprotected plots.

Up t ct d							P t t d						
Entry	Ra k	Colo	Hab t	S ze	Yield (kg/ha)	Phys iog cal atu ty (days)	Entry	Ra k	Col	H b t	S	Yield (kg/ha)	Phys iog cal atu ty (days)
BAT 1234	1	B o n	2	S ll	896	95	BAT 1238	1	B		S all	2164	99
BAT 1238	2	Bro n	2	S all	841	97	BAC 57	2	Othe	2	S ll	120	98
BAT 1231	3	Bro	2	S all	772	97	BAT 1235	3	B o	2	S ll	1702	98
BAT 1235	4	B o	2	Small	643	98	BAT 1231	4	B	2	S all	164	98
BAT 1225	5	B ow	2	S ll	548	95	BAT 1232	5	B o		S ll	163	98
BAC 57	6	Other	2	S all	506	99	BAT 1147	6	B o	1	B g	1619	9
BAT 1230	7	Bro n	2	S all	484	97	BAT 1225		B o	2	S all	1526	98
BAT 1232	8	B o	2	S all	402	99	BAT 1234	8	B o	2	S all	14 C	97
A 179	9	Pu ple	1	M d	340	98	BAT 1230	9	B	2	S all	1388	97
BAT 1250	10	Purple	1	B g	328	99	BAT 1250	10	P ple	2	S all	1157	95
A e age of 10 best					576	97	A e age of 10 best					1647	98
A e age of 12 EP at rials					502		A e age of 12 EP at rials					1498	
Ma 896 M 130							Ma 2164 M 632						
Sta da d check a rtes							Sta da d check a rtes						
Pompad r 2 G4460	1	Red	1	M d um	516	98	Po p dow 2 G4460	1	R d	1	Medi	1280	95
A e age					516	98	A e age					1280	95
C V %	2 0						C V %	11 1					
LSD	0 05						LSD	0 05					

Table 23 Yields of red mottled large seed size bush beans (group 4) tested in 1981A Preliminary Yield Trials (EP) at CIAT Popayán under chemically protected and unprotected conditions

Unprotected							Protected						
Entry	Rank	Color	Habit	Size	Yield (kg/h)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/h)	Physiological maturity (days)
A 185	1	Red	2	Medium	1170	97	A 185	1	Red	2	Medium	2709	100
A 159	2	Pink	2	Medium	1053	98	A 159	2	Pink	2	Medium	2235	99
BAT 1256	3	Purple	1	Big	885	99	BAT 1254	3	Purple	1	Big	1793	98
A 193	4	Red	2	Big	792	95	BAT 1274	4	Black	1	Big	1677	98
A 109	5	Pink	1	Small	707	95	A 72	5	Pink	2	Small	1625	97
BAT 1274	6	Brown	1	Big	690	97	BAT 1275	6	Brown	1	Big	1584	98
BAT 1222	7	Purple	1	Big	680	98	BAT 1253	7	Purple	1	Big	1564	95
A 72	8	Pink	2	Small	593	99	BAT 1276	8	Black	1	Big	1545	98
BAT 1275	9	Brown	1	Big	547	95	BAT 1249	9	Black	1	Big	1541	98
A 108	10	Pink	3	Medium	535	95	A 109	10	Pink	1	Small	1519	98
Average of 10 best					765	97	Average of 10 best					1779	98
Average of 25 EP materials					540		Average of 26 EP materials					1421	
Max 1170 Min 177							Max 2709 Min 782						
Standard check varieties							Standard check varieties						
ICA Gualí G4452	1	Red	1	Big	691	98	Dacol Calima G4494	1	Red	1	Big	1569	95
Dacol Calima G4494	2	Red	1	Big	386	99	ICA Gualí G4452	2	Red	1	Big	1482	95
Wdsol Log Pod G0687	3	Red	1	Big	380	99	Wdsol Log Pod G0687	3	Red	1	Big	1219	98
Sangre Toro G5708	4	Red	1	Big	360	97	Sangre Toro G5708	4	Red	1	Big	1161	96
ICA L 24	5	Red	1	Big	535	95	Carateño G0118	5	Red	2	Medium	1069	97
Cua teño G0118	6	Red	2	Medium	180	95	ICA L 24	6	Red	1	Big	1007	98
Average					392	97	Average					1251	97
International checks							International checks						
Dacol Calima G4494	1	Red	1	Big	386	99	Dacol Calima G4494	1	Red	1	Big	1569	98
Average					386	99	Average					1569	98
C V %					19.9		C V %					11.3	
LSD					0.05		LSD					0.05	

Table 24 Yields of white bush beans (group 5) tested 1981A P Lima Y Yield Trials (EP) at CIAT Popaya de chemically protected and non-protected  
od t ns

U protected							P oted						
Entry	R k	Color	Habit	S z	Y ld (kg/h)	Phy iolog'c T at ity (days)	Entry	R k	Col	Hab t	Size	Y ld (kg/ha)	Phys' log cal m t ty (days)
BAT 1281	1	Wh te	3	S all	955	99	BAT 1198	1	Wh te	3	Small	2004	98
BAT 1280	2	Wh t	3	Med	634	99	BAT 1280	2	White	3	M d m	1984	99
BAT 1257	3	Whit	3	Small	630	98	BAC 38	3	White	3	S ll	1980	97
BAT 1282	4	White	3	Small	359	97	BAT 1281	4	White	3	S all	1891	98
BAT 1198	5	White	3	Small	322	97	BAT 1257	5	White	3	S all	1673	98
BAC 38	6	White	3	S ll	249	99	BAT 1282	6	Wh t	3	Small	1548	97
BAC 77	7	White		S all	<u>145</u>	<u>98</u>	BAC 77	7	Wh t		Small	<u>1196</u>	<u>97</u>
Average of best					471	98	A e age of 7 best					1557	98
Ave age of 7 EP mate als					471		A e age of 7 EP ate als					1557	
Ma 955 M <sub>1</sub> 145							M 2004 M 1196						
Sta da d check a eties							Sta dard check ariet es						
N p 2 G4459	1	White	2	S all	<u>1149</u>	<u>98</u>	Nep 2 G4459	1	White	2	S ll	2021	97
							Ex R co 23 G4445	2	White	2	S all	<u>1094</u>	<u>98</u>
Average					1149	98	A erage					1557	99
							I te natio al checks						
							Ex R co 23 G4445	1	White	2	S all	<u>1094</u>	
							A erage					1094	
C V %	80.3						C V %	23.1					
LSD	0.05						LSD	0.05					

Groups 6 and 7 were not represented

Group 8 Cream-striped brown yellow small seed size (Table 25) This is the group that showed the lowest yield difference between protected and nonprotected conditions which means that this group has the highest level of resistance to anthracnose. The breeding lines (not only from CIAT but also from other institutions) all outyielded the standard checks except the improved Carioca type under nonprotected conditions. Line A 176 yielded 3060 kg/ha the highest of the experiments of 1981 under protected conditions and outyielded the best check improved Carioca by more than 500 kg/ha. By protecting this line against diseases yields were increased by 1000 kg/ha.

Group 9 Cream-striped speckled gray small to medium seed size (Table 26) Under unprotected conditions most of the breeding lines outyielded the best of the standard check group under protected conditions only A 114 outyielded Flor de Mayo. Line A 114 yielded 2075 kg/ha (the highest of the trial of this year) under unprotected conditions and 2784 kg/ha under protected conditions. This indicates that A 114 is highly resistant to anthracnose and to a lesser extent to ascochyta.

Group 10 Gray yellow light tan medium to large seed size (Table 27) The two breeding materials represented in this group under both unprotected and protected conditions were outyielded by the check Tortolas-Diana. Another check Titan did not produce at all under nonprotected conditions and produced only 630 kg/ha under protected conditions.

Group for diverse color and seed sizes for breeding purposes (Table 28) BAC 24 performed well under protected and nonprotected conditions and outyielded the check G 4000. Line A 117 under protected conditions and BAT 1270 under unprotected conditions also outyielded the check.

Climbing Beans

Climbing bean lines were divided into six groups according to seed color, size and target-area climatic conditions (see Table 15 Chapter 1). The yield trials were conducted only under unprotected conditions and in direct association with maize variety Suwan 1 at CIAT-Palmira and variety H 302 at CIAT-Popayan. Maize was seeded on hills 0.66 m apart and on beds separated 1 m. Every hill at Popayan received dolomitic lime and complete fertilizer (10-30-10) at the rate of 2000 kg/ha CaCO<sub>3</sub> equivalent and 500 kg/ha respectively. At CIAT-Palmira only those materials adapted to a warmer climate were planted and at CIAT-Popayan both warm and cool climate-adapted lines were tested. The trials in CIAT-Palmira suffered from Empoasca and Chrysomelid damage. Standard checks for climbing beans are still being selected. The results of the CIAT-Popayan trials are shown in Tables 29 to 31.

Table 25 Yields of cearbo yellow bush beans (group B) tested 1981A Preliminary Yield Trials (EP) at CIAT Popayan under chemically protected and non-protected conditions

Entry	Unprotected						Protected						
	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
CATU	1	Cream	2	Small	1495	99	A 176	1	Cream	3	Small	3060	101
A 154	2	Cream	2	Small	1463	98	A 175	2	Cream	3	Small	2622	99
A 175	3	Cream	3	Small	1444	99	A 89	3	Cream	3	Small	2572	98
Sena 163 1 1	4	Yellow	2	Small	1400	97	A 156	4	Cream	2	Small	2381	101
A 158	5	Canary	2	Small	1369	101	Sena 163 1 1	5	Yellow	2	Small	2244	99
EMP 89	6	Yellow	3	Small	1331	99	BAC 76	6	Cream	2	Small	2243	98
A 90	7	Cream	3	Small	1311	98	A 107	7	Cream	2	Small	2237	98
A 79	8	Cream	3	Small	1303	97	A 162	8	Cream	3	Small	2230	99
A 176	9	Canary	3	Small	1288	98	APN 18	9	Brown	2	Small	2205	97
A 148	10	Cream	2	Small	1229	97	A 90	10	Cream	3	Small	2222	97
Average of 10 best					1363	98	Average of 10 best					2402	99
Average of 47 EP materials					976		Average of 47 EP materials					1956	
Max 1495 Min 437							Max 3062 Min 1223						
Standard check varieties						Standard check varieties							
Caoca G4017	1	Cream	3	Small	1439	98	Caoca G4017	1	Cream	3	Small	2528	98
BAT 93	2	Cream	2	Small	871	99	Rosinha G6970	2	Cream	2	Small	2022	99
Rosinha G6970	3	Cream	2	Small	857	99	BAT 93	3	Cream	2	Small	1807	99
IPA 74 19 G11893	4	Cream	3	Small	681	98	IPA 74 19 G11893	4	Cream	3	Small	1765	98
H1 Mulat ho G5054	5	Cream	2	Small	590	97	Aoana G7951	5	Cream	2	Small	1627	97
Brazil 2 G3807	6	Cream	1	Small	583	96	H1 Mulat ho G5054	6	Cream	2	Small	1431	99
Aoana G7951	7	Cream	2	Small	525	98	H6 Mulat ho G5059	7	Cream	2	Small	986	99
H6 Mulat ho G5059	8	Cream	2	Small	939	99	Brazil 2 G3807	8	Cream	1	Small	872	99
Average					705	98	Average					1630	99
Iterative checks						Iterative checks							
Caoca G4017	1	Cream	3	Small	1439	98	Caoca G4017	1	Cream	3	Small	2528	
Brazil 2 G3807	2	Cream	1	Small	583	97	Brazil 2 G3807	2	Cream	1	Small	872	
Average					1011	98	Average					1700	
C.V.	18.7						C.V. %	9.8					
LSD	0.05						LSD	0.05					

Tabl 26 Y ld cf c ea sp kl d gay b sh bea s (j o p 9) t t d 1981A P l y Y eld T l (EP) t CIAT Pop ya u de che cally pot ted  
 a d p t t d d t o s

U p o t e c t e d							P o t e c t e d						
E t y	Ra k	Colo	H b t	S e	Y ld (kg/ha)	Phy mat ty (day)	E t y	Ra k	Color	H b t	S ze	Y eld (kg/ha)	Physiologic l atu ty (days)
A 114	1	C	3	S all	075	97	A 00114	1	C	3	S all	2784	95
A 59	2	B o	2	S all	1093	98	BAT 01203	2	G ay	3	Small	2342	96
A 6	3	P to	2	Med	1072	98	A 00067	3	Pi to	2	Med	2196	95
A 171	4	C a	3	M d	1168	97	A 00171	4	C ea	3	Medi m	2052	95
AT 1203	5	G y	3	S ll	82	95	A 00059	5	B o	2	S ll	1941	97
A 174	6	C	1	Med	395	9	A 00174	6	C	1	Med u	1356	95
A e ag f 6 best					1104	97	A e ge of 6 best					2112	96
A g of 6 EP at 1					1104		A age of 6 EP at 1s					2112	
M 2075 t 395							M 784 M 1356						
St d d check a etis							Sta da d check a eties						
Flo d M yo G5877	1	C	3	M d	632	98	F1 de M y G5877	1	C ea	3	Med	2381	95
S d h B o G1540	2	C ea	1	S ll	387	97	S ed sh B o G1540	2	C ea	1	S all	1133	96
A e ag					510	98	A ag					1757	96
C V % 52.1							C V % 13.0						
LSD 0.05							LSD 0.05						

Table 27 Yields of gay yellow light tan b sh beans (group 10) tested 1981A Preliminary Yield Trials (EP) at CIAT Popay under chemically protected and unprotected conditions

Unprotected							Protected						
Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
A 197	1	Cream	1	Big	894	95	A 195	1	Cream	1	Big	2105	95
A 195	2	Cream	1	Big	785	95	A 197	2	Cream	1	Big	1905	97
Average of 2 best					840	95	Average of 2 best					2005	96
Average of 2 EP materials					840		Average of 2 EP materials					2005	
Max	894	M1	785				Max	2105	M	1905			
Standard check varieties							Standard check varieties						
Tortolas x Diana G7160	1	Other	3	Big	1122	96	Tortolas Diana G7160	1	Other	3	Big	2493	95
Bayo Mex G5896	2	Cream	1	Medium	549	95	Bayo Mex G5896	2	Cream	1	Medium	1625	97
Average					836	96	Average					1583	96
CV %	26.2						CV %	16.7					
LSD	0.05						LSD	0.05					



Table 28 Yields of various seed color groups for bush bean breeding purposes tested in 1981A Pella dry Yield Trials (EP) at CIAT Payaguá de chemically protected and unprotected conditions

Unprotected							Protected						
Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
BAC 24	1	Other	2	Small	1153	99	BAC 24	1	Other	2	Small	2458	101
BAT 1270	2	Other	2	Small	974	98	A 117	2	Purple	1	Medium	2351	99
A 116	3	Purple	1	Medium	851	98	BAC 44	3	Other	2	Medium	2024	99
BAT 1266	4	Yellow	2	Small	815	99	BAC 81	4	White	2	Small	1971	100
A 117	5	Purple	1	Medium	777	97	BAT 1270	5	Other	2	Small	1907	98
BAC 63	6	Cra	2	Small	743	98	EMP 81	6	Other	3	Small	1590	98
A 167	7	Other	2	Small	706	99	A 167	7	Other	2	Small	1775	99
BAC 44	8	Other	2	Medium	684	97	BAC 63	8	Cra	2	Small	1499	98
BAC 81	9	White	2	Small	657	98	BAC 161	9	Gay	2	Small	1323	99
A 112	10	Brown	1	Medium	499	98	BAT 1266	10	Yellow	2	Small	1175	97
Average of 10 best					786	98	Average of 10 best					187	99
Average of 12 EP materials					717		Average of 12 EP materials					1649	
Max 1153 Min 306							Max 2105 Min 1905						
Standard check varieties							Standard check varieties						
Nep Bayo 22 G4000	1	Bo	2	Small	967	98	Nep Bayo 22 G4000	1	Bo		Small	2171	98
Average					967	98	Average					2171	98
C V %					21.0		C V %					19.3	
LSD					0.05		LSD					0.05	

In general yields seldom reached 1400 kg/ha under direct association and nonprotected conditions but this is higher than average farmer yields. The growth cycle of the climbing beans was at least 30 days longer than that of bush beans.

Group 11 Black small seeded for cool climates (Table 29)  
Only four lines of 11 entries yielded over 1 t/ha. G 6040 was the best yielder (1343 kg/ha). The average yield of the checks was higher than that of the G lines.

Group 12 Black small seeded for warm climates (Table 29)  
and Group 13 Red small to medium seed size for cool climates (Table 30)  
In both groups few breeding lines outyielded the checks. The average yields of the breeding lines and the checks were almost equal.

Group 14 Red seeded for warm climates (Table 30)  
In this group the three breeding lines were outyielded by the three checks.

Group 15 Various colors and sizes for cool climates (Table 31)  
Several of the materials selected from the germplasm bank yielded significantly higher than the checks. This group showed the best improvement in the climbing bean trials.

Group 16 Various colors and sizes for warm climates (Table 31)  
No significant yield improvement was observed in this group.

In general yield performance of the climbing beans was slightly better than the checks. Yields were mostly low but the range between the lowest and the highest yielder was sufficient for evaluation. The low yield was due to the direct association. Most of the breeding lines were resistant to anthracnose. Ascochyta damage on the climbers was almost negligible compared to that of bush beans.

#### IBYAN - International Bean Yield and Adaptation Nursery

A total of 23 bush and 27 climbing bean lines and varieties selected from the 1980 EP were tested in the 1980 IBYAN trial. The IBYAN started in 1976 as a bush bean trial with a single trial where all seed colors were studied together. In 1977, 1978, and 1979 black and colored entries were kept separate in two different trials. Climbing bean trials started in 1978 with color separations. For the 1980 trials the IBYAN was increased to seven different nurseries to cover most of the basic bean groups. It is estimated that by 1984 the EP will be providing material to establish all the IBYAN nurseries required to comply with the needs of the specific types preferred in the primary bean-production areas.

The characteristics, composition, and number of entries in the 1980 IBYAN trials are shown in Table 32. As of October 30, 1981, data had been received from 82 trials. The results of the international bean yield trials are published in separate reports. The present discussion includes only the trials planted in Colombia by the Bean Program.

Table 29 Yields of standard black and grey sorghums (groups 11 and 12) tested in 1981 at Popayan under check conditions

Cool late materials (group 11)							Warm late materials (group 12)						
Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
G 6040	1	Black	4	Small	1343	115	V 8025	1	Black	3	Small	984	107
G 6342	2	Black	4	Small	1300	115	V 7982	2	Black	4	Small	901	108
G 6076	3	Black	4	Small	1031	119	V 8014	3	Black	4	Small	847	116
G 5971	4	Black	4	Small	1141	109	V 8030	4	Black	4	Small	820	110
G 2338	5	Black	4	Small	983	118	V 7967	5	Black	4	Small	769	108
G 4201	6	Black	4	Small	947	116	V 8016	6	Black	3	Small	693	106
G 6079	7	Black	4	Small	817	121	V 7984	7	Black	4	Small	616	110
G 5960	8	Black	4	Small	792	116	V 8017	8	Black	4	Small	614	106
G 5927	9	Black	4	Small	690	119	V 8012	9	Black	3	Small	488	107
G 5272	10	Black	4	Small	620	108	V 8020	10	Black	4	Small	515	111
Average of 10 best					966	116	Average of 10 best					725	109
Average of 10 EP materials					966		Average of 11 EP materials					704	
Max 1343 Min 690							Max 984 Min 501						
Standard check varieties							Standard check varieties						
G 6040	1	Black	4	Small	1316		G 3159	1	Black	4	Small	848	106
G 3145	2	Black	4	Small	1107		G 2327	2	Black	4	Small	837	110
G 6076	3	Black	4	Small	1045		G 5004	3	Black	4	Small	816	107
G 5924	4	Black	4	Small	881		G 3873	4	Black	4	Small	586	107
Average					1087		Average					772	108
C.V. % 21.9							C.V. % 21.2						
LSD 0.05							LSD 0.05						

Tabl 30 Y elds of o tsta dng d seeded l b ng b s (g o ps 13 and 14) t sted 1981A Prelimina y Y eld Trials (EP) at CIAT Popaya u der chemically u p o tected co d t ons

Cool l ate mat ls (g o p 13)							Warm l ate materials (g oup 14)						
E t ry	Ra k	Color	H b t	Size	Yield (kg/ha)	Physiolog cal matu ty (days)	E t ry	Ra k	Colo	Habit	Siz	Yield (kg/ha)	Physiolog cal matu ty (days)
G 2754	1	Red	4	S all	961	108	V 79116	1	Red	4	S all	733	109
G 3912	2	Red	4	S all	745	119	V 79119	2	Red	4	Small	695	108
G 5346	3	Red	4	S all	671	114	G 5701	3	Red	4	Small	597	109
G 7318	4	Red	4	Med m	643	129							
G 685	5	Red	4	S ll	624	123							
G 7233	6	Red	4	Med1	567	132							
G 7230	7	Red	4	Med1	449	126							
G 8160	8	Red	4	Med u	432	139							
G 8171	9	Red	4	M d m	378	122							
G 11820	10	Red	4	Med1	310	137							
Average of 10 best					578	125	Ave ge of 3 best					675	109
A e age of 11 EP ate ls					534		A e age of 3 EP aterials					675	
Ma 961 M n 93							Max 733 M1 597						
Sta d d check a eties							Standa d check a eties						
G 2371	1	Red	4	Small	932	109	G 7128	1	Red	4	Small	948	108
G 5653		R d	4	Small	651	107	G 2839	2	Red	4	S all	908	108
G 11821	3	Red	4	S all	457	137	G 3913	3	Red	4	Small	770	108
A age					680	118	Ave ag					875	108
C V %	40 0						C V %	15 5					
LSD	0 05						LSD	0 05					

Table 31 Yields of outstanding climbing beans of various colors (groups 15 and 16) tested 1981A Preliminary Yield Trials (EP) at CIAT Popayan under chemically protected conditions

Cool climate materials (group 15)							Warm climate materials (group 16)						
Entry	Rank	Color	Habit	Size	Yield (kg/h)	Physiological maturity (days)	Entry	Rank	Color	Habit	Size	Yield (kg/ha)	Physiological maturity (days)
G 2641	1	Cream <sup>a</sup>	4	Small	1126	108	V 8024	1	Beige	4	Medium	932	109
G 811	2	Cream <sup>a</sup>	4	Medium	1115	107	V 8023	2	Beige	4	Medium	857	112
G 2331	3	Yellow	4	Small	1007	106	V 7987	3	Beige	4	Medium	684	112
G 2016	4	Red	4	Small	939	109	V 79107	4	Cream	4	Medium	427	106
G 3410	5	Yellow	4	Large	893	110	V 7964	5	Cream	4	Small	164	112
G 6435	6	White	4	Medium	891	112							
G 2520	7	White	4	Medium	878	109							
G 735	8	Yellow	4	Small	719	107							
G 12488	9	Cream <sup>a</sup>	4	Large	546	118							
G 4727	10	Cream <sup>a</sup>	4	Large	438	116							
Average of 10 best					857	110	Average of 5 best					613	110
Average of 12 EP materials					768		Average of 5 EP materials					613	
Max 1126 Min 314							Max 932 Min 164						
Standard check varieties							Standard check varieties						
G 12488	1	Cream <sup>a</sup>	4	Large	631	123	G 3467	1	Cream <sup>a</sup>	4	Small	813	106
G 4727	2	Cream <sup>a</sup>	4	Large	533	117	G 2829	2	Cream	4	Small	803	108
G 5702	3	Cream <sup>a</sup>	4	Large	507	117	G 2540	3	White	4	Small	665	113
Average					557	119	Average					760	109
C V % 36.3							C V % 38.2						
LSD 0.05							LSD 0.05						

a Mottled or striped

Table 32 Characteristics and geographical distribution of the 1980 IBYAN

Type of trial	Growth habit	Grain characteristics		No of entries in the trial	No of trials in <sup>a</sup>				Total
		Color	Size		Latin America	Africa	Asia	Other countries	
IBYAN 10000	Bush	Black	Small	14	81 (96.4)	1	1	1	84
IBYAN 20000	Bush	Red	Small/medium	9	52 (70.3)	13	8	1	74
IBYAN 30000	Bush	White	Small/medium	9	25 (59.5)	5	9	3	42
IBYAN 50000	Bush	Cream/brown	Small	14	22 (53.7)	8	8	3	41
VIRAF 60000	Climbing	Black	Small	10	21 (87.5)	1	2	0	24
VIRAF 70000	Climbing	Red	Small	10	30 (73.2)	6	5	0	41
VIRAF 80000	Climbing	Cream mottled	Medium/large	10	13 (68.4)	2	4	0	19
Total				76	244 (75)	36 (11)	37 (11)	8 (3)	325

a Figures in parentheses are percentages

## Bush Beans

Four different trials for bush beans were planted at CIAT-Palmira and at CIAT-Popayan. Jamapa and Porrillo Sintetico for blacks Diacol-Calima for reds Ex Rico 23 for whites and Carioca for cream-seeded materials were considered as international checks. A local variety and an outstanding line from previous trials were the local and elite checks respectively.

CIAT-Palmira Trials at CIAT-Palmira were conducted without chemical control for diseases.

Black-seeded trials (group 1) The results for the IBYAN trials planted in 2 semesters are shown in Table 33. Of the four new lines tested BAT 910 and BAT 873 were the best, none of these was significantly better than the checks. These two lines plus ICA Pijao BAT 304 and BAT 58 were the outstanding materials in these trials.

Small red-seeded trials (group 2) Table 34 shows the results for the IBYAN trials planted in 2 semesters. A 40 M-92 and BAT 37 were outstanding among the new breeding lines tested. The elite check A 21 outyielded all materials.

Small white-seeded trials (group 5) The results for the IBYAN trials planted in 2 semesters are shown in Table 35. BAT 482 was consistently better than all the other lines in both seasons. Another elite check BAT 338 outyielded most of the material tested. Among the new breeding lines 78-0374 and A 48 were the best.

Small cream-seeded trials (group 8) The results for the IBYAN trials planted in 2 semesters are shown in Table 36. BAT 85 was consistently the best material in both semesters. Among the new materials BAT 477 was the highest yielder. These two lines plus Carioca and BAT 336 were the best lines selected from these trials.

CIAT-Popayan Trials at CIAT-Popayan were conducted with and without chemical control of diseases.

Black-seeded trials (group 1) Two IBYAN trials were planted in each semester. Anthracnose and ascochyta were the predominant diseases in nonprotected nurseries.

The results for the two trials conducted during the second semester 1980B are shown in Table 37. BAT 873 and BAT 527 were the best materials both with and without chemical control for diseases. BAT 873 was also among the outstanding materials at CIAT-Palmira but BAT 527 did not do as well at Palmira as at Popayan (see Table 33). BAT 910 a good line at Palmira was among the lowest yielders at Popayan. BAT 1057 proved to be a good material at Popayan when subjected to chemical control. In general lowest yielding materials lost 40% more due to diseases than the highest yielding lines.

Table 33 Average yields of the new black seeded bush bean breeding material and checks (group 1) tested in the 1980 IBYAN at CIAT Palmira under chemically unprotected conditions

Entry	Semester 1980B			Semester 1981A			Average yield (kg/ha)
	Rank	Yield (kg/ha)	Days (no )	Rank	Yield (kg/ha)	Days (no )	
<u>New breeding materials</u>							
BAT 910	1	3190	68	3	2233	66	2712
BAT 87 <sup>2</sup>	2	3094	68	4	2199	61	2646
BAT 527	10	2471	70	13	1869	67	2170
BAT 1057	14	1537	68	9	2088	66	1812
<u>Local check</u>							
ICA Pijao	3	3060	68	5	2175	62	2618
<u>International check</u>							
Porrillo Sintético	8	2635	68	6	2136	66	2386
<u>Elite checks</u>							
BAT 304	4	3029	68	8	2093	63	2561
BAT 58	6	2723	72	1	2375	66	2549
Mean		2638			2090		
LSD 05		364			371		
Range		1653			519		
C V		8.2%			10.6%		



Table 34 Average yields of the new red seeded bush bean breeding material and checks (group 2) tested in the 1980 IBYAN at CIAT Palmira under chemically unprotected conditions

Entry	Semester 1980B			Semester 1981A			Two semesters	
	Rank	Yield (kg/ha)	Days (no )	Rank	Yield (kg/ha)	Days (no )	Rank	Average yield (kg/ha)
<u>New breeding lines</u>								
A 40	2	2762	68	2	1942	63	2	2352
M 92	5	2443	68	4	1817	63	3	2130
BAT 37	7	2379	68	3	1865	61	4	2122
BAT 896	8	2006	68	8	1657	68	8	1832
BAT 795	9	1721	68	5	1807		9	1764
<u>Local check</u>								
Diacol Calima	3	2621	68	9	1617	63	5	2119
<u>Elite checks</u>								
A 21	1	2890	70	1	2281	66	1	2586
BAT 41	4	2560	68	7	1674	61	6	2117
BAT 202	6	2437	68	6	1708	61	7	2072
Mean		2424			1819			
LSD 05		391			346			
Range		1169			664			
C V		9.3%			11.0%			

Table 35 Average yields of the new white seeded bush bean breeding material and checks (group 5) tested in the 1980 IBYAN at CIAT Palmira under chemically unprotected conditions

Entry	Semester 1980B			Semester 1981A			Two semesters	
	Rank	Yield (kg/ha)	Days (no )	Rank	Yield (kg/ha)	Days (no )	Rank	Average yield (kg/ha)
<u>New breeding lines</u>								
78 0374	2	2475	71	4	1816	72	4	2146
A 48	5	2404	71	3	2020	70	3	2212
BAT 1061	6	2363	71	5	1803	70	5	2083
2 W 33 2	7	1717	68	6	1772	62	7	1744
W 126	8	1558	68	7	1636	63	8	1597
<u>International check</u>								
Ex Rico 23	4	2436	68	8	1302	62	6	1849
<u>Elite checks</u>								
BAT 482	1	2998	68	1	2359	62	1	2678
BAT 338	3	2452	69	2	2248	69	2	2350
Mean		2229			1889			
LSD 05		479			386			
Range		1440			1057			
C V		12 4%			11 8%			

Table 36 Average yields of the new cream seeded bush bean breeding material and checks (group 8) tested in the 1980 IBYAN at CIAT-Palmira under chemically unprotected conditions

Entry	Semester 1980B			Semester 1981A			Average yield (kg/ha)
	Rank	Yield (kg/ha)	Days (no )	Rank	Yield (kg/ha)	Days (no )	
<u>New breeding lines</u>							
BAT 477	2	3194	77	2	2623	77	2908
M 101	6	2598	68	6	2064	66	2331
BAT 331	7	2522	72	7	2044	69	2283
IAPAR RAI 54	9	2504	68	9	1942	68	2223
A 51	11	2490	70	10	1940	73	2215
BAT 874	12	2445	71	8	1977	71	2211
CENA 164 1	14	2230	71	12	1860	70	2045
<u>Local checks</u>							
Brazil 2	14	1941	69				1941
A 81				5	2163	73	2163
<u>International check</u>							
Carioca	4	2844	71	4	2221	70	2532
<u>Elite checks</u>							
BAT 85	1	3287	68	1	2636	66	2962
BAT 336	3	3098	68	3	2282	66	2690
Mean		2629 (n 14)			2089 (n 14)		
LSD 05		453			306		
Range		1346			822		
C V		10.3%			8.7%		

Table 37 Average yields of black seeded bush bean material (group 1) in the 1980 IBYAN with and without chemical protection against diseases at CIAT Popayan semester 1980B

Entry	With chemical protection			Without chemical protection			Yield loss	
	Rank	Yield (kg/ha)	Days (no )	Rank	Yield (kg/ha)	Days (no )	(kg/ha)	(%)
<u>Best materials in each group</u>								
BAT 873	1	2780	91	2	1722	87	1058	38 1
BAT 527	2	2665	91	1	2120	89	545	20 4
BAT 1057	3	2473	92	8	843	93	1630	65 9
BAT 304	4	2330	89	4	1158	88	1172	50 3
Control								
Jamapa	5	2322	91	3	1673	89	649	28 0
Mean of 4 best		2562			1668		894	34 9
<u>Worst materials in each group</u>								
BAT 910	11	1949	93	7	912	91	1037	53 2
ICTA Quetzal	12	1928	98	9	744	92	1184	61 4
BAT 7	13	1834	95	11	495	91	1339	73 0
ICTA Jutiapan	14	1822	100	12	449	94	1373	75 4
Control								
ICA Pijao	9	1965	87	13	430	86	1535	78 1
Porrillo Sintetico	10	1963	95	14	366	94	1597	81 4
Mean of 4 worst		1883			435		1448	76 9
<hr/>								
Grand mean (n 14)		2175			964		964	
LSD 05		651			474		474	
Range		612			1754			
C V		17 8%			29 3%			

Table 38 shows the results of the two trials conducted in the 1981A season. BAT 527 confirmed its outstanding performance of the previous semester. BAT 873 and BAT 910 were two other good materials. Chemical control had an effect on foliage but pods showed almost the same degree of attack by diseases in both treated and untreated experiments for most varieties.

Small red-seeded trials (group 2) The results of the two trials in 1980B are shown in Table 39. BAT 37 and BAT 795 showed the least yield reduction due to diseases. Line A 21 was another outstanding material. The rest of the lines tested showed yield reductions as large as 70 to 95% due to diseases.

Results from 1981 are shown in Table 40. Results of the previous semester were confirmed in these trials with A 21, BAT 795 and BAT 37 again performing as the best materials. All three varieties and Diacol-Calima also showed a remarkably low degree of attack of anthracnose in the pods.

Small white-seeded trials (group 5) Results of 1980B are shown in Table 41. BAT 1061 and BAT 482 had the lowest yield reductions of all lines tested. Lines 78-0374, BAT 338 and A 48 performed well when anthracnose was controlled but yields diminished about 70% when there was no chemical control.

Results of 1981A are shown in Table 42. BAT 482 and BAT 1061 (the same outstanding lines of the past semester) and lines A 48 and 78-0374 were the best materials.

Small cream-seeded trials (group 8) Results of 1980B are shown in Table 43. Brazilian materials including CENA 164-1, Carioca and an old entry Brasil 2 were the best materials together with BAT 561. Materials that had shown good performance at CIAT-Palmira for example BAT 85 and BAT 336 were among the worst materials at Popayan.

Results of 1981A are shown in Table 44. Three materials from Brazil and two from CIAT were the outstanding materials. Carioca, CENA 164-1 and BAT 874 had good performances in the previous semester as well. All the outstanding varieties showed pods with a low degree of attack of anthracnose.

Among all the 70 entries tested in four different trials over two seasons at two places of contrasting climatic soil characteristics a group of 26 distinguished themselves from the rest. Table 45 shows the most outstanding in these trials.

### Climbing Beans

Trials with climbing beans are designed for planting in association or relay with maize.

Table 38 Average yields of black seeded bush bean material (group 1) in the 1980 IBYAN with and without chemical protection against diseases at CIAT Popayan semester 1981A

Entry	With chemical protection			Without chemical protection					
	Rank	Yield (kg/ha)	Rating <sup>a</sup> for anthracnose on pods	Rank	Yield (kg/ha)	Rating <sup>a</sup> for anthracnose on Leaves	Pods	Yield loss (kg/ha)	(%)
<u>Best materials in each group</u>									
BAT 527	1	3093	2 0	1	1858	4 0	4 0	1235	39 9
BAT 1057	2	2770	4 0	5	929	4 0	2 0	1841	66 5
ICTA Quetzal	3	2753	4 5	8	771	3 5	4 5	1982	72 0
BAT 910	4	2680	4 5	2	1485	4 0	4 0	1195	44 6
BAT 873	5	2507	3 5	3	1204	4 0	4 5	1303	52 0
BAT 58	7	2408	2 7	4	1077	4 0	4 0	1331	55 3
Mean of 4 best		2824			1406			1266	44 8
<u>Worst materials in each group</u>									
ICA Pijao	10	2044	4 5	11	685	4 0	4 5	1359	66 5
BAT 7	11	2022	4 0	6	898	3 5	4 0	1124	55 6
Talamanca	12	1855	4 0	13	395	4 0	4 5	1460	78 7
Porrillo Sintetico	13	1662	4 5	12	466	4 5	4 5	1196	72 0
BAT 271	14	1128	4 5	14	114	4 5	4 0	1014	89 9
Mean of 4 worst		1667			415			1257	75 4
Grand mean (n 14)		2254			876				
C V									

a Scale 1 immune 2 resistant 3 - intermediate 4 - susceptible 5 highly susceptible

Table 39 Average yields of red seeded bush bean material (group 2) in the 1980 IBYAN with and without chemical protection against diseases at CIAT Popayan semester 1980B

Entry	With chemical protection			Without chemical protection			Yield loss	
	Rank	Yield (kg/ha)	Days (no )	Rank	Yield (kg/ha)	Days (no )	(kg/ha)	(%)
Diacol Calima	1	2488	85	4	664	85	1824	73 3
A 21	2	2163	88	3	961	88	1202	55 6
BAT 41	3	2155	88	7	265	88	1890	87 7
BAT 37	4	2097	87	1	1443	87	654	31 2
BAT 795	5	2020	97	2	1280	97	740	36 6
A 40	6	1926	86	6	290	86	1636	84 9
BAT 202	7	1920	88	5	430	88	1490	77 6
BAT 896	8	1632	91	8	70	91	1562	95 7
M 92	9	946	87	9	58	87	888	93 9
Mean		1927			607			
LSD 05		402			328			
Range		1542			1385			
C V		12 0%			31 2%			

Table 40 Average yields of red seeded bush bean material (group 2) in the 1980 IBYAN with and without chemical protection against diseases at CIAT Popayan semester 1981A

Entry	With chemical protection			Without chemical protection				Yield loss	
	Rank	Yield (kg/ha)	Rating <sup>a</sup> for anthracnose on pods	Rank	Yield (kg/ha)	Rating <sup>a</sup> for anthracnose on Leaves	Pods	(kg/ha)	(%)
A 21	1	3400	2 0	1	2019	3 0	2 5	1381	40 6
BAT 795	2	2880	1 0	2	1867	1 0	1 5	1013	35 2
BAT 37	3	2872	2 3	3	1311	4 5	4 0	1561	54 3
A 10	4	2370	4 5	5	542	4 5	4 5	1828	77 1
Calima	5	2180	1 5	4	763	5 0	5 0 <sup>b</sup>	1417	65 0
BAT 895	6	1735	4 0	6	481	4 0	4 0	1254	72 3
BAT 41	7	1707	4 0	8	156	4 5	4 5	1551	90 9
BAT 202	8	1511	4 5	7	232	4 5	4 5	1279	84 6
M 92	9	875	3 5	9	40	4 5	4 0	835	95 4
Mean		2170			823			1347	62 0
C V									

a Scale 1 immune 2 resistant 3 = intermediate 4 susceptible 5 highly susceptible

b Defoliated



Table 41 Average yields of white seeded bush bean material (group 5) in the 1980 IBYAN with and without chemical protection against diseases at CIAT Popayan semester 1980B

Entry	With chemical protection			Without chemical protection			Yield loss	
	Rank	Yield (kg/ha)	Days (no)	Rank	Yield (kg/ha)	Days (no)	(kg/ha)	(%)
78 0374	1	2550	100	3	745	99	1805	70.8
BAT 1061	2	2282	98	1	1512	98	770	33.7
BAT 482	3	2265	89	2	1215	90	1050	46.4
BAT 338	4	1790	98	5	306	99	1484	82.9
A 48	5	1732	98	4	630	100	1102	63.6
2 W 33 2	6	1649	90	7	93	97	1556	94.4
W 126	7	1610	87	6	290	97	1320	82.0
BAT 21	8	1349	88	8	90	101	1259	93.3
Ex Rico 23	9	1340	88	9	82	91	1258	93.9
Mean		1841			551			
LSD 05		782			575			
Range		1210			1430			
C V		24.5%			60.3%			

Table 42 Average yields of white seeded bush bean material (group 5) in the 1980 IBYAN with and without chemical protection against diseases at CIAT Popayan semester 1981A

Entry	With chemical protection			Without chemical protection				Yield loss	
	Rank	Yield (kg/ha)	Rating <sup>a</sup> for anthracnose on pods	Rank	Yield (kg/ha)	Rating <sup>a</sup> for anthracnose on Leaves	Pods	(kg/ha)	(%)
78 0374	1	2495	4 5	1	1552	2 3	2 5 4 0	943	37 8
BAT 1061	2	2211	3 0	3	1302	2 3	1 5 2 5	909	41 1
A 48	3	2116	3 5	4	1284	2 3 5	4 0	832	39 3
BAT 482	4	2096	2 5 3 0	2	1399	3 0	3 0	697	33 2
BAT 338	5	2067	4 5	6	760	4 5	4 0	1307	63 2
2 W 33 2	6	1949	4 0	8	220	4 5	4 5	1729	88 7
W 126	7	1739	4 0	7	694	4 5	4 0	1045	60 1
Ex Rico 23	8	1465	4 5	9	33	4 5	4 5	1432	97 8
Mean		2017			906			1112	55 1
C V									

a Scale 1 - immune 2 resistant 3 intermediate 4 susceptible 5 = highly susceptible

Table 43 Average yields of cream seeded bush bean material (group 8) in the 1980 IBYAN with and without chemical protection against diseases at CIAT Popayan semester 1980B

Entry	With chemical protection			Without chemical protection			Yield loss	
	Rank	Yield (kg/ha)	Days (no )	Rank	Yield (kg/ha)	Days (no )	(kg/ha)	(%)
<u>Best materials in each group</u>								
Cena 164 1 (Brazil)	1	2762	94	1	1839	90	923	33 4
Carioca (Brazil)	2	2461	94	2	1787	93	674	27 4
BAT 160	3	2391	92	6	1130	91	1261	52 7
BAT 874	4	2220	100	8	835	95	1385	62 4
BAT 561	6	1959	93	3	1549	94	410	20 9
Brasil 2 (Brazil)	8	1710	87	4	1407	87	303	17 7
Mean of 4 best		2458			1646		1061	43 2
<u>Worst materials in each group</u>								
BAT 336	11	1468	87	10	594	89	874	59 5
BAT 51	12	1411	100	14	220	95	1191	84 4
M 101	13	1179	88	12	232	88	947	80 3
BAT 331	14	1158	96	13	222	96	936	80 8
BAT 85	7	1711	87	11	550	86	1161	67 9
Mean of 4 worst		1304			306		1059	81 2
Grand mean (n 14)		1836			964			
LSD 05		715			280			
Range		1604			1619			
C V		23 2%			17 3%			

Table 44 Average yields of cream seeded bush bean material (group 8) in the 1980 IBYAN with and without chemical protection against diseases at CIAT Popayan semester 1981A

Entry	With chemical protection			Without chemical protection				Yield loss	
	Rank	Yield (kg/ha)	Rating <sup>a</sup> for anthracnose on pods	Rank	Yield (kg/ha)	Rating <sup>a</sup> for anthracnose on Leaves	Pods	(kg/ha)	(%)
<u>Best materials in each group</u>									
Carioca (Brazil)	1	3214	1 0	1	2376	1 0	1 0	838	26 1
Cena 164 1 (Brazil)	2	3150	1 2	3	1913	1 0	1 0	1237	39 3
A 81	3	3144	1 0	6	1650	1 0	1 5	1494	47 5
BAT 874	4	3006	2 5	2	1997	1 0	2 5	1009	33 6
IAPAR A 154 (Brazil)	7	2768	2 5	4	1891	1 0	1 5	877	31 7
Mean of 4 best		3128			2044			990	32 7
<u>Worst materials in each group</u>									
A 51	10	1751	4 0	12	525	4 5	4 5	1226	70 0
BAT 336	11	1513	4 0	11	545	4 5	4 0	968	64 0
M 101	12	1508	4 5	13	253	4 5	3 5	1255	83 2
BAT 85	13	1369	4 0	9	572	4 5	2 0	797	58 2
BAT 331	14	1159	4 5	14	195	4 0	4 0	964	83 2
Mean of 4 worst		1387			380			1103	75 1
Grand mean		2346			1192				
C V									

a Scale 1 immune 2 resistant 3 intermediate 4 susceptible 5 highly susceptible

Table 45 Most outstanding bush bean materials among the 70 entries tested in the 1980 IBYAN in two semesters in two climatic regions

Grain type	CIAT-Palmira	CIAT-Popayan	
	Semesters 1980B and 1981A	Semester 1980B	Semester 1981A
Black-seeded (group 1)	BAT 873	BAT 873	BAT 873
	BAT 304	BAT 304	
	BAT 910		BAT 910
	BAT 58		
	ICA Pijao	BAT 527 Jamapa	BAT 527
Red-seeded (group 2)	A 21	A 21	A 21
	BAT 37	BAT 37	BAT 37
		BAT 795	BAT 795
	A 40 M 92		
White-seeded (group 5)	BAT 482	BAT 482	BAT 482
		BAT 1061	BAT 1061
	A 48		A 48
	78-0374 BAT 338		78-0374
Cream-seeded (group 8)	Carioca	Carioca	Carioca
		Cena 164-1	Cena 164-1
		BAT 561	
			IAPAR A 154 BAT 874 A 81
	BAT 85 BAT 336 BAT 477		

Black-seeded trials (groups 11 and 12) Black-seeded climbing beans are grown in tropical warm and temperate climates Table 46 shows the results of the trial at two sites in Colombia representing the contrasting growing regions The trials were planted associated with maize At both locations local checks were outyielded by most of the breeding lines tested The best varieties at either one of the locations were the worst at the other site indicating a narrow adaptation of the material

Table 46 Average yields of black seeded climbing bean materials (groups 11 and 12) in the 1980 VIRAF one semester (1981A) at two locations (in association with maize)

Rank	CIAT Palmira		CIAT Popayan	
	Entry	Yield (kg/ha)	Entry	Yield (kg/ha)
<u>Three highest yielders</u>				
1	V 7923	750	G 6342	846
2	V 7966	666	V 7935	762
3	V 7937	564	G 6076	731
	Mean	660		780
<u>Three lowest yielders</u>				
8	Local Check	452	Local check	465
9	G 6076	242	V 7925	412
10	G 6342	207	V 7937	410
	Mean	300		429
General mean (n 10)		491		593
C V				

Red-seeded trials (groups 13 and 14) Red-seeded climbing beans were grown in the same places in Colombia as were black-seeded to observe their adaptation to areas similar to where they are usually grown. The results are shown in Table 47. Beans and maize were planted simultaneously. Genotype-by-location interaction was not as marked in this type of bean as it was with the black-seeded ones. Two entries G 2333 and G 2371 were among the best yielders at both Palmira and Popayan.

Large grains are preferred for the cool highland conditions of the Andean zone and in Mexico. Material for these areas was included in the trial planted at Popayan and at La Selva Antioquia, one of the Colombian sites chosen as representative of the areas where large-seeded red beans are grown. The trial in La Selva was planted in association with maize and in Popayan in relay with maize. Table 48 shows the results of this trial. All entries except G 11820 at Popayan outyielded the local check ICA Viboral, a newly released variety. Yields were generally doubled at Popayan over those at La Selva. Line G 2331 performed well at both places. Line G 12488, an otherwise excellent variety tested at several international sites, did not do well at Popayan.

Table 47 Average yields of small red seeded climbing bean materials (groups 13 and 14) in the 1980 VIRAF one semester (1981A) at two locations (in association with maize)

Rank	CIAT Palmira		CIAT Popayan	
	Entry	Yield (kg/ha)	Entry	Yield (kg/ha)
<u>Three highest yielders</u>				
1	V 79117	398	G 2371	623
2	G 2333	390	G 3912	497
3	G 2371	254	G 2333	454
Mean		374		525
<u>Three lowest yielders</u>				
8	V 79115	201	V 79117	311
9	G 7128	185	V 79115	280
10	V 79116	170	Local check	246
Mean		185		279
General mean (n 10)		247		402
C V				

Table 48 Average yields of large red seeded climbing bean materials (groups 13 and 14) in the 1980 VIRAF at two locations (planted with maize)

Rank	(association)		La Selva 80B (relay)	
	Entry	Yield (kg/ha)	Entry	Yield (kg/ha)
<u>Three highest yielders</u>				
1	G 2331	1804	G 2641	4492
2	G 12488	1752	G 2331	4220
3	G 1780	1481	G 811	3770
Mean		1679		4161
<u>Three lowest yielders</u>				
8	G 3410	1255	G 12488	2889
9	G 11820	601	ICA Viboral	2498
10	ICA Viboral	543	G 11820	1611
Mean		800		2333
General mean (n 10)		1294		3339
C V				

## 1980 IBYAN Trials

The complete results of the international bean yield trial are published in a separate report however a brief summary is given here Table 49 shows the mean yield of the four types of bush bean trials across locations BAT 58 BAT 561 A 21 and BAT 482 were the best within their respective group although in general most of lines gave yields as high as those of the best elite and international checks In most places the best local check was outperformed by the best experimental line (Table 50) Superiority of the new breeding lines as shown for black beans in the Dominican Republic large reds in Haiti and creams in Zimbabwe was dramatic whereas in cases where the local entries outyielded the best experimental lines differences always were small and only in one instance reached 13%

A cluster analysis was used to classify all experimental sites into groups where varieties have similar performance independent of the level of productivity at the localities involved Grouping of course is valid only for the genotypes involved nevertheless it is important since it allows us to assess the range of adaptation of the materials and provides a base for further analysis of each group taking into account factors other than the genotypes themselves (Tables 51 52 53 and 54) It also indicates contrasting sites for EP evaluations

## Validation of Technology in Farm Trials

A key objective of the Bean Program is to develop improved technologies which remain accessible to small farmers because they do not entail expensive shifts to far more input-intensive production systems This had led for example to an emphasis on developing genetic resistance to diseases in beans rather than on relying on fungicides Similarly efforts are being made to promote higher levels of nitrogen fixation in association with beans in order to partially substitute for chemical fertilizers

Farm-level trials can provide important information on the performance of new technologies in actual farm conditions with regard to these and other objectives This year farm trials were conducted on 13 small farms in Antioquia Colombia with the collaboration of ICA The region is characterized by small-farm bean production which contributes slightly less than one-third of the total national production Farm size averages 4.4 ha among bean producers and 98% of the crop is marketed

Farmers' typical practice in Antioquia is to relay-crop climbing beans with maize the beans being planted when the maize kernel is in the milk stage Organic and chemical fertilizers as well as fungicides are used by nearly all farmers Average yield with farmer technology and management in 1981 was 1013 kg/ha among farmers using customary fungicides while it was significantly higher (1638 kg/ha)



Table 49 Average yields of the bush breeding lines tested in the 1980 IBYAN

Rank	Black-seeded lines <sup>a</sup>		Cream-seeded lines <sup>b</sup>	
	Experimental lines	Yield (kg/ha)	Experimental lines	Yield (kg/ha)
1	BAT 58	1576	BAT 561	1784
2	BAT 7	1566	Carioca	1774
3	BAT 873	1559	CENA 164-1	1704
4	Jamapa	1552	BAT 160	1694
5	BAT 304	1547	BAT 85	1680
6	ICA-Pijao	1537	IAPAR-RAI 54	1671
7	BAT 910	1526	BAT 477	1635
8	ICTA Quetzal	1504	BAT 332	1580
9	Porriño Sintético	1493	BAT 874	1567
10	BAT 1057	1465	BAT 336	1530
11	BAT 527	1401	BAT 331	1461
12	ICA COL 10103	1386	A 51	1389
13	ICTA Jutiapan	1368	M 101	1208
Mean		1497		1589
LSD 05		112		280
Rank	Small red-seeded lines <sup>c</sup>		Small white-seeded lines <sup>d</sup>	
	Experimental lines	Yield (kg/ha)	Experimental lines	Yield (kg/ha)
1	A 21	1509	BAT 482	1693
2	BAT 37	1384	78-0374	1663
3	A 40	1330	BAT 1061	1618
4	BAT 795	1305	BAT 338	1606
5	BAT 202	1236	A 48	1585
6	BAT 41	1226	Ex Rico 23	1435
7	BAT 896	1135	W 126	1386
8	M 92	1057	2W-33-2	1302
Mean		1273		1536
LSD 05		163		200

a Based on data from 47 sites

b Based on data from 17 sites

c Based on data from 28 sites

d Based on data from 19 sites

Table 50 Performance of outstanding lines relative to the best local check 1980 IBYAN

Country	Site	Best		Yield of EL relative to LC (LC 100%) <sup>a</sup>
		Experimental lines (EL)	Local check (LC)	
<u>Black seeded</u>				
Mexico	Huastecas	Jamapa	Delicias 71	102
	Isla Veracruz	BAT 58	Negro Veracruz	108
	Santiago Ixcuintla	Jamapa	Negro Nayarit	89
El Salvador	San Andres B	EMP 84	Porrillo 70	94
	San Andres B	ICTA Tamazulapa	S 184 N	143
Costa Rica	Alajuela B	BAT 304	Pavamor	114
Dominican Republic	San Juan de la Maguana	BAC 78	VEN 44	257
Cuba	Alquizar	ICTA Tamazulapa	Bolita 42	107
Venezuela	Maracay	BAT 873	Coche	111
	Saman Mocho	Porrillo Sintetico	Coche	101
	Turmero	BAT 804	Coche	102
Peru	Cañete	BAC 25	T Local 2	123
Chile	Chillán	EMP 84	Negro Argel	105
	Graneros	BAT 58	L 6080	118
	Graneros	EMP 84	Negro Argel	112
Argentina	Monte Redondo	A 232	DOR 41	113
	Rosario de la Frontera	A 218	T Local 1	100
	Trancas	BAT 832	DOR 41	101
	Misiones	BAT 832	Ex Rico 23	135

Brazil	Rio de Janeiro Vicosa Vicosa	Porrillo Sintetico BAT 873 BAT 804	Moruna BAT 64 BAT 65	105 132 99
<u>Small red seeded</u>				
El Salvador	San Andres San Andres	BAT 1289 BAT 41	Arbolito Retinto MCS 97 R	112 130
Honduras	Zamorano Catacamas Jamastran	A 21 BAT 1289 BAT 1289	Honduras 46 Cincuenteno Danli 46	108 91 122
Costa Rica	Alajuela	BAT 37	Mexico 80	148
Cuba	Alquizar	BAT 1293	CC 25 9	104
<u>Large red seeded</u>				
Colombia	Palestina	BAT 1230	Calima	141
Peru	Mollepata La Molina	Linea 22 BAT 1296	Red Kidney Red Kloud	198 116
Chile	Chillan Graneros	BAT 1296 BAT 1297	Araucano INIA Small Red Rufus	90 100
Haiti	Saint Raphael	BAT 1275	Salagnac 86	258

(Continued)

Table 50 (Continued)

Country	Site	Best		Yield of EL relative to LC (LC 100%) <sup>a</sup>
		Experimental lines (EL)	Local check (LC)	
Cuba	Alquizar	Linea 23	M 112	134
Cameroon	Dschang	Linea 22	Long Rouge Vigneaux	188
Rwanda	Rwerere	Linea 23	Tostado	98
	Karama	BAT 1297	Bataaf	100
	Rubona	BAT 1297	Tostado	121
Burundi	Mosso	BAT 1297	Karama	94
Zimbabwe	Harare	BAT 1296	Red Canadian Wonder	242
Mauritius	Beau Bassin	BAT 1297	Local Red	137
Rep South Africa	Delmas	BAT 1296	Bonus	87
<u>Small white seeded</u>				
Chile	Graneros	BAT 1061	L 7580	110
	Santiago	78 0374	Testigo Local 2	96
	Graneros	Ex Rico 23	D 76035	99
Cuba	Alquizar	BAT 1061	BAT 482	99
Rep South Africa	Delmas	BAT 1198	Bonus	112

Small cream seeded

Brazil	Lavras Ponte Nova	BAT 874 BAT 561	Rio Ivaí VI 1010	48 124
Bolivia	Santa Cruz	BAT 874	CENA 164 2	129
Argentina	Misiones	IAPAR RAI 54	Carioca Comun	126
Chile	Graneros Graneros	A 83 BAT 160	BAT 85 Tortola Diana	104 134
Zimbabwe	Harare	BAT 561	Line 193	319
Rep South Africa	Delmas	IAPAR RAI 54	Bonus	105

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a EL Experimental Line  
LC Local Check

Table 51 Groups of sites where yields of black seeded lines tested ranked similarly 1980 IBYAN

Group	Site	Country	Average yield of group	Three best materials in group
I	Monjas B	Guatemala	1957	ICA Pijao BAT 58 Porrillo Sintetico
	Maracay	Venezuela		
	Upala	Costa Rica		
	Monjas A	Guatemala		
	Palmira B	Colombia		
II	Palmira A	Colombia	1391	ICA Pijao ICTA Jutiapan BAT 58
	Monjas	Guatemala		
	Veracruz	Mexico		
	Santiago Ixcuintla	Mexico		
	Santiago	Chile		
III	Linhares	Brazil	1914	ICTA Quetzal Jamapa BAT 1057
	Bega	Libia		
	Huastecas	Mexico		
	Alajuela B	Costa Rica		
	Alquizar	Cuba		
IV	Ponte Nova	Brazil	1853	BAT 1057 ICA Pijao Porrillo Sintetico
	Metan	Argentina		
	Turmero	Venezuela		
	Damen	Haiti		
	Canete	Peru		
V	Alajuela A	Costa Rica	685	BAT 304 BAT 58 Jamapa
	Santa Cruz	Bolivia		
	Jalpatagua	Guatemala		
VI	Chincha	Peru	1183	Porrillo Sintetico BAT 304 BAT 58
	La Molina	Peru		
	Masaya A	Nicaragua		
	Guarabao	Venezuela		
	Buenos Aires	Costa Rica		
VII	San Andres A	El Salvador	1589	BAT 304 ICTA Quetzal ICA COL 10103
	Ahuachapan	El Salvador		
	Chimaltenango	Guatemala		
VIII	Trancas	Argentina	1544	Jamapa BAT 58 ICA COL 10103
	Belmonte	Brazil		
	Chapeco	Brazil		
	Graneros	Chile		
	Lavras	Brazil		
IX	Rio Braco	Mexico	1538	BAT 527 Jamapa BAT 1057
	Nueva Guadalupe	El Salvador		
	Cordoba	Argentina		
	Popayan B	Colombia		
	Fort Collins	USA		
Popayan A	Colombia			

Frequency among three best

<u>Line</u>	<u>Frequency</u>	<u>Line</u>	<u>Frequency</u>
BAT 58	5	BAT 1057	3
Jamapa	4	ICTA Quetzal	2
Porrillo Sintetico	3	ICA COL 10103	2
ICA Pijao	3	ICTA Jutiapan	1
BAT 304	3	BAT 527	

Table 52 Groups of sites where yields of small red seeded lines tested ranked similarly 1980 IBYAN

Group	Site	Country	Average yield of group	Three best materials in group
I	San Andres B	El Salvador	1358	A 21
	Alquizar	Cuba		A 40
	Kampala	Uganda		M 92
	Palmira A	Colombia		
	La Compania	Nicaragua		
II	Metan	Argentina	1073	A 21 BAT 37 M 92
III	Popayan A	Colombia	1532	A 21
	Popayan B	Colombia		BAT 37
	Potchefstroom	Rep South Africa		A 40
	Masaya B	Nicaragua		
IV	Alajuela A	Costa Rica	1931	A 21
	Palmira B	Colombia		A 40
	Masaya A	Nicaragua		BAT 37
V	Upala B	Costa Rica	1491	A 40
	Ahuachapan B	El Salvador		BAT 202
	Nueva Guadalupe	El Salvador		BAT 37
VI	Danli B	Honduras	1191	A 21
	San Andres A	El Salvador		BAT 41 BAT 202
VII	La Concordia	Nicaragua	557	BAT 41
	Fort Collins	USA		BAT 202
	Matagalpa	Nicaragua		BAT 896

Frequency among three best

<u>Line</u>	<u>Frequency</u>	<u>Line</u>	<u>Frequency</u>
A 21	5	BAT 202	3
A 40	4	BAT 41	2
BAT 37	4	M 92	2
		BAT 896	

Table 53 Groups of sites where yields of small white-seeded lines tested ranked similarly 1980 IBYAN

Group	Site	Country	Average yield of group	Three best materials in group
I	La Molina A	Peru	398	W 126 A 48 Ex Rico 23
II	Metan Caisan	Argentina Panama	1237	BAT 482 W 126 BAT 338
III	Chillan	Chile	2295	78-0374 BAT 338 Ex Rico 23
IV	Potchefstroom Chincha	Rep South Africa Peru	1857	BAT 338 2W-33-2 A 48
V	Santiago Rousse	Chile Bulgaria	1592	Ex Rico 23 78-0374 BAT 482
VI	Graneros Palмира B	Chile Colombia	2870	BAT 482 Ex Rico 23 78-0374
VII	Bega Fort Collins	Libia USA	1330	BAT 1061 BAT 338 A 48
VIII	Popayan B Palмира A Popayan A	Colombia Colombia Colombia	1675	78-0374 BAT 482 BAT 1061

Frequency among three best

<u>Line</u>	<u>Frequency</u>	<u>Line</u>	<u>Frequency</u>
Ex Rico 23	4	A 48	3
BAT 338	4	BAT 1061	2
BAT 482	4	W 126	2
78-0374	4	2W-33-2	1



Table 54 Groups of site where yields of cream-seeded lines tested ranked similarly 1980 IBYAN

Group	Site	Country	Average yield of group	Three best materials in group
I	Chapeco A Palmira A Palmira E	Brazil Colombia Colombia	2016	BAT 85 BAT 477 BAT 336
II	Lavras Linhares	Brazil Brazil	719	CENA 164-1 BAT 477 BAT 332
III	Graneros Rousse Fort Collins	Chile Bulgaria USA	1834	BAT 477 BAT 85 BAT 331
IV	Ponte Nova Potchefstroom	Brazil Rep South Africa	1937	BAT 160 A 51 BAT 85
V	Santiago	Chile	1948	BAT 874 IAPAR-RAI 54 BAT 331
VI	Popayan B Popayan A	Colombia Colombia	1553	Carioca CENA 164-1 BAT 561

Frequency among three best

<u>Line</u>	<u>Frequency</u>	<u>Line</u>	<u>Frequency</u>
BAT 85	3	BAT 336	1
BAT 477	3	BAT 332	1
BAT 331	2	BAT 160	1
CENA 164-1	2	BAT 874	1
		BAT 561-A 51	1
		Carioca	1

among farmers who use the newer chemical Benomyl This finding is consistent with the results from the 1980 trials which also showed that yields are depressed by about one-half ton by poor control of diseases the most important of which is anthracnose

The highest yield this year was obtained from an introduced variety E 1056 which also performed well in the 1980 trials Line E 1056 yielded 2063 kg/ha without any chemical control of anthracnose It yielded significantly more than the farmers variety in the absence

of chemical control of anthracnose and it yielded more than the local variety with chemicals although this difference was not significant. Thus line E 1056 appears to have good disease resistance yielding as much without fungicides as it does when fungicide is applied. This variety also has a more even distribution of pods from the bottom to the top of the plant than does the local variety and it is less vigorous. These two characteristics should reduce problems of lodging when E 1056 is grown at a higher plant density.

This variety is also noteworthy for having been found by local bean merchants to be of an acceptable seed color and size for the local market although it would sell for an estimated price discount of 12%-18% due to its flatter shape. As shown in Table 55 E 1056 earns about the same per hectare net income as the local variety while the return on variable cash costs of production rises from 6.5 to 7.0 pesos due to the cost savings resulting from reduced fumigation.

For the first time in these trials inoculation with Rhizobium at the farm level appears to offer promise as a possible substitute for nitrogenous fertilizers. In the absence of any nitrogen amendments inoculation of the local bean variety with a mixture of Rhizobium strains obtained yields that were not significantly different from a farmer's technology treatment in which 20 kg/ha of chemical nitrogen and 2 t/ha of chicken manure were applied. Substitution for nitrogen fertilizers by a Rhizobium inoculant would reduce total cash costs of production by 34% while the net return per peso invested would rise from 5.6 to 7.7 pesos making it a highly attractive investment to farmers.

The results of this year's farm-level technology validation trials provide some preliminary favorable evidence on the behavior of potentially promising technologies that improve profitability while actually reducing input costs over current levels. While these results need to be verified in subsequent farm trials it appears that progress is being made with improved disease resistance and Rhizobium inoculation in the context of bean varieties of acceptable market characteristics.

#### Seed Distribution

The Bean Program has cooperated with the Seed Unit in seed production. With the completion of the Unit's new facility it is now possible to multiply larger quantities of the new lines than was possible in the past. Table 56 gives information on the bean lines and quantity of seed sent to various countries in 1981.

The Bean Program collaborates closely with the Seed Unit including monitoring for the presence of insects and diseases during seed production. Breeders in the program also check fields to verify that they are true to type and in accordance with the description developed for the line.

Table 55 Economic comparisons of various farm trial treatments in beans in the Antioquian region 1981

	Farmers technology	Farmers seed (no N chem organic with inoculation)	Farmers technology (with Benomyl)	Seed E 1056 (no Benomyl)
Bean yield (kg/ha)	1013	1435	1638	2063
Gross revenue (Col \$/ha)	86 105	121 975	139 230	144 410
Total costs (Col \$)	53 653	49 133	57 844	57 770
Cash costs (Col \$)	18 853	14 083	21 244	20 570
Net return/ha cash	67 252	107 892	117 786	123 840
Net return/cash cost (Col \$)	3 6	7 7	5 6	6 0

Table 56 Bean seed sent to cooperators by the Seed Unit

Line or variety	Seed color	Quantity (kg)	Country
BAT 76	Black	500	Argentina
BAT 261	Black	250	Argentina
BAT 271	Black	150	Argentina
		50	Honduras
		10	Dominican Republic
BAT 448	Black	350	Argentina
		50	Peru
ICTA-Quetzal	Black	430	Argentina
ICTA Jutiapan	Black	325	Nicaragua
Talamanca (ICA Col 10103)	Black	225	Nicaragua
ICA Pijao	Black	1500	Cuba
		500	Honduras
		100	Nicaragua
Revolucion 79 (BAT 41)	Black	3400	Nicaragua
Bayito INIAP (Brazil 2)	Black	150	Ecuador

The seed-multiplication program at CIAT is not a substitute for the breeder or basic seed-production responsibility of the national programs. Each national program is encouraged to develop and improve its own seed-production capability as rapidly as possible. However through the present seed-production activity at CIAT it is possible for programs to obtain enough seed for more extensive farm trials and more rapid multiplication of promising material than would have been possible otherwise.