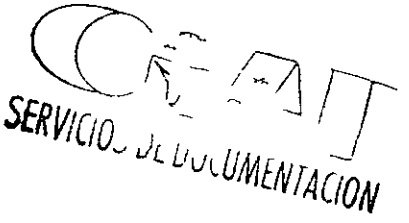
Progeny Evaluation in Uniform Nurseries



VEF Bean Team Nursery

The Bean Team Nursery (Vivero del Equipo de Frijol VEF) is composed of advanced coded CIAT hybrid lines from various breeding projects as well as lines from the germplasm bank and lines submitted by national programs It is the first uniform and multidisciplinary evaluation for adaptation and disease and insect resistance Selected materials proceed subsequently to the Preliminary Yield Trial (EP) and ultimately to the International Bean Yield and Adaptation Nursery (IBYAN) Due to the progressive nature of evaluation materials selected from the 1980 VEF will appear in the 1981 EP

The VEF nursery has as its principal objectives 1) the evaluation of multiple factor lines for overall agronomic merit 2) the evaluation of specific character lines to determine their value as parents in crosses and 3) the assessment of annual progress for specific factors and in the recombination/reselection of multiple traits Since the inauguration of the VEF trial in 1978 several modifications have made the comparison of years (and thereby the measurement of progress) difficult a) a shift from germplasm collections to hybrid lines and from predominantly black seeded entries towards an array of most commercially acceptable colors b) an increasing frequency of climbing bean entries c) the establishment of resistance to BCMV as a VEF precondition for nearly all entries d) changes in the rating scales used by disciplines and e) the search for a group of standard check varieties that would remain constant from year to year Efforts are underway to better standardize data taking and to facilitate comparisons meanwhile several results from the 1980 VEF merit special mention

- The distribution of bush and climbing bean entries grouped according to grain type and reaction to bean common mosaic virus (BCMV) is summarized in Table 1 An ever increasing number of larger seeded mottled types which are more difficult to classify for BCMV reaction increased the frequency of BCMV susceptible lines as compared to 1979 results This was especially true for climbers

- Among the bush bean entries 16% showed resistant rust reactions and another 20% were intermediate Advances were also made in the climbers over 1979 results (see Tables 2 and 3)

Table 1 Number of bush and climbing bean entries in the 1980 Bean Team Nursery (VEF) showing different reactions to bean common mosaic virus (BCMV)

Source and grain type	BCMV Reaction			Total
	Resistant	Variable	Susceptible	
CIAT hybrid lines				
Small blacks	33 (97.1)	1 (2.9)	0	34 (8.7)
Small red	54 (94.7)	2 (3.5)	1 (1.8)	57 (14.6)
Small other colors	192 (92.8)	11 (5.3)	4 (1.9)	207 (52.9)
Medium and large	47 (71.2)	7 (10.6)	12 (18.2)	66 (16.9)
Natural population	9 (75.0)	0	3 (25.0)	12 (3.1)
Check line	14 (93.3)	0	1 (6.7)	15 (3.9)
Total	349 (89.3)	21 (5.4)	21 (5.4)	391 (100)
Climbing bean	34 (21.3)	39 (24.4)	87 (54.4)	160 (100)

Percentage within each grain type

I bl 2 N mb d p p rt f b h b t the 1980 VEF d g to th re ct t d se se a d t p t

R t g	*Emp*	R t	C mm b t al bl ght	A th	A g l l f p t
R t t		63 (15 9)	44 (11 1)	114 (30 2)	366 (95 6)
T l t	12 (3 1)				
I t m d t	41 (10 3)	80 (20 2)	96 (24 2)	104 (27 6)	6 (1 6)
S pt bl	344 (86 7)	254 (64 0)	257 (64 7)	159 (42 2)	11 (2 9)
N d t labl				20	14
A g	4 5	3 6	3 7	3 3	1 1

l g h h d g p
Sc b d l l l mm h ghl 5 h ghly p bl

I bl 3 N mb d p p rt f l mb g be t the 1980 VEF cc d g t th re tio t d sease d t p t

R t g	*Emp*	R t	C mm ba t l bl ght	A th	A g l l f p t
R t t		51 (31 9)	0 (0)	69 (44 8)	63 (39 6)
T l t	2 (1 3)				
I te m d t	4 (2 5)	29 (18 1)	6 (3 8)	33 (21 4)	40 (25 2)
Su cept bl	154 (96 3)	80 (50 0)	154 (96 2)	52 (33 8)	56 (35 2)
N d ta l bl				6	1
A g sc	4 8	3 2	4 4	2 9	2 8

l g h t d g p
S b sed l l l mm h ghly ta 5—h ghly p bl

T bl 4 C mp f b l f om th CIAT ba t l bl ght b d g p oject a d th l s f t t th d the 1980 B Te m N rse y (VEF)

S	N of l	Bact ri l bl ght at g (N)				A ag t g
		2	3	4	5	
B d g p j t	71	35 (49 3)	29 (40 8)	7 (9 9)	0	2 6
Oth t	465	17 (3 6)	70 (15 1)	260 (55 9)	118 (25 4)	4 0

R g sc l l mm 2 ta 3 m dia 4 sc p ble d 5 highly cep bl
P tag h h p gr p

- The overall frequency of entries resistant and in termediate to anthracnose jumped to 34% and 24% respectively a significant advance from 1979 results

- Common bacterial blight results were especially en couraging in the 1980 VEF where 71 lines from the blight breeding project (BAC code) were compared to 465 other climbing and bush bean lines (Table 4) One half of the selected lines showed resistance in this trial compared to only 4% among all other entries The overall frequency of resistant lines for bush bean entries in the 1980 VEF was 11% representing an enormous gain over results from the past two years

- Resistance to the leafhopper *Empoasca kraemeri* is very difficult to compare between years due to large fluctuations in population levels The 1980 VEF trial was however subjected to the highest pressure ever as evidenced by the visual damage rating of variety ICA Tui (Table 5) used as a common check since 1978 The freque ncy of lines equal to or superior to ICA Tui was greatest in 1980 However the frequency of black seeded entries which tend to be more resistant to *Empoasca* was greater in 1978 Results this year were particularly exciting considering the low frequency of black entries and the very heavy pressure The value of the refined selection methods in the third cycle of intermating and selection for *Empoasca* resistance discussed in the previous section were clearly supported by results of the 1980 VEF The mean reading (visual score) for *Empoasca* resistant selections in the 1980 VEF was 3 2 while the score for all other entries was 4 6

T bl 5 F qu y l d m ge sco e t th i th pp *(Emp k m)* b h be th e Bea Team N y (VEF) t l mp d t sco fth t m d t h k ty ICA I

V sual	No of entr es with VEF t al		
	1978	1979	1980
Le tha ICA T	222 (15 3)	33 (6 2)	47 (12 0)
Equal t ICA T	88 (6 0)	71 (13 3)	7 (1 8)
G t th ICA I	1149 (78 7)	429 (80 5)	337 (86 2)
T tal	1459	533	391
Bl k seed d m t l	636 (43 6)	100 (18 8)	46 (11 8)

A g sc f ICA I 3 2 (1978) 2 2(1979) 3 8 (1980)
P g t ll h y

- The frequency of lines combining important traits also increased in the 1980 VEF For example 103 entries combine resistance to BCMV and anthracnose with non black grain color factors neccesary for acceptability in Africa

- The increased number of hybrid selections among climbing bean entries in the 1980 VEF resulted in greater resistance to anthracnose and rust for that group (Table 3)

- Among climbing bean types resistance to *Empoasca* and common bacterial is only important for small seeded black and red varieties for Central America

FP Preliminary Yield Trials

The 1980 Preliminary Yield Trials (Ensayos Preliminares E) consisted of 105 lines selected from 594 evaluated in the 1979 VEF Of these six were obtained from national programs three from the CIAT germplasm bank and the remainder were produced by CIAT before June 1979

The 91 bush materials and 14 climbers were grouped into seven classes based on their grain types Table 6 shows growth habits and grain types for all tested materials

l bl 6 G wth h b t f d g g p luat d the 1980 P l m ry I l (EP) f b

G a typ	G wth hab t					T t l
	I	II	III	IV	V riabl	
Sm ll bl k	0	23	3	8	1	35
Sm ll d	0	3	3	0	0	6
Sm ll m	0	7	3	2	0	12
Sm ll wh t	0	6	2	0	0	8
Sm ll th l	2	15	4	2	0	23
Small bl	0	4	1	0	0	5
M d m d l g	3	5	4	2	2	16
t t l	5	63	20	14	3	105

All entries were evaluated by Bean Program scientists at several locations within Colombia and in Costa Rica (web blight) in the United States (by Dr F Bliss of the University of Wisconsin for seed protein) in the Netherlands (by Dr Drijfhout at the Institute for Plant Breeding for races of anthracnose not found locally) and in Tanzania (by Ms Anatolia Mpunami for bean fly)

Screening for reactions to disease and insect pests was done in the field screenhouse and/or glasshouse Field nurseries for common bacterial blight rust anthracnose and angular leaf spot were inoculated with a mixture of isolates of the pathogens collected from previous nurseries grown at the same location

Data on web blight (Costa Rica) powdery mildew white leaf spot leafhopper tropical mite and bean fly (in Tanzania) were obtained from natural occurrences in the fields

Resistance to Diseases and Insect Pests

All EP entries were required to be resistant to the Florida and NY 15 strains of BCMV Also all materials were resistant to at least one additional disease or insect pest The frequency of materials with resistance to first and second priority diseases and insect pests is given in Tables 7 and 8 respectively

A total of 68 materials out of 105 evaluated possessed resistance to two or more diseases and insect pests besides resistance to BCMV Some of these combinations for bush beans with commercial grain types are given in Table 9

Table 7 F qu y f mate al t t d te m d t t f tp rnty d ease d se t pe t e al t d the 1980 P l m y l l (EP) f b

Be typ	Rust		A gula le f p t		A th se		C mm bacte ial bl ght		Leafh ppe	T tal l t d
	R	l	R	l	R	l	R	l	l	
Bush										
Small bl k	2	5	3	6	0	0	0	1	1	27
Sm ll d	0	0	0	1	0	0	0	1	0	6
Sm ll m	0	1	0	3	0	0	0	2	2	10
Small wh t	0	3	1	1	0	0	0	1	0	8
Sm ll th col	0	4	0	9	1	0	0	4	1	21
Small a abl	0	0	3	0	0	0	0	1	1	5
M d m d l g	1	4	1	3	1	0	1	4	0	14
Climbe										
Bl k	0	2	0	0	0	1	0	0	0	8
Oth l	0	0	0	0	3	0	0	0	3	6
T t l	3	19	8	23	5	1	1	14	8	105

All m l t d b mm m sa R l m d

T bl 8 F q y f m t l t t d t med te t c d pri rity d se se d t pe ts luated th 1980 l l m y l l (LP) f b

Be typ	H l bl ght	Wh te leaf sp t		P wd ry m ldew		W b bl ght		T p cal m t	Be fly d m g		T t l luated
	l	R	l	R	l	R	l	l	1 5%	9 15%	
B sh											
Sm ll bl k	21	0	2	4	3	0	1	12	7	8	27
Sm ll ed	4	0	0	2	1	0	1	4	2	2	6
Small m	4	0	2	1	3	0	1	5	4	6	10
Sm ll wh t	5	0	0	0	2	0	5	5	1	1	8
Sm ll th l	10	5	4	3	1	0	2	7	10	10	21
Sm ll n ble	1	0	0	0	1	0	1	1	1	4	5
M d m d l g	5	7	1	0	1	1	1	7	6	6	14
Cl mb rs											
Bl k	8	8	0	0	1	0	3	3	5	3	8
Oth l	3	6	0	0	3	0	0	4	2	2	6
T tal	61	26	9	10	16	1	15	48	38	42	105

All m tal ta t be mm m sa ru R l med

T bl 9 E p m t l b h b l f mm l g typ b d th q d BCMV t h w g mb t f t t tw m f t s

C typ	ld t l t	F t b t
S ll bl k	BA l 148 BA l 451 BA l 91 BA l 527 BA l 871 BA l 910	A g l l f p t R t *E f* l wd n ld w A g l l f p t
S ll	BA l 966	A g l l f p t C b t l bl ght *F f*
	A 51	A g l l f p t l d y m ld w

C typ	ld t l t	F t mb t
M d d	BA l 841	C mm b t l bl ght A th
M d b m ttled	BA l 1105	C m b t l bl ght l wd y m ld w
M d tl d	BA l 79	A g l l f p t R t

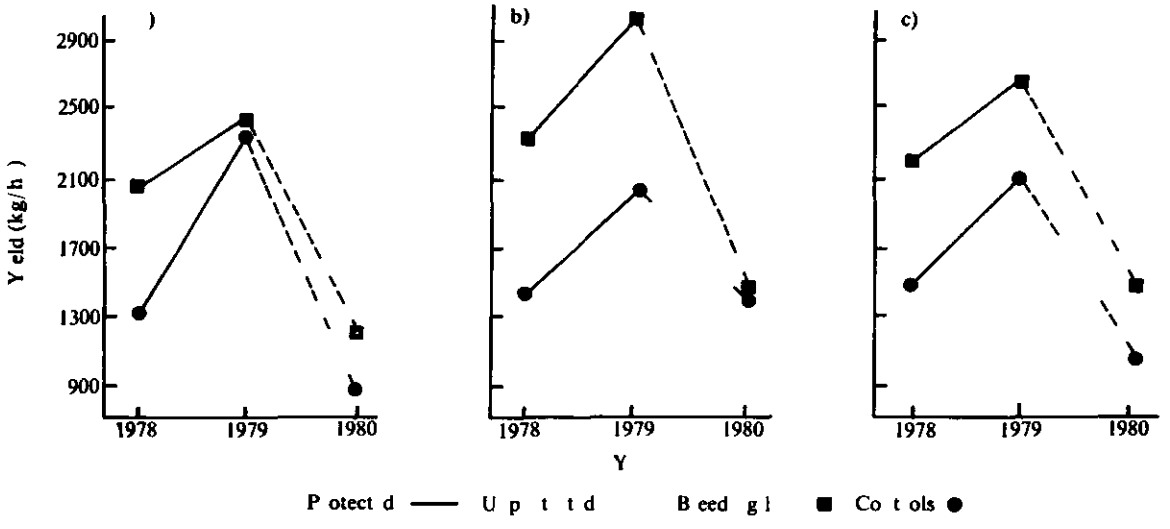
Yield Trials

The trial at CIAT Palmira was not protected against disease or insect attack At Popayan both a protected and an unprotected trial were grown During the crop cycle severe attacks of tropical mite and powdery mildew occurred at CIAT Palmira and Popayan respectively in unprotected fields Since resistance to either constraint is not sought in the breeding program few materials showed resistance

Bush bean yield trials

All entries were placed into nine groups according to their seed colors and growth habit Each group was compared to the same checks as last year plus inter national checks and elite checks (the best performing materials from the 1979 EP)

All EP trials were conducted under moderate fertiliza tion in order to select materials under conditions close to those of the small farmer At CIAT Palmira 200 kg/ha of 14 14 14 fertilizer were applied primarily to neutralize the effect of decomposing sugarcane bagasse incorporated three months before planting to improve the physical structure of the field At Popayan 1000 kg/ha of 10-30 10 fertilizer and 4 t/ha of lime were broadcast These applications were needed to obtain a reasonable yield at the Popayan site which is not a bean growing area due to the high Al and Mn toxicity and the high P fixing capacity of the soil



F gure 1 *Yield patte ns of the 10 b t b eeding lin of th e ol g up in th 1980 Pr l m na y Tr ls (EP), und unp t t d nd t ns t CIAT Palmir nd mp ed to p ot t d t als n p e us y a) R d d d b) Bl k d d) Oth r c l*

CIAT Palmira trials Figure 1 (above) shows yield comparisons between the best breeding lines and controls during the three years of EP trials The 1978 and 1979 trials were heavily fertilized and protected while this year the trial was unprotected and grown under lower soil fertility

Moreover this year all lines evaluated in the EP nurseries were much closer to commercial color requirements so that some high yielding ones with non commercial colors had been eliminated before entering the EP Nevertheless all breeding lines in all seed color groups outyielded the controls

Only four red breeding lines entered the EP trials and three of them outyielded the best control and the average of the elite checks (Table 10) The ten best black breeding materials under unprotected conditions outyielded the controls but not significantly (Table 11)

The largest yield difference between the breeding lines and controls was in the colored group The ten best breeding lines outyielded the control by 500 kg/ha despite some controls being famous varieties such as Carioca and Aroana (Table 12) Yields of the elite checks were far below last year results but higher than the controls except for the black seeded entries

Tabl 10 Y eld f ed ded b h b t t d th 1980 P lm y T l (EP) t CIAT Palm d p t t d d t

ld t f u	C th h b t	DPM	Y ld (kg/h)
Breeding m t ials			
A 40	II	80	1398
BAT 896	II	80	1253
BAT 37	III	81	1180
BAT 995	III	84	681
M			1128
C t ol ar t			
F ty D y	II	80	1097
N h l	III	78	1004
ICA G l	I	80	908
H l 141 652		80	874
S g l	I	80	865
R j 011	III	81	811
Dia l C l ma	I	80	740
DI M D ph l g l y I l k			

ld t f t	C th l b t	DPM	Y ld (kg h)
G 0687	I	78	624
Z 2	III	84	583
M			834
El te h k			
ICA L 4	I	80	954
BAT 41	II	77	1269
A 21	II	80	1247
M			1157
M f 4 b d g m te l			1128
CV ( )			17 5
L S D (0 05)			321

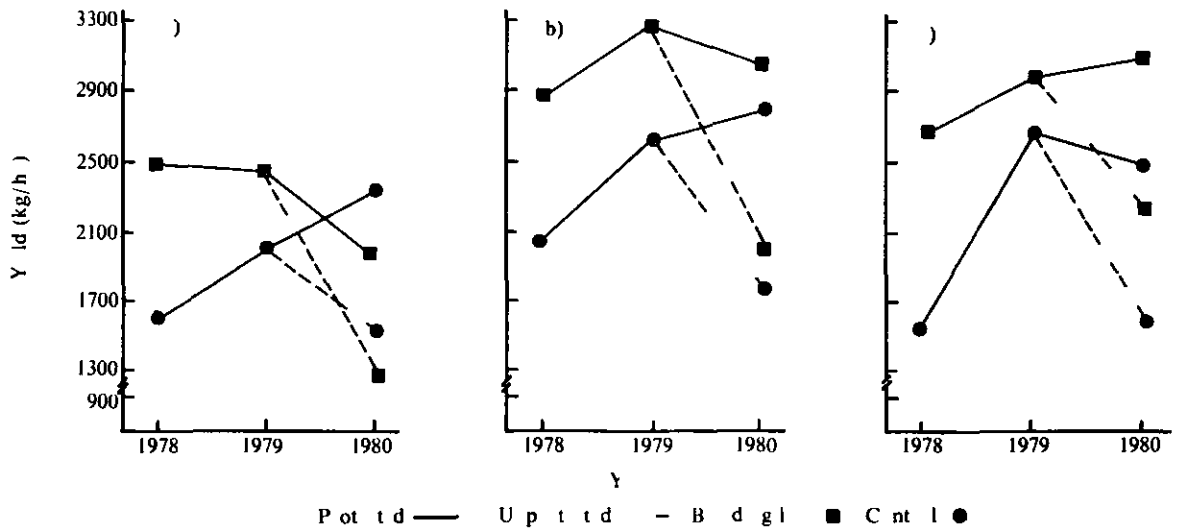
T bl 11 Y ld f t t d g bl k d d bu h be te ted th 1980 P lm y I l (EP) t CIAT P lm d p t t d d t

ld t f t	G wth h b t	DI M	Y eld (kg/ha)
B eed g mat ials			
BAT 1057	II	80	1734
BAT 913	II	80	1617
BAT 873	III	84	1562
BAT 910	II	80	1527
BAT 945	II	80	1520
BAT 832	II	80	1498
BAT 589	II	80	1394
BAT 871	II	80	1388
G 0489 1 CM	II	80	1386
G 3658	II	80	1385
M			1501
C ntr l ti s			
P ll S t t	II	80	1678
J m p	II	80	1644
ICA P J	II	80	1581
G 2959	III	84	1521
ICA T	II	80	1472
G 2005	III	84	1468
Igua	II	80	1397
G 3607	III	84	1327
R T b j	II	80	1292
P bl 152	III	84	1084
M a			1446
El t hecks			
BAT 261	II	80	1601
BAT 448	II	80	1427
BAT 76	II	80	1201
M a			1410
M t 27 bre d g mat l			1390
CV (%)			14 8
L S D (0 05)			349
DI M d pl l g l l t l h k			

T bl 12 Y ld f t t d g l d b h be t t d th 1980 P lm n y T al (EP) t CIAT P lm a u d p t t d d t

ld t f cat	Growth hab t	DPM	Y ld (kg/h)
B eeding m ter l			
A 51	II	80	1783
BAT 794	III	81	1755
BAT 874	II	80	1739
IAPAR RAI 54	II	80	1734
BAT 947	III	84	1587
G 6520	III	84	1478
BAT 936	II	80	1464
BAT 331	II	80	1425
A 48	II	80	1424
BAT 805	II	80	1411
Mea			1580
C nt ol ar eties			
C	III	84	1502
E R 23	II	80	1303
G 4421	II	80	1300
Nep Bay 22 C 286	II	80	1224
A na	II	80	1206
B l 343	III	84	1141
B l 2	I	80	1106
Sw d h B w	I	80	693
N p 2	II		415
M			1099
Elite checks			
Ca ca	III	84	1549
BAT 93	II	80	1339
BAT 332	II	80	1132
M			1340
M f 61 b d g mat l			1161
CV (%)			18 7
L S D (0 05)			378
DPM d y t phy l g l m ty l t t l h k			

Popayan trials Figure 2 shows yield differences between the best breeding lines and their controls at Popayan for three years under protected and unprotected conditions Yield differences between the 10 best black and colored breeding materials and their respective controls were maintained Yields of red breeding lines have tended to decrease and in 1980 the controls outyielded the breeding lines Several red seeded controls produced very



F gu e 2 *Y ld p tt ns f th 10 b tb d ng l n of thr lo g up n th 1980 P l m y T l (EP) nd p ot t d and unp t t d nd t ns t P p y n, nd mp d t p t t d t ls p) R d ded b) Bl k e d d) Oth colo*

Tabl 13 Y eld f ed d d b h b s te ted th 1980 P l m ry T l (EP) t P p y d p otect d a d p tected co d t ns

ld t f cat	G wth h b t	P t t d d t		Unp t t d d t n		Y ld loss
		DPM	Y eld (kg/h)	DPM	Y ld (kg/ha)	(%)
Breeding materi ls						
BAT 995	II	105	1536	93	1390	10
A 40	II	100	2626	86	1356	48
BAT 37	III	90	1665	86	1297	22
BAT 896	III	105	2004	92	1022	49
Mea			1958		1266	
Control arieties						
Zamo a o 2	III	95	2725	86	2268	17
R j 011	III	100	2536	86	1821	29
Sang T	I	90	2138	86	1699	21
N h izal	III	90	1896	86	1614	15
D acol Cal m	I	90	2680	86	1349	50
ICA Gu I	I	91	2767	86	1333	52
G 0687	I	90	2720	86	1294	52
Hu la 141-652	II	105	2394	86	1211	49
F rty Days	II	90	2105	86	1146	46
Mea			2440		1514	
Elit hecks						
A 21	II	97	2782	86	2074	25
BAT 91	II	90	3008	86	1954	37
ICA L 24	I	90	2351	86	1064	55
Mea			2714		1697	
Mea f 4 b d g m t l			1958		1266	
CV (%)			10 2		7 8	
L S D (0 05)			421		234	

DPM d y phy l g l m y l l h k

high yields as they are well adapted to Popayan conditions (Table 13) since the red breeding lines were selected at CIAT Palmira they were poorly adapted at Popayan

The mean of the 10 best black breeding lines was 300 kg/ha more than the control average under both protected and unprotected conditions (Table 14) The greatest yield increase in the EP trials this year was obtained in the colored seed groups the best breeding lines as a group outyielded controls by more than 600 kg/ha under protected and unprotected conditions (Table 15)

The elite checks were superior to the 10 best 1980 breeding lines in the red seeded materials but were inferior in the black seed group both under protected and unprotected conditions In the colored seed group the elite checks outyielded the controls but not the breeding lines

Comparing the 10 best breeding lines or accessions across all seed colors a few including BAT 873 BAT 871 BAT 936 BAT 874 and G 6520 were represented in both locations This suggests that EP trials should be tested more than one semester in several locations to obtain better information on yield performance of the breeding materials The growth cycle in unprotected plots at Popayan was 10 14 days less than in the protected field (Tables 13 14 and 15) Powdery mildew *(Erysiphae polygoni* DC ex Merat) apparently reduced yield by

T ble 14 Y ld f utsta d g ola k b sh bea tested n the 1980 Pr l m ry Trial (EP) t P p y de p te t d d p t t d co d t ons

P tected d t s				U p ot ct d d n ns			
Id t f cat	G owth hab t	D y to phys l g cal maturity	Yield (kg/ha)	Id tif cat o	G owth hab t	D ys to phys olog cal m t ty	Y ld (kg/ha)
Breeding materials							
BAT 1056	II	105	3173	BAT 527	II	87	2627
BAT 1057	II	105	3171	**BAT 1037**	II	90	2175
BAT 235	II	105	3105	BAT 804	II	95	2109
BAT 137	II	105	3099	BAT 873	III	86	2079
BAT 1037	II	105	3045	BAT 906	II	93	1975
BAT 910	II	105	3058	BAT 832	III	90	1944
G 4489 1 CM	II	105	304	**BAT 871**	III	95	1905
BAT 589	II	105	3024	BAT 912	II	89	1890
BAT 871	II	105	3019	P t 132	II	93	1875
BAT 913	II	105	2978	**BAT 1056**	II	90	1848
Mean			3071				2043
Control varieties							
Pu bla 152	II	105	3207			90	2365
G 3607	III	105	2921			92	1946
G 2005	III	100	2397			90	1930
R o T baj	II	105	2837			95	1847
J mapa	II	105	2798			90	1803
G 2959	III	105	2808			87	1755
Igua	II	105	2912			87	1385
ICA T	II	105	2499			89	1373
ICA Pijao	II	105	2502			95	1280
P rill S t t	II	105	2627			95	1204
Mean			2751				1689
Elite hecks							
BAT 448	II	105	2830			95	1465
BAT 76	II	105	2459			92	1455
BAT 261	II	105	2438			90	1207
M a			2576				1375
Mea f 27 b eeding m t rial t ted			2879				1800
CV (%)			13 5				11 6
L S D (0 05)			0658				356

M t l b ldf ce yp p f rmed w ll d both p ected d p tected co d u l rna nal heck

Tabl 15 Y ld f t t d g l d b h bea t t d th 1980 P l m nary Trial (EP) t Popaya der p t t d d p t t d d t n

	P t t d d t			U p t t d d t n			
Ide t ficat	Growth h b t	D ys t phy l gical m t ty	Y ld (kg/ha)	ld t f cat	G wth h b t	D y t phys l g cal mat rity	Y eld (kg/ha)
Breedng m terials							
BAT 1088	II	105	3304	G 6520	III	89	2569
BAT 799	II	101	3249	BAT 936	II	93	2557
BAT 838	II	105	3200	**BAT 839**	III	95	2257
BAT 331	II	105	3126	**BAT 799**	II	90	2233
BAT 477	III	105	3105	BAT 1105	II	93	2179
BAT 792	II	96	3097	BAT 337	III	87	2174
BAT 839	III	105	3081	**BAT 838**	II	95	2142
BAT 1061	II	105	3002	**BAT 874**	II	95	2066
BAT 874	II	105	3002	CENA 164-2	III	87	2063
BAT 947	III	101	2945	BAT 1127	III	93	2044
M an			3111				2217
Control arieties							
C rioc	III	105	3219			89	2365
N p Bay 22 C 286	II	105	2139			93	1905
G 4421	II	105	2503			90	1831
Brazil 2	I	90	2413			89	1539
A oana	II	105	2861			89	1503
Brazil 343	III	105	2662			95	1359
Swedish B ow	I	90	2467			86	1251
Ex R co 23	II	105	1438			86	827
Mea			2463				1573
Elite cbecks							
Carioca	III	105	3002			87	2329
BAT 332	II	105	2908			95	1364
BAT 93	II	101	2468			86	1355
Mean			2793				1633
Mea f 59 breed g mate ials test d			2547				1739 14 6
CV (%)			12 1				423
L S D (0 05)			546				

M rial b ldf ce ype pe f rmed well d b h p cted nd p ec ed d l rnat nal heck

T bl 16 S l t d b h bea mat ial that perf rm d w ll und b th p t t d d pr tected nd ti th 1980 P l m y T ial (EP) t Popayan

ld t f cat	S d ol	Y ld (kg/ha)		Y ld (%)
		P t ted	U p ot cted	
Carioca	C m m ttl d	2905	2673	8 0
G 6520	C m	2763	2569	7 0
BAT 527	Bla k	2691	2627	2 4
BAT 1113	B w	2310	2105	8 9
BAT 1129	B w	2228	2025	9 1
Mea		2579	2400	7 t

shortening the plant growth cycle especially the period between flowering and physiological maturity While powdery mildew reduced yields up to 65% in some lines and in most of the controls some materials (Table 16) showed an insignificant yield loss They could be used as parental sources if this disease becomes more important

Climbing bean trials

The 14 climbing bean entries and three controls were grown separately from the bush beans because of different plant density spacing and their artificial support system Results for all trials are shown in Table 17

T bl 17 Y eld f mb g bean b d g m t rial th 1980 P lm y l l (EP) t tw l at o s u de p t ct d d p t t d d t

ld t f cat	Y ld (kg/h)		
	U p t ct d d t s		P tected co dit
	At CIAT P lm a	At P paya	At P p ya
Breeding m t ls			
V 7936	1862	2366	2622
V 7939	1640	2035	2723
V 7923	1610	2308	2510
V 7944	1591	1963	2733
V 7945	1457	1979	2040
V 7955	1425	1441	2382
V 7917	1415	2617	3123
V 7920	1244	2999	3240
V 7921	1210	1668	2617
V 7913	1189	1339	1588
V 7918	1148	2750	3206
V 7959	1073	2157	2738
V 7949	983	2345	2919
V 799	769	1965	2370
M	1330	2138	2629
Cont ol lines			
G 2006	2245	1732	2518
G 2525	1664	1789	2144
G 2258	1581	2446	3135
Mea	1830	1989	2599
CV (%)	16	12	12
L S D (0 05)	388	400	545

The average yield of the breeding lines was lower than controls at CIAT Palmira whereas at Popayan the breeding lines were slightly better than their controls under both protected and unprotected conditions

All breeding lines in the climber group had commercial seed colors Improvement of the climbing materials may be slower than that of bush beans because only one to two generations can be harvested per year whereas in bush beans three gen rations can be evaluated per year

Adaptation of EP Lines

Bush beans were generally better adapted than climbing beans in the 1980 EP Good yielders at CIAT Palmira often performed well at Popayan or vice versa but in climbing beans good yielders at CIAT Palmira often performed poorly at Popayan This suggests that like the bush bean situation more locations are needed for conducting EP trials with climbing beans

IBYAN International Bean Yield and Adaptation Nursery

The 1979 International Bean Yield and Adaptation Nursery (IBYAN) was the first since testing began in 1976 comprising lines selected through the sequential evalua tion system developed by the Bean Program VEF EP IBYAN

Bush Beans

Selected materials were tested in two trials one for black seeded lines only and the other formed of lines with all other seed colors A total of 157 trials were distributed to 33 countries Distribution was as follows 140 nursery sets within Latin America 13 in Africa 1 in Asia and 3 sets in other regions As for the end of October 1980 data had been received from 64 trials

Black-seeded trials Fifteen black seeded lines were selected from the 1979 EP to be compared in the IBYAN with three international checks and three local checks at each location

Table 18 shows the results obtained in two seasons at CIAT Palmira and Popayan

In both trials at CIAT Palmira the line BAT 271 was outstanding and BAT 140 also performed consistently

Results at Popayan seemed to indicate the existence of a location x genotype interaction since with the exception of BAT 179 BAT 240 BAT 448 and BAT 518 the most outstanding lines at each location were different even in the different seasons

Conditions in both Popayan and CIAT Palmira during the 1979B semester were more favorable than in 1980A Under favorable conditions the experimental lines showed a net superiority over ICA Pijao one of the best adapted materials in the Cauca Valley

Under moisture stress and heavy attack by diseases as ocurred in 1980A differences between the best experimen tal lines and the local variety were slight

Figure 3 shows the behavior of materials tested in Popayan with and without disease control Although yields of lines were strongly reduced by diseases principally powdery mildew reductions were proportionate in all varieties so that the best and the worst lines remained the same under both methods of management

Tabl 18 A e age y elds of th f be t bl k-s ed d bu h b eed g mat ri l te ted n th 1979 l t nat nal Bean Y ld nd Adaptat n Nu sery (1BYAN) each of tw emest s t tw locat o s

	T l t CIAT P lm				l l t P p ya			
	S me te 1979B		Semest 1980A		S m t 1979B		Semeste 1980A	
Id t f t	Y ld g wth y le (kg/ha)		Id tif cat	Y eld a g wth y l (kg/ha)	Ide t f t	Y ld g wth y le (kg/ha)	Ide t f t	Y ld a gr wth y l (kg/ha)
B eeding m t l								
BAT 271	4737 77	(148)	BAT 271	2732-69 a (142)	BAT 261	3131 100 a (164)	BAT 518	2454-94 (118)
BAT 179	4050 73 abc	(126)	DOR 15	2056-67 bc (106)	BAT 76	2912 102 ab (152)	BAT 445	2415 99 b (116)
BAT 64	3911 74 b d	(122)	BAT 518	2025 70 bcd (105)	BAT 450	2894 100 b (152)	BAT 240	2282 98 abc (110)
BAT 140	3711 75 bcde	(116)	BAT 140	2005 73 bcd (104)	BAT 448	2878 100 b (151)	BAT 179	2274 95 b (109)
BAT 448	3659 74 b d	(112)	BAT 240	1993 72 bcd (103)	BAT 518	2722 99 b (143)	BAT 450	2260 96 ab (109)
Best loc l heck								
ICA P J	3200 69 bcd	(100)	ICA Pijao	1928-67 bcd (100)	ICA P J	1909 93 e (100)	ICA P jao	2078 94 cdef (100)
Best nternatio al h k								
J m p	3174 71 cde	(99)	Po rill S ntét co	1928-67 bcd (99)	Jamapa	2654 96 b d (139)	J m pa	2183 94 ab d (105)
Best elite ch k								
BAT 15	4071 71 b	(127)	BAT 7	2279 70 b (118)	BAT 15	2634 100 bcd (138)	BAT 15	2394 98 b (115)
M	3526			1813		2385		2125
CV (%)	12 6			20 8		11 2		6 9

V l h d ff l g f ca tly d ff h 5% l l d gt D ca M lt pl R g T t
H g t h hyph d y phy l g l m t ty
V l p th p g y ld mp d t h l l h k

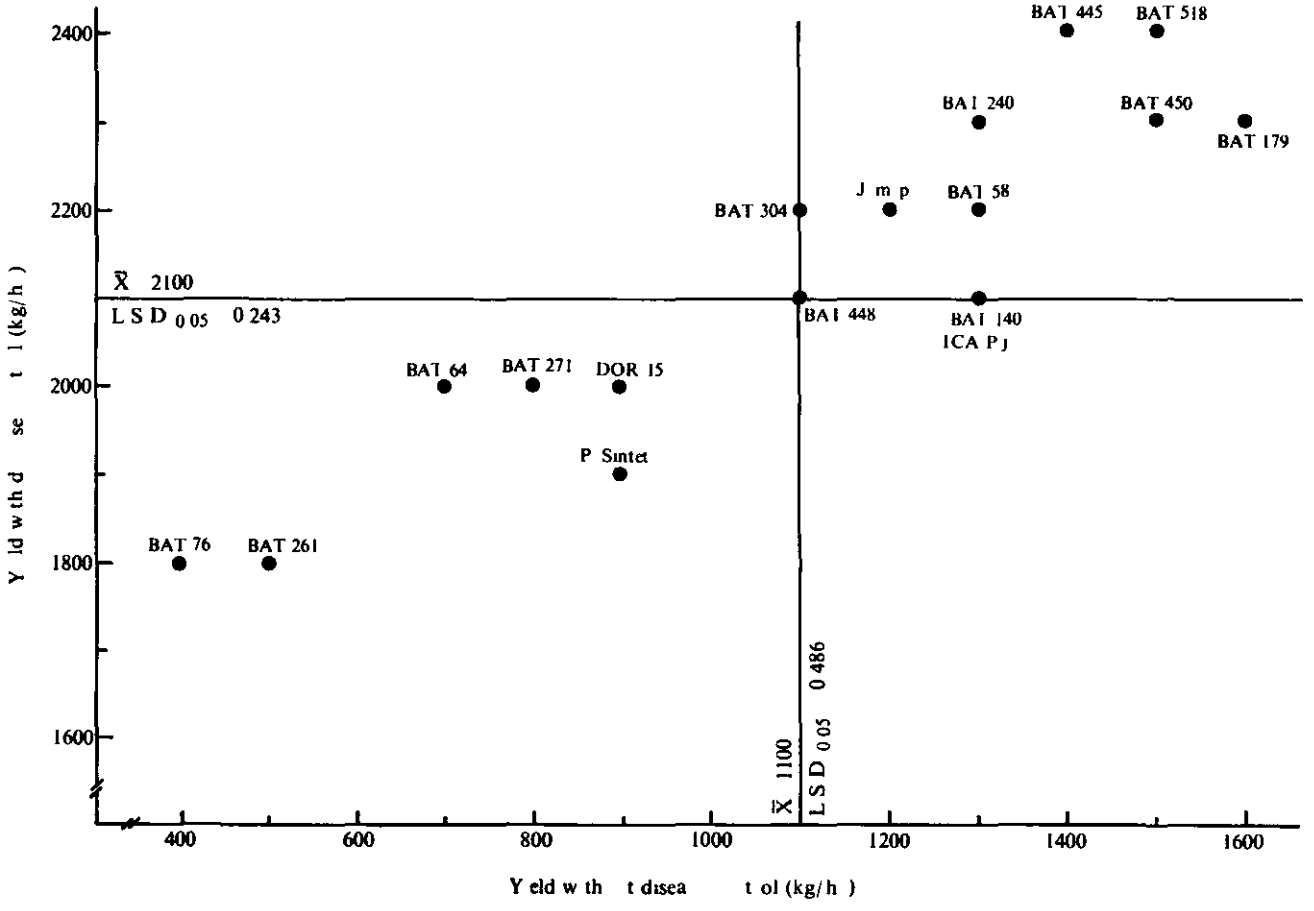


Fig 3 *Yield performance of black seeded materials in the 1979 International Bean Yield and Adaptation Nursery (IBYAN) with and without protection against powdery mildew in 1980A*

Results from some trials outside of Colombia demonstrated the wide adaptation of some materials like BAT 304 which performed well in Brazil Chile Costa Rica Cuba the Dominican Republic El Salvador and Venezuela Others were more specifically adapted for example BAT 240 in Venezuela Line BAT 445 behaved consistently in three locations of Brazil BAT 304 BAT 58 and Jamapa all performed consistently in two locations in Chile

Other seed colors Twenty five lines with seed of various colors were selected from the 1979 EP and tested together with a line from ICA three international checks and three local checks Table 19 shows the results obtained in CIAT Palmira and Popayan during two planting seasons

With the exception of BAT 317 the best lines in the two seasons at CIAT Palmira were different As was the case with the black seeded beans results in Popayan showed an environment x genotype interaction Only Carioca BAT 561 and to a lesser extent BAT 614 behaved with any consistency in both locations and seasons

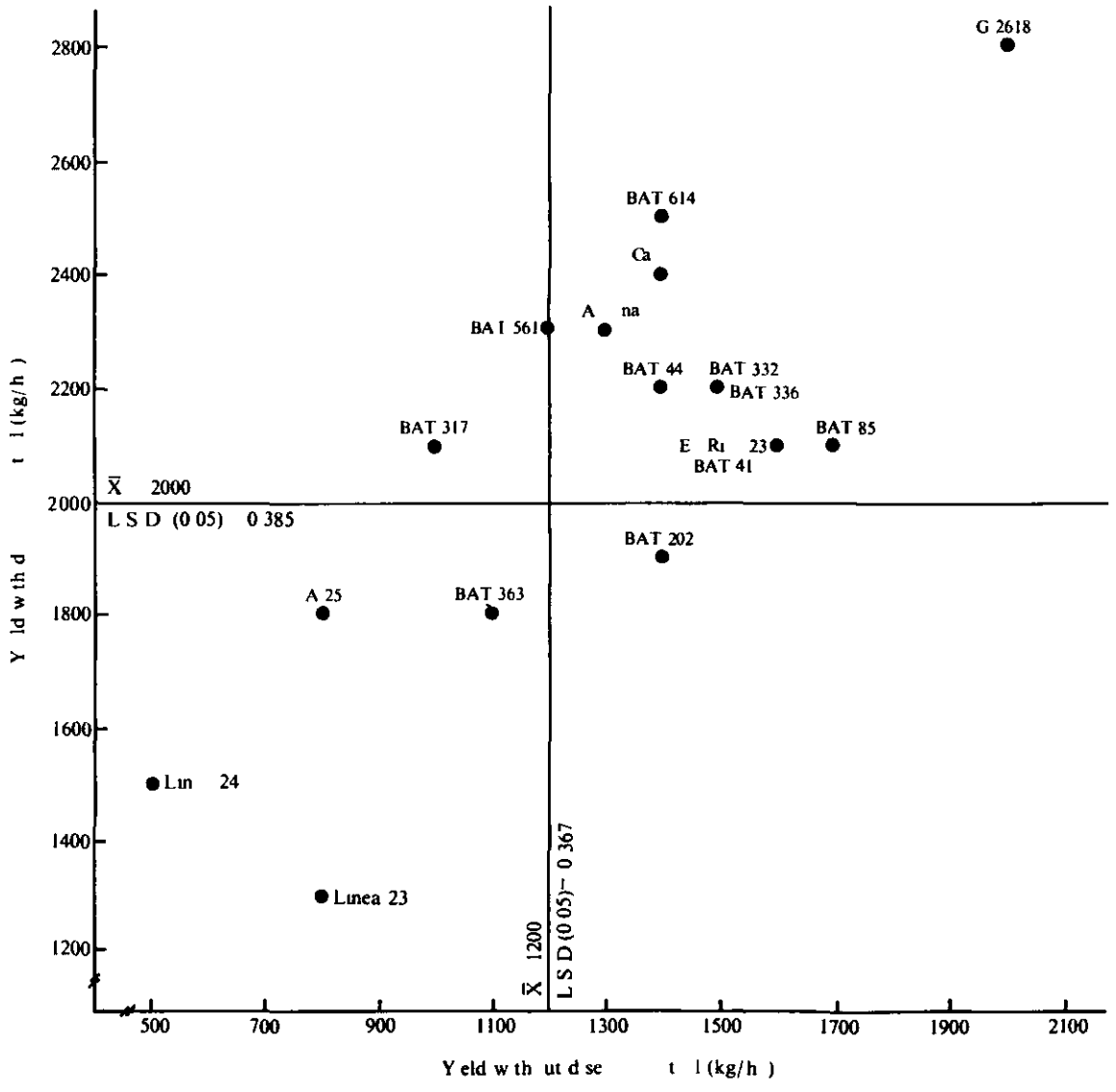
Using the international check Ex Rico 23 as a reference the superiority of the lines tested becomes evident particularly under low stress conditions like those prevailing in CIAT Palmira Figure 4 shows the behavior of those lines differing significantly from the general average at Popayan with and without disease control Although the prevalent disease was only powdery mildew still the best varieties in the protected and unprotected trials were the same ones Only G 2618 however maintained its position under both conditions

Lines BAT 85 BAT 41 BAT 332 BAT 336 BAT 44 and G 2618 together with Ex Rico 23 suffered the least yield reduction from powdery mildew

Tabl 19 A r g y elds of the f e be t l d bush breeding mat rials tested n the 1979 Inte national Bean Yield a d Adaptation Nur e y (IBYAN) in each of two semesters at two locat o

	T l t CIAT Palm				Trn l t Popaya			
	Semeste 1979B		Semester 1980A		Semester 1979B		Semeste 1980A	
Id t f at	Y ld a growth cycle (kg/ha)		Id tif cation	Y eld in a gr wth cycle (kg/ha)	Ide tification	Y eld a growth cycl (kg/ha)	Ide t fi t o	Y eld a g wth cicle (kg/ha)
Breeding mate rials								
BAT 85 (creme)	4611 75	(192)	Car oca (creme striped)	2511 72 a (146)	Ca oca (crem st ped)	2990-103 a (121)	G 2618 (c eme)	2803 96 a (143)
BAT 336 (m)	4150-72 b	(173)	BAT 317 (b wn mottled)	2506-67 a (146)	BAT 561 (m)	2911 100 a (118)	BAT 614 (ariable)	2485 93 ab (126)
BAT 419 (b w m ttl d)	3964-74 bc	(166)	A 21 (ed)	2462 70 ab (144)	BAT 93 (yell w)	2837 98 ab (115)	Carioca (brown striped)	2448 99 abc (125)
BAT 317 (b w)	3920 71 bcd	(164)	BAT 614 (a able)	2322-64 bc (136)	A 25 (b own m ttled)	2791 100 ab (113)	BAT 561 (brown)	2315 100 bcd (119)
BAT 340 (wh te)	3802 75 bcde	(159)	BAT 561 (creme)	2300-69 abcd (134)	EMP 28 (me)	2780 99 ab (113)	Aroa a (b ow)	2267 95 bcde (115)
Best local check								
D l Cal m	2395-69 g	(100)	D a l Cal ma	1714-66 f (100)	D a ol Cal ma	2468 93 abc (100)	D acol Cal ma	1964- 93 d f (100)
Best ntern tional check								
B s l 2	3615-69 cd f	(151)	E R co 23	2006-66 cdef (117)	E Rico 23	1876-97 d (76)	E Rico 23	2108 94 bcdef (107)
Best lite heck								
BAT 21	3382 71 bcde	(141)	BAT 21	2354-67 abc (137)	BAT 1188	2976-100 (121)	BAT 21	2018 93 def (103)
Mea	3323			2054		2286		2032
CV (%)	9 5			9 0		15 8		11 6

V l w th d ff l g f ly d ff re t t th 5%l l cc rd g t D M l pl R g T t
H g t h hyph d y phy l g cal m ty
V l p h p t g y ld mp d th l l heck



F gu e 4 *Yield p f m f ol d m t ls th 1979 Int rn t l Be Yield nd Ad pt tio Nu y (IBYAN) w th nd th t p t t on g inst dis a e t Pop y n 1980A*

Results from 16 locations in 12 countries besides Colombia showed the variety Carioca and the lines BAT 85 BAT 561 all creme seeded to be the most outstanding in most sites

Climbing Beans

International trials of climbing beans commenced in August 1978 Climbing beans have historically received less breeding attention than bush beans and are normally more sensitive to photoperiod and more specifically adapted to temperature Testing in the IBYAN represents the first attempt to study and broaden adaptability in climbing beans

Trials are designed for planting in association or relay with maize or in monoculture depending on local custom Three grain types — small blacks small reds and other colors — were tested In the second IBYAN for climbing beans the third category was redefined as large grains of the Andean and Mexican types principally for adaptation to cool highlands conditions

Tabl 20 P l m y re lts of nternational trial with cl mb ng beans through Septembe 1980

Gra typ	Tr al l cat	System	Y eld (kg/ha)			Days t flower ng		
			Test lines		Control ariety	Test lines		Cont ol ar ety
			Mean	Be t		Mea	Be t	
1978-79 IBYAN								
Bla k	Ch ll Ch le	A	878	1053	925	51	48	49
Black	Ch maltenango Guatemala	R	330	845	1813	52	53	78
Bla k	Ch m lt na go Guatemala	R	581	1187	1928	52	52	70
Red	Mai ana Bol v a	A	658	1158	772			
R d	San l d o Costa R ca	M	2638	3417	3333	37	35	36
Red	B enos A res Costa R ca	A	876	1350	748			
Oth l	La Pl t a Ch le	A	728	1774	1574	39	43	36
Othe colo s	Cajabamba Peru	A	988	1751	395	63	64	114
Oth r olo	Carhuaz Pe u	A	243	594	190	81	82	83
Oth l s	Sa t ago Nayarit M o	A	217	380	230	41	43	40
Mea			814	1351	1191	52	53	63
1979-80 IBYAN								
Black	Alaju la Costa Rica	M	2077	2333	1988			
Bla k	P lm ra Colombia	A	566	860	686	41	42	41
Black	La Haban Cuba	M	1805	2481	2022	44	39	49
Red	D nl Hondu as	M	961	1281	875	41	41	43
Red	Alajuela Co ta R ca	M	1545	1919	1418			
Red	P lm a Colomb a	A	626	765	794	39	38	41
Red	La Habana Cuba	M	2499	2756	2293	40	41	41
Red	Caj bamba P ru	A	288	685	391	65	64	117
Red	Co o c B l via	A	1541	2191	1350	52	41	145
La ge g a	Rio Neg o Col mb a	R	900	1327	903	72	73	67
La ge gra s	Santa Catal a Ecuador	M	2714	4167	2469	71	64	72
La ge gra	Cajab mb Peru	A	758	1145	691	81	81	98
M			1357	1826	1323	55	52	71

A A t w h maiz R rel y wi h ma M m oc lt

In the 1978 79 IBYAN all materials distributed were from the germplasm bank they consisted of nine black lines (13 trials) nine reds (16 trials) and 24 lines of other colors (13 trials) The first CIAT bredding lines entered the 1979 80 trials Materials distributed included two germ plasm and seven breeding lines of small blacks (21 trials) seven and two lines respectively of small reds (40 trials) and seven and two lines of large seeded materials (8 trials) Preliminary results of the two sets of tests are shown in Table 20

In the 1978 79 series the average gain in yield from the best variety over the local control was slight (13%) The principal improvement over local controls was in earliness —reflected by days to flowering— especially in the highlands of Peru and Guatemala

In the 1979 80 trials yield improvement of the best variety over the local control averaged 38% and was again combined with earliness particularly for the highland areas Some of the first breeding lines in these trials were promising

Appendix A

Description of *Phaseolus vulgaris* L Growth Habits

Type I Determinate growth habit reproductive terminals on the main stem with no further node production on the main stem after flowering commences

Type II Indeterminate growth habit vegetative terminals on the main stem with node production on the main stem after flowering commences erect branches borne on the lower nodes of the main stem erect with relatively compact canopy variable guide development depending on environmental conditions and genotype

Type IIIa Indeterminate growth habit vegetative terminals on the main stem with node production on the main stem after flowering; relatively heavily branched with variable number of facultatively climbing branches borne on the lower nodes variable main stem guide development but generally showing climbing ability

Type IIIb Indeterminate growth habit vegetative terminals on the main stem with node production on the main stem after flowering, relatively heavily branched with variable number of facultatively climbing branches borne on the lower nodes variable main stem guide development but generally showing climbing ability

Type IVa Indeterminate growth habit vegetative terminals on the main stem with heavy node production after flowering commences branches not well-developed compared to main stem development moderate climbing ability on supports and pod load carried evenly along the lenght of the plant

Type IVb Indeterminate growth habit, vegetative terminals on the main stem with heavy node production after flowering commences branches not well-developed compared to main stem development strong climbing tendency with pod load mostly borne on the upper nodes of the plant

Notes The growth habit classification has been expanded for the climbing types since the 1977 Annual Report Type III materials with some tendency to climb are now recognized as Type IIIb, and Type IV has been divided on the basis of vigor and pod distribution

The most important distinguishing features of the growth habits are as follows terminal raceme on main stem for Type I indeterminate with erect branches for Type II indeterminate with prostrate branches for Type IIIa indeterminate with semi-climbing main stem and branches for Type IIIb indeterminate with moderate climbing ability and pods distributed evenly up the plant for Type IVa indeterminate with aggressive climbing ability and pods carried mainly on the upper nodes of the plant for Type IVb

Growth habit is not necessarily a stable characteristic since changes in growth habit may occur from one location to another The classification of growth habit for a particular genotype is only useful in a defined environment particularly with regard to climbing ability

Appendix B

CIAT Accessions of *Phaseolus* Referred to in this Report

CIAT No	Identification	Local register	Source[2]
G00057	Swedish Brown	PI 136735	USA
G00076	Red Kloud		USA
G00118	Forty Days	PI 162566	USA
G00124		PI 163372	USA
G00159	Cali Fasulya	PI 165078	USA
G00489	Raytal	PI 175269	USA
G00687	Windsor Long Pod	PI 182026	USA
G01507	Ojo de Cabra	PI 281988	USA
G01820	Negro Jamapa	PI 309804	USA
G01854	Nima	PI 310512	USA
G02005		PI 310739	USA
G02006		PI 310740	USA
G02047		PI 310805	USA
G02258	Morada del Agua	PI 311904	USA
G02333	Colorado de Teopisca	PI 311998	USA
G02525	Magdalena 3	PI 313624	USA
G02618	Col No 168	PI 313755	USA
G02858	*Zacatecano*	PI 319665	USA
G02959	Pecho Amarillo	GTA-014	GTA
G03353	Puebla 152		MEX
G03607	C C G B-44	I-462	VNZ
G03645	Jamapa	I-810	VNZ
G03652	Puebla 152	I-820	VNZ
G03658	Mexico 27N	I-867	VNZ
G03776	Venezuela 2	I 1062	VNZ
G03807	Brasil 2 Pico de Oro	I 1098	VNZ
G03834	51051	I 1138	VNZ
G03942	Michelite	B-33	CRA
G04000	NEP Bayo 22	C 286	CRA
G04122	S 166-A N	N 555	CRA
G04393	Tlaxcala 62 C		MEX
G04421	S-630 B	C-63	CRA
G04434	Antioquia 11	P 111	CRA
G04435	Diacol Calima	P 146	CRA
G04445	Ex Rico 23		CLB
G04446	Ex Puebla 152 Brown Seeded		MEX
G04449	Pinto UI 114		USA
G04451	9 Al 2		USA

CIAT No	Identification	Local register	Source
G04452	ICA Guali		CLB
G04454	ICA Tui		CLB
G04459	NEP 2		CRA
G04460	Pompadour 2		CRA
G04470	Pompadour		DOM
G04482	Zamorano 2		HDR
G04489	Guilapa 72		GTA
G04494	Diacol Calima		CLB
G04495	Porrillo Sintetico		HDR
G04498	Sanilac		USA
G04503	Widusa		FRC
G04505	Top Crop		USA
G04523	Linea 17		CLB
G04525	Linea 32		CLB
G04727	Ancash 66		PER
G04816	Mulatinho		BZL
G04821	Iguacu (Lote 4)		BZL
G04824	Roxão		BZL
G04825	Carioca		BZL
G04830	Rio Tibagi (Lote 10)		BZL
G04978	Amanda		NLD
G05158	Bico de Ouro 1445	BZL 905	BZL
G05270	Sataya 425		MEX
G05653	Ecuador 299		ELS
G05694	Cornell 49 242		USA
G05702	Cargamanto		CLB
G05708	Sangretoro		CLB
G05743	Preto 897		ATL
G05745	Redlands Greenleaf B		ATL
G05768	Pinto No 650		USA
G05773	ICA Pijao		CLB
G05897	Flor de Mayo		MEX
G06361	Great Northern		USA
G06520	AETE 2	CA 21	UTK
G06719	Jubila		NLD
G06721	Double White		NLD
G07932	Nahuizalco Rojo		ELS
G07951	Aroana		BZL
G09446	Imuna	FRC 542	FRC
G11249	Pinto	IVT 771004	NLD
G11274	Brasil 343 Mulatinho	IVT 77039	NLD
G11488	CENA 164-2 CM CM (12 B) F5		BZL
G12631	Ancash 143		PER
G12709	Mortino	Sanudo 45	CLB
G13497	AETE 1/37		BZL
G13499	Petro 132		BZL

Ih G od I ccess is h mbe assigned t by th germpla m bank f h CIAT Genetic R sources Unit BAT A EMP BAC DOR d V odes bel g ma ial mp d by CIAT Bea Pr gram.

AIl A I BZl B I CLB C I mb CRA Cos Rica DOM D m ca R p bl ELS El Sal d FRC F GIA Gua m I HDR H d MEX M PER Peru UTK U ed Kingd m VNZ V ne uela