Validation of Technology in Farm Trials

The principal objective of the farm trials is to provide feedback to the technology generation/varietal improvement process rather than to develop specific recommendations for each micro region Moreover the collaboration with the national research and extension organization ICA is essential in this research process and is gratefully acknowledged

In farm trials there is little interest in separating input effects First the principal research problem is the profitability of the new combined treatments Can the farmer make money with the new technology? Secondly one input changes are expected to have little effect in agriculture due to the interrelated or systems nature of crop production Modifying one part of the system causes other changes For example increased density in the Antioquian region s bean production may require better disease control due to higher disease incidence an improved support system or less vigorous varieties and modifications in methods of performing the other cultural practices such as weeding and spraying

The second principal research problem in farm trial is the between farm variation of the new technology The large within treatment between farm varience generally encountered even in the same environment results from variations in microclimate disease and insect incidence initial soil fertility and cropping history and farmers management ability To stratify the farms according to the variation in economic response to the new technology treatment (s) a large sample size is sought approximately 15 farms in each environment Rather than minimize non treatment variance as in regional variety trials and most other agronomic experiments on farm trials need to analyze the sources of this variance to answer the research problem of which farm level factors are affecting the economic performance of the new technology

Farm trials reported this year were done in the Huila region (10 farms in 1980A) and in Antioquia (14 farms in 1979 A and 1980 B) and in the marginal coffee regions of Restrepo (5 farms in 1980 B) and Darien (7 farms in 1980 B) Between one fourth and one third of Colombian beans are produced in Huila and Antioquia The coffee zones are a potential production zone with the presently declining coffee price

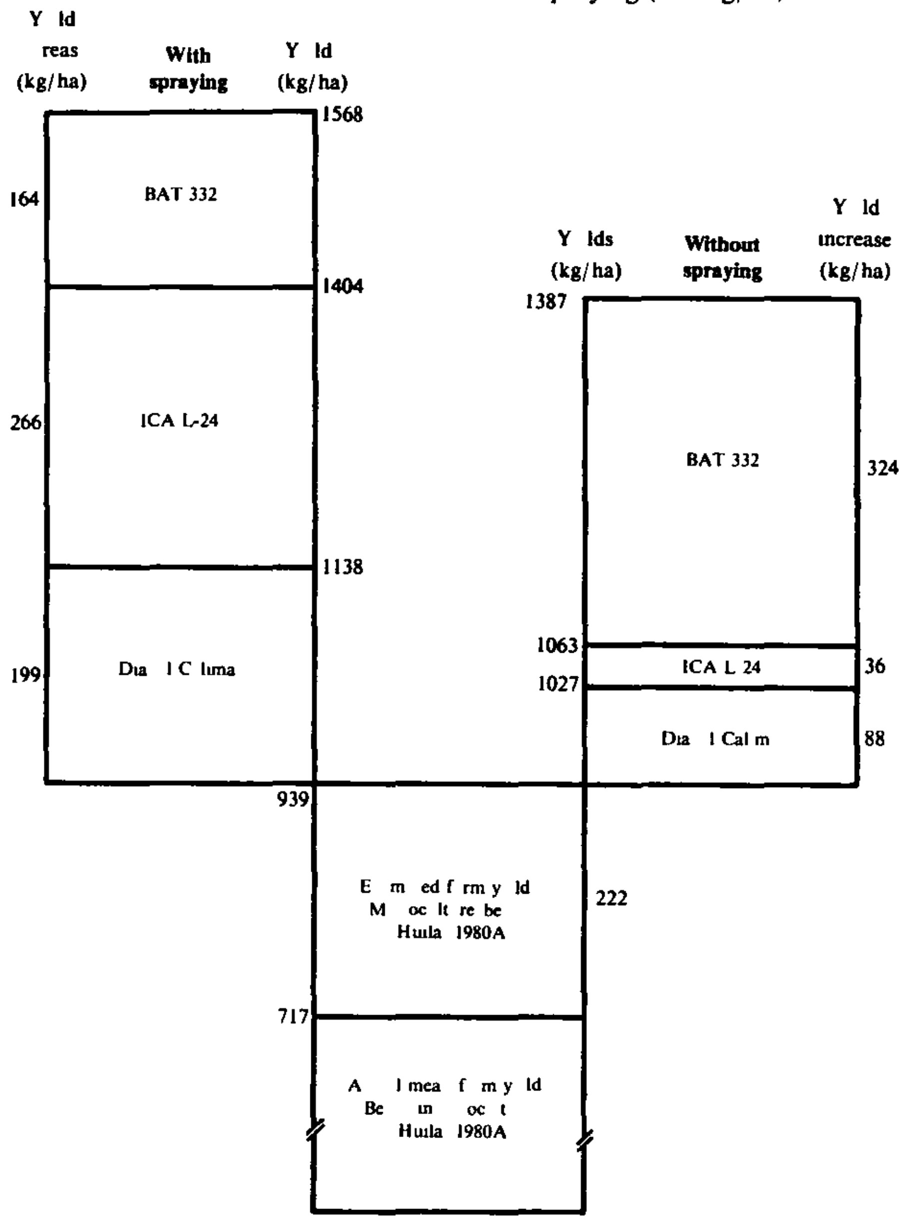
Farm Trials in Huila

In the first two years (1978 and 1979) of farm trials in Huila the principal focus was on improved agronomic practices for monoculture bean production Improved seed quality did not affect yields seed quality improvements of present commercial varieties are apparently poor substitutes for new varieties Fertilizer also gave no yield response on 80% of the farms However in monoculture systems improved agronomic practices of higher planting density and curative chemical control of diseases and insect pests increased farm yields between 31 and 50% and was highly profitable both years (CIAT Ann Rept 1978 and CIAT Bean Prog 1979 Ann Rept) In 1980 two new varieties appeared promising for farm testing after advanced trials ICA L 24 a variety from the Colombian national bean research program has resistance to bean common mosaic virus (BCMV) the first research priority in CIAT's Bean Program and has a grain type almost identical to Diacol Calima and Nima the commercial varieties of Huila farmers BAT 332 a line from CIAT's Bean Program is resistant to BCMV has moderate resistance to angular leaf spot and rust and resistance to the lambda race of anthracnose although it is susceptible to other races of that disease BAT 332 is a small creme-colored bean so is not a commercial type for Colombia Accordingly it has no market price and only yield comparisons were made in these trials However its yield performance can be utilized for partial evaluation of the disease resistance strategy of the Bean Program

In Huila as in most of tropical Latin America beans are predominantly grown in direct association with maize Improved agronomic technology identified in monoculture bean production was put into two bean maize associations featuring the improved maize Suwan 1 and the local bean variety Diacol Calima One association system had 1 m between the maize rows with one row of beans between them plant populations were 100 000/ha for beans and 50 000/ha for maize In the second association two rows of beans were planted between the maize rows which were 1 2 m apart (162 425 plants/ha for beans and 42 000 plants/ha for maize)

Previously curative spraying with a maximum of two applications to control principally anthracnose and *Empoasca* had been applied In the 1980 trials all five treatments were repeated on each farm with and without the two sprayings This provided evaluations of variety and association performance at a minimum input level as well as with the chemical treatments that were already shown to be highly profitable in previous years

Yield results of the bean monoculture systems are shown in Figure 1 Without spraying variety Calima yielded only 88 kg/ha more than the estimated farmers yields ICA L 24 with BCMV resistance had only slightly higher yields than Calima without spraying but differences were large with spraying (266 kg/ha)



Figu 1 *F m y ld f th be n tie w th nd w thout p ot t ve p y ng n the Hu la g on 1980A*

BAT 332 was very impressive without spraying yielding 324 kg/ha more than L 24 and 164 kg/ha more when both varieties were sprayed twice The improved agronomy with farmers seed high density two sprayings and herbicide which in 1978 had yielded 1 5 t/ha only yielded 1 1 t/ha in 1980 This was probably due to the heavy web blight epidemic and the lodging from high winds (see following section on Disease incidence) The improved agronomy monoculture system was still more profitable than the farmers monoculture system However ICA L 24 was more profitable than this improved agronomic check treatment either with or without spraying (Table 1)

In 1980 the farmers associated system was substantially more profitable than the improved agronomy monoculture system This performance can be principally attributed to the excellent yields from Suwan 1 maize which was about double that of the local maize yields Moreover there was a price premium for Suwan 1 apparently due to its earliness and marketing before the price decline when local maize went to market Bean yields were sharply lower in both associations compared to monoculture yields However the high maize yields more than compensated for the reduced bean yields The lower bean density in association was more profitable at the 1980 price ratio of beans to maize whereas the higher density system in association was more profitable at the price ratios of earlier years (Table 2)

The substantially reduced bean yields in association make selection of bean varieties more difficult due to the smaller yield differences nevertheless the economic analysis indicates the importance of more research on association Finally the yield advantage of BAT 332 with and without spraying validates the Bean Program s strategy placing emphasis on breeding for disease resistances if these characteristics can be put into commercial grain types

Table 1 Eco mi mparisons of n us farm trial treatments in bean m oculture in th Huila regio 1980A.

Economic ariabl	Farmers traditional pr ctices	F rm rs seed (Cal ma) with p ay ng	New vari ty (ICA L 24) w thout pray ng	w th spray ng
Bean yield (kg/ha)	939	1138	1063	1404
Gross reve e (Col $/ha)	31 580	35 920	33 110	43 460
Variable costs (Col $/ha)	14 756	18 472	15 196	19 252
Net com (Col $/ha)	16 824	17 448	17 914	24 208
Increase t ncome (Col $/ha)		624	466	6294
Increase sts (Col $/ha)		3716	3276	4056

Also includes th al f beans damaged by disease staining t harv

T bl 2 Ec nomic omparisons of arious farm trial treatm t in be mai e assoc t ons the Huila regi n 1980A

Eco m ariable	1980 price rat beans maize (2 1) Farmers trad t onal p actices	Calim beans a d S wan 1 ma e: Low be de ty	H gh be dens ty	1979 price rat o beans maize (3 1) Farm rs t ad t nal pra tices	Calima bean and S wan 1 maize: Low bean d nsity	High bea d n ty
Bea y eld (kg/ha)	717	590	731	717	590	731
Ma yi ld (kg/ha)	2660	5008	4672	2660	5008	4672
G ss re e (C l $/h)	63 050	106 840	105 857	75 035	116 440	118 097
Variabl co ts (Col $/ha)	20 920	37 232	38 292	20 920	37 232	38 292
Net me (C l $/ha)	42 130	69 608	67 565	54 115	79 208	79 805
I ase t incom (Col $/h)		27 478	2043		25 093	597
Inc ease n co ts (Col $/ha)		16 312	1060		16 312	1060

I l ded D l Cal m bea nd na ype f maize
V l w h as risk ig if ca ly diff re f m f rm rs yi ld t the 99% f d nce le l

Disease incidence The Pathology and Entomology sections of the Bean Program evaluated incidences of diseases and insects in the Huila farm trials From these observations the following equation was set up to explain yield variation between farms Yield f (N WB ALS P) where N is the number of *Empoasca* on 30 leaves WB is a severity scale for web blight ALS is a severity scale for angular leaf spot and P is a dummy variable for protected and unprotected plantings The function was estimated in both linear and semi logarithmic forms with the latter preferred for theoretical reasons and for its more consistent estimates

The intercepts of the plotted function estimate the yield potential of the three varieties in the absence of the biological constraints Diacol Calima yielded akmost 1 t/ha over protected and unprotected conditions whereas ICA L 24 yielded 1 2 t/ha (Table 3) The yield potential of BAT 332 was substantial (2 5 t/ha) However web blight also seriously affected yield of this variety

Differentiating with respect to incidence the yield effect of two levels of resistance to web blight was obtained If the average disease severity is reduced from 3 6 to 0 (on a scale of 0 5) yields of BAT 332 would increase by 1 6 t/ha If the average severity is only reduced to 1 8 yields are still increased by 840 kg/ha Web blight has a much more significant effect once the new higher yielding materials become available Clearly this disease has now been identified as an important second generation constraint in Huila

Finally holding the effects of the three principal constraints constant spraying can increase yields of BAT 332 by another 529 kg/ha Even in the presence of a high web blight infestation BAT 332 outyielded the farmers variety and the other improved variety Further substantial gains are possible if progress with web blight can be achieved

Mulching has been shown effective as a cultural control of web blight in Costa Rica In Huila two farm observations with mulching and without any chemical or fertilizer applications provided mean yields of 1 5 t/ha a net income of 27 174 Colombian pesos/ha and input costs of 18 876 pesos/ha Farm yields increased 59% and farm income increased 62% (Table 1) Since there were only two preliminary observations further farm testing of various types of mulching must be undertaken

T bl 3 Eff ts f the princ pal b log cal t t n yields of three bean ariet s the Hu la regi 1980A

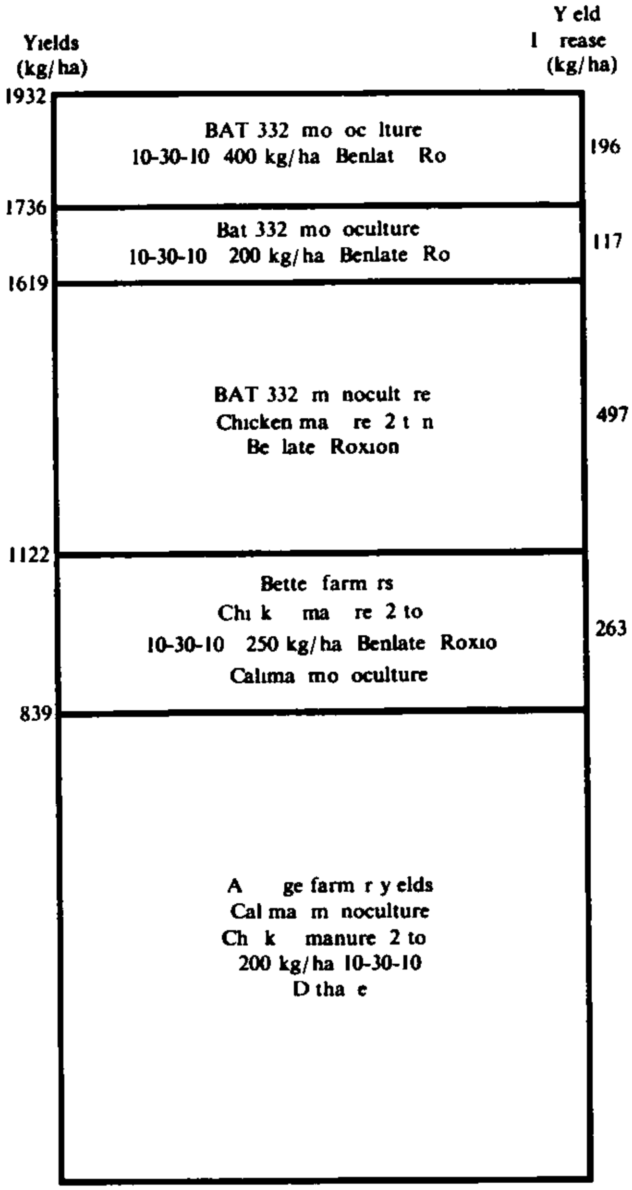
Va ty	Y eld (kg/h)					R	$\overline{R}$ ( )
	Int pt	Log			P otect on		
		Empoas ymphs	W b bl ght	A g la leaf pot			
Diacol Cal ma	983 (2 5)	29 (0 9)	45 (0 2)	133 (2 2)		0 29	0 19
ICA L 24	1190 (1 6)	-68 (1 6)	-45 (08)	48 (0 5)		0 16	0 05
BAT 332	2538 (5 7)	56 (1 3)	1210 (4 3)	78 (1 4)	529 (1 9)	0 66	0 58

( ) R h R ec ed f h d gree f freed m
V us m es f d ce w t lized h w in th ra y sea th re t m h p blem f m *Empoasca*
Bl k d g fica t ffec f m inclus f th d mmy variable hence th equat was es im ted with
V l p heses 1

Farm Trials in a Marginal Coffee Zone

Previous farm testing in Restrepo (CIAT Report 1980) indicated a dramatic yield response to increased fertiliza tion In the 1980 farm trials in two marginal coffee regions the same three varieties Calima ICA L 24 and BAT 332 were utilized as in the Huila trials Three fertilization levels were employed on each of the varieties All treatments were sprayed twice with benomyl and azodrin and improved agronomy of reasonably high density and good weed control (two weedings) was utilized The better farmers were found to be already utilizing high fertilization levels and attaining reasonably high yields at 1 1 t/ha in the prevaling mono-culture bean production system

Due to the intense rainfall,disease incidence was heavy in spite of the two sprayings especially for web blight and anthracnose and on some farms angular leaf spot rust and sclerotinia Hence diseases were the principal constraint in this production season and there was no response to increased fertilization except on BAT 332 the new variety with more resistances Yields of BAT 332 with improved agronomy and 2 t/ha of chicken manure were 1 6 t/ha and increased to 1 9 t/ha with increased fertilization (Figure 2) These absolute yields were almost identical to those of Calima in 1978 when there was much less disease pressure When conditions for these two potentially devastating diseases web blight and anthracnose are favorable the disease pressures become the principal constraint When rainfall is less (1978) or varieties with some resistances are available then there is a large response to fertilization in the marginal coffee region



F g 2 F m nd new t hnology yields in R t ep and Da ie 1980 B

Farm Trials in Antioquia

The 1979 and 1980 farm trials in the Antioquia region evaluated a) improved agronomy including different support systems (1980) b) new bean selections with anthracnose resistance and having generally less vigorous growth than the local variety Cargamanto and c) *Rhizobium* inoculation (1979)

In 1978 farmers of the region reported yields of 1 t/ha In 1979 farmers measured yields were 1 2 t/ha so that the measurement error from asking farmers their yields or harvesting their fields was only 20% The input shift from the fungicide maneb to benomyl increased yields 323 kg/ha (27%) compared with an estimated yield increase of 55% in 1978 This was a very large effect from a one input change and shows the importance of effective disease control in this case principally anthracnose

The combined effects of higher density (66 000 plants/ha from 22 000) improved disease control and artificial supports to reinforce the maize and support the very vigorous Cargamanto bean increased yields 0 5 t/ha and provided absolute yields of over 2 t/ha each of the past three years In 1980 one of the treatments utilized a higher density without artificial support and achieved a yield increase of approximately one half the 0 5 t/ha difference between the farmers system and the high-density/artificial support system (Fig 3)

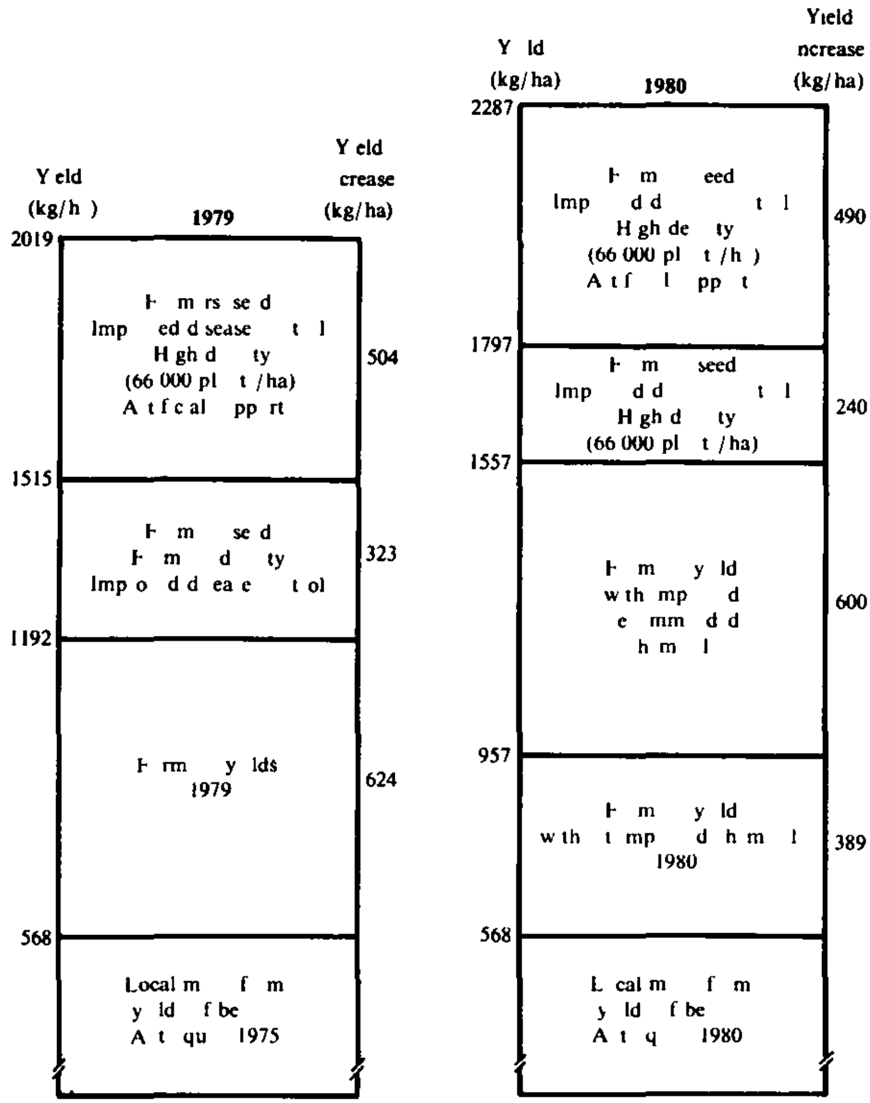


Fig 3 *Effect of different technology on bean yields in farm trials in the Antioquia region 1979 and 1980*

With promotion from the Instituto Colombiano Agropecuario (ICA) farmers in the local area are shifting from maneb to the use of benomyl The differences in yield on the farmers harvested plots with and without this input are shown in Table 4

Not all the yield difference should be attributed to the fungicide since the better farmers are expected to be the early adopters hence edaphic and management differences may also be operating Nevertheless in this small sample 40% of the farmers were following the recommended practice this year despite the higher cost of benomyl Stratifying the sample into these two groups highlights the need for a large sample size in the farm trials

From 1979 to 1980 net incomes of bean producers in the region declined sharply The cause was a price collapse for Cargamanto from 75 Colombian pesos/kg to 45 pesos/kg (Fig 4) In 1980 farmers began utilizing benomyl hence gains from the treatment (B) disappeared (A to B) The profitability of the shift in cultural practices to higher density and artificial supports with the farmers variety declined substantially in 1980 with the lower price In 1979 a shift to higher density and artificial supports (treatment C) resulted in a 1 5 peso gain in net income for each peso invested whereas in 1980 this gain declined to 0 37 pesos

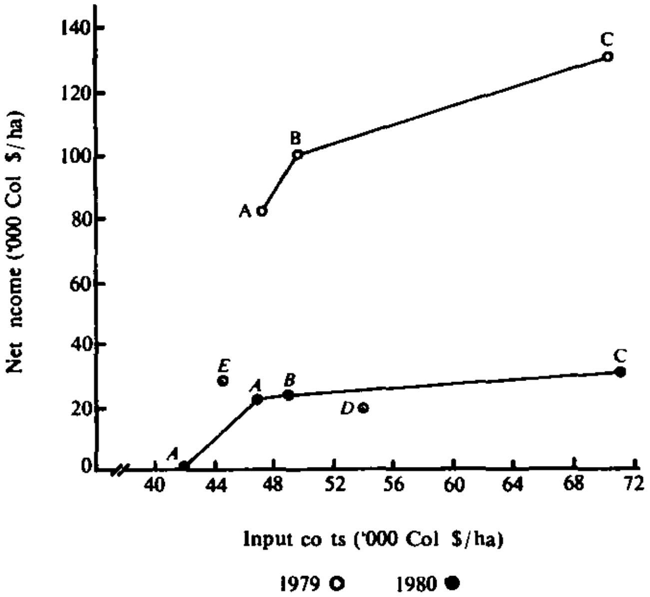
In 1980 a new variety E 1056 earned almost the same net income as the farmers variety at high density if no sprayings were neccesary but at a substantially lower cost of inputs To shift from farmers production to the new variety at high density (C to E) would involve decreased costs of 26 658 pesos with an income loss of only 2261 pesos

Clearly the new variety would be preferred over the farmers variety at the high density if it were possible to eliminate the input expenditures due to the resistance of this variety

Table 4 Y elds n farmers plot w th and with t benomyl and in the treatment w th farmers practices and impro ed chemicals n the A tioquia region, 1980B

Farm	Bean yield (kg/ha)		
	Farmers plots		E perim ntal treatments
	Farmers us g benomyl	Farmers not using be myl	Farmers pract ces d be myl
1		772	1515
2		924	1743
3		977	1968
4	934		1119
5		990	1062
6	1925		1669
7		656	1049
8		532	693
9	1729		2079
10		1365	2368
11	1421		2153
12	1413		1618
13		1446	1563
14	1921		1942
Mea	1557	957	1610
S D	381	319	485
All farm rs plot			
Mea	1215		
S D	453		

F rm rs seed and pla ng d ns y w re lized his reatm



A F m fields
A F m fields t l ng be myl
A" F m f ld th ut ben myl
B F m d d p w th b n myl
C=F m d b myl h gh dens ty (66 000 plants/h) nd t f al upp t
D Va ty E 1056 th t of h m ls
E V ty E 1056 w h ut h m l nd t s m y ld as D

Fig 4 *N t om nd inp t t f a ous new t chn logies c mp ed w th f me t hnology n the Antioquia region, 1979 d 1980 (1979 in ome nd ost we e nflated to 1980 lue fo d ct mpa is n)*

In 1979 ınoculatıon wıth *Rhızobıum* was agaın unsuccessful The contrast between yıelds ın a regıonal trıal at the La Selva experımental statıon ın Antıoquıa and farm trıal results was dramatıc (Table 5) On the experıment statıon ın monoculture wıth artıficıal supports and hıgh ınputs beans ınoculated wıth any of three *Rhızobıum* straıns outyıelded the check plot wıth added nıtrogen Puttıng the same varıety ın the same regıon ınto a relay plantıng system caused the results to be reversed for the farm trıals

Despıte usıng less fertılızer wıth the ınoculatıon treatment net ıncome was lower than wıth the nıtrogen check ın the farm trıals The Soıl Mıcrobıology sectıon contınues to work on the problems of root rots and natıve *Rhızobıum* to resolve these farm level problems As soon as they are solved ınoculatıons wıll return as a treatment to the farm trıals

Performance of new clımbıng bean selectıons ımproved substantıally from 1979 to 1980 Varıetıes were selected generally for resıstance to anthracnose and for theır reduced vıgor (compared to Cargamanto) so plantıng densıty could be ıncreased wıthout the hıgh costs of artıficıal support In the 1979 regıonal varıety trıals wıthout chemıcal protectıon all four materıals selected outyıelded Cargamanto

Tabl 5 Eff t on y ld d farm et ncome of d fferent be arıet d *Rh b um* oculatı treatment at th La Sel xp m t tat n d f rme s f ld Ant oq ıa 1979 a d 1980

Effect	Y ld (kg/h)		Farm rs et com (C l $/ha)
	At La S l a tat o	I farmer f lds	
Inoculation effects 1979			
Y ld f h k w th t g	3386	1999	87 121
A e ag yı ld w th th ee best *Rh b um* t ns	3584		
A rage y ld f oc lated t eatm ts t tw pl t g d n t es		1649	59 827
Varietal effects 1979			
F rm rs a ty (Ca gament)	1159	2183	102 373
G 5653	1635	1708	6901 (58 171) (65 770)
G 2333	1947	1075	9579 (22 671) (30 270)
Varietal effects, 1980			
F rmers ety (Ca gam t)	1159	2287	31 619
E 1056	2307	1947	20 585 (29 358)
G 4727	1793	2007	16 617 (25 390)

C gam t w t lız d h oc lat mpa ns Sta trıals sed rt f ıal pp rts d hıghe p t tha f m l All p t l ls pt ınoc lat were d calın h f rm trıals Ch mıcal f rt lıze d h k ma w re lızed th t g heck I ınoculated reatm ts P O d K O were sed t th sam l ls h mb ed h mı l d g f rtılızers
F m rs rec ed 75 C l pe os/kg f Ca gama F rm rs est mated h w mall red va ıetıes G 5653 d G 2 3 w ld 30 C l pe /kg local ma k
I m cal ula ns w re l mad t nly m ll p ce dısc t f h se es See lso foot 3
N t m re t ma ed g m nım l p ce dısc t f m 75 60 Col pes /kg
C f h w es w ree m ted ass m g pray g bea prıce f 60 Col peso /kg
Mea p ce d f C gam was 45 C l pe /kg
F rm rs m d hese la g graı ız sel ct ns w ld rece 40 (E 1056) nd 38 (E 4727) C l peso /kg
P d t f h w select ns w re reestım ted w h t osts f pray ng gaı dısease and pe s

However farmers in Antioquia commonly use fungicides With chemical protection in the farm trials the local Cargamanto outyielded both selections in 1979 and the farmers expected price discount from 75 pesos/kg to 30 pesos/kg for the smaller red seeded varieties was especially dramatic

Even at a small price discount of 75 to 60 pesos/kg and assuming it would not be necessary to spray the new variety net income would only be 64% of the income from the farmers variety at the high density Again the farm trials identified other production and economic constraints not observed in the regional variety trials The extreme vigor of Cargamanto enables it to resist early attacks of root rots and insects much better The new varieties were treated with carbofuran against early attack from nematodes but this treatment was not necessary with Cargamanto

In the 1980 farm trials yields of new varieties were much better but still below the local variety Net income was also much closer to that of the farmers practices because the price discount was only 12 5% due to the larger seed size of the new variety Were it not necessary to spray E 1056 net income from producing it would almost equal income from Cargamanto but at a substantially reduced input cost (point E in Figure 4 and Table 5)

Conclusions

The bush bean trials with the new varieties in Huila indicated that a disease resistance strategy could increase farmers yields with and without spraying Moreover with the improved maize price and the doubling of maize yields with the new variety the maize/bean association was much more profitable than any of the mono-culture systems In future trials new varieties will be put into the associated system Analysis of disease and insect incidence on these new varieties indicates the importance of the second generation problem of web blight resistance

In the coffee zone the showing of the BAT 332 variety with multiple disease resistances was impressive Only on this variety was there a response to fertilizer as disease and irregular rainfall decimated the yields of the other two Even in the marginal coffee zone with its poor soils diseases continue to be the principal constraints

In Antioquia rapid diffusion of improved control of anthracnose with benomyl is taking place Small farmers rapidly adopt new inputs which are more profitable and do not imply high input costs Another 0 5 t/ha in increased yields can be obtained with the farmers variety at higher densities with some artificial support reinforcing the maize stalks This innovation requires a large expenditure on stakes or the substitution of less vigorous varieties and some changes in cultural practices i e weeding and spraying The relative performance of new selections with respect to Cargamanto in the farm trials improved substantially from 1979 to 1980 however the absolute income performance of all the new technologies decreased drastically with the abrupt price decline of Cargamanto

Gains appear to be more rapid in climbing beans where the seed size requirement is not as difficult as in bush beans, and there has been less research in the past Previous research efforts in Colombia have had preference for large seed size

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 characteristc 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	Pecl o 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 AI 2		USA

Appe d B (ont n d)

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	Mo tino	Sañudo 45	CLB
G13497	AETE 1/37		BZL
G13499	Petro 132		BZL

Th G d I access h mbe ss gned by the ge mplasm bank f the CIAT Gene ic R so rce U BAT A EMP BAC DOR d V d bel ng ma I mp d by CIAT Bea P gram

A11 Aus ral BZL B I CLB C l mbia CRA Costa R ca DOM Dom ca R p bl ELS El Sal d FRC F ia GTA C m l HDR H d MEX M PER P UTK U ed K gd m VNZ V ne uela