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SURVEY AND EVALUATION OF WEED CONTROL RESEARCH IN COLOMBIA

SURVEY AND EVALUATION

WEED CONTROL RESEARCH IN COLOMBIA

Lane E. Coulston

August 1969

OSU/AID Contract

"Development of Weed Control in

Less Developed Countries"

OSU/AID Publication 69-8

Department of Farm Crops

Oregon State University

Corvallis, Oregon 97331

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Lane E. Coulston

SURVEY AND EVALUATION OF WEED CONTROL RESEARCH IN COLOMBIA

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SURVEY AND EVALUATION OF WEED CONTROL RESEARCH IN COLOMBIA

SUMMARY

Background

The Oregon State University/USAID project "Development of Weed Control in Less Developed Countries" is an active technical assistance program aimed at increasing basic food production through application of economical weed control practices.

During two years of operation, the program has been involved with an extensive survey of weeds in Colombia, with introduction of chemical weed control practices, with training of Colombian professional counterparts and with extension of economic practices to commercial farming.

The project is cooperating with ICA (Instituto Colombiano Agropecuario) to establish weed research programs at regional experiment stations. Activity has centered around testing of new and commercial compounds submitted by cooperating industry and with training personnel.

Due to the nature of the ICA program efforts have been concentrated on the major food crops to increase production and export potential. The current major export crops--cotton, rice, sugar cane and coffee--are supported by associations and federations which supply advanced agricultural technology.

Purpose of the Survey

The study of project economics was undertaken in the early months of 1969 to:

1. assess the herbicide potential both by products available commercially and by areas cultivated.

2. assess the economic feasibility at the farmer level of practices that have been found technically practical and recommended by ICA.

3. to give direction and help in cooperation with the technical personnel in Colombia, and plan research that will lead to determination of the most economical practices and rates of application for commercial use.

Report findings

1. Total herbicide consumption in Colombia over the past four years has increased in dollar volume from $2.5 million (1965) to $5.1 million (1968). Colombia is the largest consumer of herbicides in Latin America.

2. Use of herbicide is highly concentrated in three mainly export crops--rice, cotton and sugar cane.

3. Corn outranks all other crops in actual area planted.

4. Indications are that lack of extension programs have resulted in limited weed control and low yields in food crops such as wheat with losses due to weeds running from 28% of the crop to total loss.

5. Labor expense for hand weeding has increased and labor availability decreased.

6. Recent studies have questioned the economics of using non-traditional agricultural inputs.

7. Reliable, substantiated data from controlled research is insufficient to formulate the necessary detailed economic analyses.

8. There is need for more integrated research that considers new varieties, fertilizers, herbicides and other factors.

Recommendations

There is an urgent need to investigate and carefully assess the economics of Colombian agriculture with regard to the usage of non-traditional inputs and to also consider the broad secondary effects on the national economy.

As the OSU/USAID program progresses, increased emphasis on concurrent economic evaluation is an absolute requirement. Data needs to be collected to establish a firm basis for accurate evaluation of the overall agricultural complex.

Priority of activity for the program, as well as area emphasis, should reflect the following goals:

1. Awareness of current weed control practices and costs by both crops and regions.

2. Observe trends in availability and costs of labor as related to geographical area.

3. Identify farmer problems in weed control and crop production.

4. Record trends in herbicide consumption in all crops to determine market potential and concentration within specific crops.

5. Determine major weed species and associated control costs by both crops and regions.

These objectives are critical to understanding the total agricultural environment and evaluating the impact of introducing weed control practices. Losing sight of the important economic goals may result in lessening the value of the program.

In addition to economics specific to weed control the project needs to consider the long range needs of Colombian agriculture and the reasons for them including: concentrating resources in crops that yield foreign exchange at the expense of basic food crops; alerting officials to the broad picture as well as weed control practices; interchange of hard data between agencies; and identifying the full range of economic potentials and alternatives.

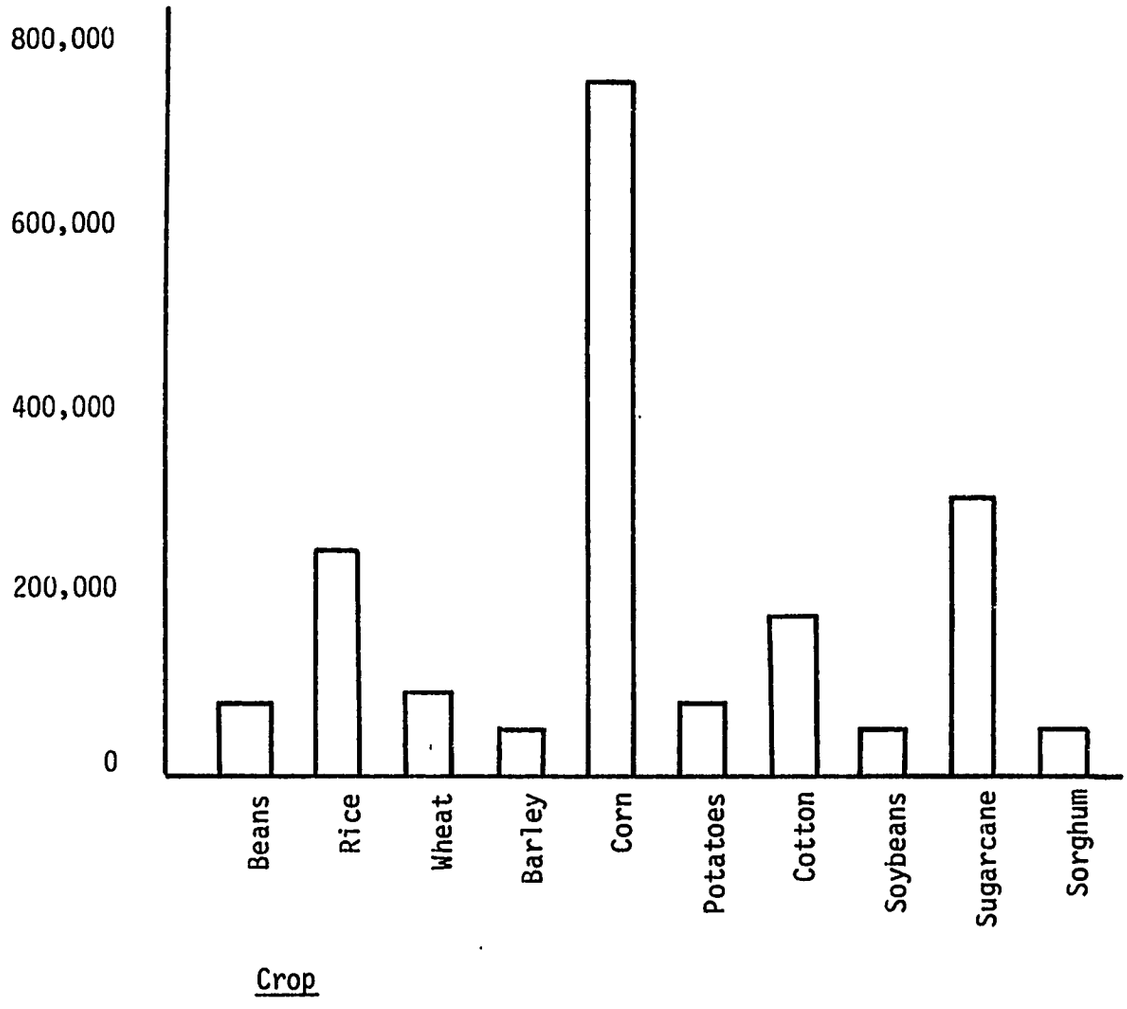
ECONOMIC SURVEY AND EVALUATION OF WEED CONTROL RESEARCH IN COLOMBIA

Research findings on selected crops in Colombia

Three major crops, rice, cotton and sugar cane are responsible for 70% of the herbicide consumption in Colombia. However, the bulk of research efforts conducted by this program are on basic food crops. The information that is lacking is the receptiveness to new weed control practices by farmers, determined by farm size and availability of capital. This information is urgently needed to determine the economic practicality of research programs in these crops.

AREA OF MAJOR CROPS IN COLOMBIA

In Hectares



Beans

Mechanical weed control practices and hand weeded fields show similar yields in research as compared to the national average, approximately 600 kg/ha. Yields, however, in the Valley (Palmira) have reached 1,000 kg/ha.

With one of the currently recommended herbicides, DNBP (Premerge and Caldon), yields can be increased by three fold. Hand or mechanical weedings are quite expensive and do not achieve the control as noted by herbicides. Approximately 15 man days are required for hand weeding.

Several new chemicals have been tried successfully, C 6313, C 3126 and C 6989. These may offer good alternatives when commercially available.

Lazo and Treflan are commercially available but not used to the extent as DNBP. Both of these herbicides are good possibilities for economic studies of alternative practices.

Beans (1968)

Area. . . . 70,000 has.
Yield . . . 571 kg/ha.
Production. 40,000 tons
*Price . . . $3,494 ton (1967)

Herbicides Currently Used	Rate kg/ha.
Treflan	1.5
DNBP	8.0

Promising Herbicides

C 6313
C 3126

Rice

Research is primarily conducted in irrigated rice in the Cauca and Tolima Valleys. National production statistics are taken with irrigated and dryland rice therefore indicating much lower yields than can be expected with irrigated rice.

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* All prices given in pesos for metric ton

Research in unfertilized trials has demonstrated yields similar to national averages. Herbicide use under these conditions can expect at best a 25% yield increase. Fertilized trials in irrigated rice give yields ranging from 7,500 kg/ha to 9,000 kg/ha with herbicides. These trials are capable of increasing yields by more than 100%.

Stam F-34 (propanil) is currently the recommended practice for either irrigated or dryland rice, with excellent control, at rates of application from 3.5-4.5 kg/ha (active ingredient). These represent from 300-400 pesos/ha material only. The phenoxies 2,4-D and 2,4,5-T are also used extensively and are considerably less expensive, however, the weed control spectrum is limited. These may also be used in combination with Stam.

Herbicide consumption in rice has increased substantially in the past several years. Estimates show 80% of the irrigated rice treated with propanil.

A new CIBA herbicide C 6989 (preforan), not yet commercial in Colombia, has demonstrated yields and weed control comparable to propanil.

Colombian statistics show that recent increases in rice production are a result of area planted and not increasing yields. At current prices for rice, the herbicide practices shown in research could be of substantial contribution to increased yields in both irrigated and dryland production.

The objectives in field research have been to compare promising new herbicides in rice. Commercial practices of 2,4-D and 2,4,5-T have not been included for comparison. Future trials should include these practices as well as C 6989, when commercially available, for economic studies of potential farmer practices.

Rice (1968)

Area. . . . 265,700 ha
Yield . . . 2,951 kg/ha
Production. 783,950 tons
Price . . . $1,914 ton (1967)

Rice

Irrigated

Herbicides Currently Used		Rate kg/ha	Yield kg/ha
Stam F-34	post	3.5	5,500
Stam F-34	late post	4.0	
2,4,5-T	post	0.75	
2,4-D	post	0.75	

Promising Herbicides

C 6989	pre	3.0	5,000
C 6989	post	4.0	

Potential for Economic Study

Stam F-34 post *vs.* C 6989 pre

2,4,5-T *vs.* 2,4-D

Dryland

Herbicides Currently Used		Rate kg/ha	Yield kg/ha
Stam F-34	post	3.5	
2,4,5-T	post	0.75	
2,4-D	post	0.75	

Promising Herbicides

C 6989	pre	4-5
C 6989	post	3-4

Potential for Economic Study

Stam F-34 *vs.* C 6989

Wheat

Wheat yields have remained low in Colombia for many years. Acreages have remained constant while there has been a great demand for imports, at times equal to domestic production levels.

Research in fertilized trials has given yields of 2,000 kg/ha with no weed control. Herbicide practices tested are capable of at least doubling these yields.

The most common herbicides practices used are linuron at 1 kg/ha, DNBP at 3.0 and 2,4-D at .75 kg/ha. Research has indicated mixtures of

linuron with 2,4-D amine and bromoxynil as potential practices with increased weed control.

Wild oats has become a serious problem in the highlands reducing yields as much as 50%. Research is currently being conducted with Avadex BW and Barban.

As is the case with many crops in Colombia, production is not increased due in part to lack of programs to extend weed control research information to the farmer level. Other factors such as capital rationing must be taken into consideration.

Wheat (1968)

Area. . . . 93,000 ha
Yield . . . 1,344 kg/ha
Production. 125,000 tons
Price . . . $1,756 ton (1967)

Herbicides Currently Used		Rate kg/ha	Yield kg/ha
linuron	pre	1.0	4,150
linuron	pre	1.5	
DNBP	post	1.5	
DNBP	pre	3.0	
2,4-D ester	post	0.75	
dinoseb	post	1.6	4,012
2,4-D amine	post	1.0	4,275
Promising Herbicides			
diuron	post	1.2	
linuron + 2,4-D amine		1.0 + 0.75	
bromoxynil	post	0.75	
linuron + bromoxynil		1.0 + 0.75	
GS 14260	post	1.5	
Promising vs. Wild Oats			
Avadex BW			
barban	post	1.0	

Barley

Colombian studies have recently shown that Colombia is in a favorable position in barley production. National yield averages have been substantiated by the research in weed control; herbicides are, however, capable of increasing yields up to 35%.

Herbicide treatments for barley are essentially the same as for wheat. The association for the development of barley PROCEBADA, has contributed substantial technical assistance in this crop.

Further research in barley, other than testing new experimental herbicides, should include economic studies with linuron and 2,4-D with possible reduction in weed control costs.

Barley (1968)

Area. . . . 46,750 ha
Yield . . . 1,600 kg/ha
Production. 74,800 tons
Price . . . $1,274 ton (1967)

Herbicides Currently Used		Rate kg/ha	Yield kg/ha
linuron	pre	1.0	4,150
linuron	pre	1.5	
DNBP	post	1.5	
DNBP	pre	3.0	
2,4-D ester		0.75	
dinoseb	post	1.6	4,012
2,4-D amine		1.0	4,275
Promising Herbicides			
diuron	post	1.2	
linuron + 2,4-D amine		1.0 + 0.75	
bromoxynil	post	0.75	
linuron + bromoxynil		1.0 + 0.75	
GS 14260	post	1.5	
Promising vs. Wild Oats			
Avadex BW			
barban	post	1.0	

Corn

This is one of the crops that has been the subject of substantial herbicide research. Yields are easily attained higher than the national average of 1,400 kg/ha. Fertilized trials with no weed control are double this average. Weed control with herbicides can reach 8,000 kg/ha and above with economical control over hand labor.

Corn in the highlands utilizes essentially the same herbicides as the hotlands, however, due to soil types and weed species, lower rates are

utilized. Corn requires eleven months for maturity and, consequently, yields in research are taken for either fresh corn (choclo) or silage.

Atrazine and 2,4-D are recommended and widely used. Combinations of atrazine with lazo, linuron, and oil have given good results.

There are many commercial herbicides available and Colombia can very easily increase production of corn for export.

Corn was chosen for an initial economic study in alternative practices. Several trials are currently being conducted to determine economic rates of atrazine alone and in combination with linuron. Hand weeding is included in these trials for comparison with herbicides on cost and yield expenses. Current hand weeding practices require two weedings of ten man days/ha.

Special research is being conducted in the hotlands in nutsedge control. This weed is extremely difficult to control and recent studies have been initiated with Sutan.

Corn (1968)

Area. . . . 775,000 ha
Yield . . . 1,097 kg/ha
Production. 845,000 tons
Price . . . $1,203 (1967)

Hotlands (Palmira, Nataima)

Herbicides Currently Used		Rate kg/ha	Yield kg/ha
atrazine	pre	2.0	7,044
DNBP	pre	6.0	
2,4-D amine	post	0.75	
Promising Herbicides			
atrazine + oil	post	2.0 + 5.0 liters	7,130
atrazine + linuron	pre	1.0 + 1.0	8,550
atrazine + Lazo	pre	1.0 + 1.5	8,075
Lazo +	pre	1.5	
2,4-D	post	0.75	

Corn (cont'd)

Promising vs. Nutsedge - Special Study

EPTC (Sutan possible)
2,4-D early post 2.0

Economic Study

atrazine pre
atrazine + oil post
2,4-D post
atrazine vs. atrazine + linuron vs. atrazine + Lazo vs. atrazine + oil

Highlands (Choclo)

Herbicides Currently Used		Rate kg/ha	Yield kg/ha
atrazine	pre	2.0	12,800
atrazine	pre	3.0	16,700
2,4-D amine	post	1.0	
DNBP	pre	3.0	

Promising Herbicides

atrazine + Lazo	pre	1.0 + 1.5	6,000
atrazine + oil	post	2.0 + 5.0 liters	20,800
linuron	pre	1.5	2,380
atrazine + linuron	pre	1.0 + 1.0	8,200

Potential for Economic Study

atrazine pre
2,4-D amine post
atrazine + linuron pre
atrazine + oil post

Potatoes

Statistics of yield compare closely with mechanical weed control practices in research in the highlands. Herbicides practices currently recommended have shown yield increases of 25%. Trials conducted in new high yield varieties have given excellent results. Practices recommended for commercial production are DNBP and linuron. A large part of the total production results from small farm operations for local consumption and herbicides are not widely used.

The major problem in herbicide acceptability in potatoes has been the cultural practices of hilling at 30 days, hand weeding is normally done

at this time. Research has indicated however that hilling at planting time is satisfactory. Hand weeding practices indicate that two weedings of 20 man days/ha are required without use of herbicides.

Potatoes (1968)

Area. . . . 85,000 ha
Yield . . . 10,588 kg/ha
Production. 900,000 tons
Price . . . $876 ton (1967)

Herbicides Currently Used		Rate kg/ha	Yield kg/ha
DNBP	pre	3.0	34,000
linuron	pre	1.0	37,000
Promising Herbicides			
C 3126 (Patoran)	pre	2.0	
prometryne	pre	2.0	

Soybeans

Soybeans is a relatively new crop in Colombia and due to a good price support, production has been increasing. Little research has been conducted as Treflan has a good market in soybeans and gives good weed control.

Soybeans (1968)

Area. . . . 50,000 ha
Yield . . . 1,700 kg/ha
Production. 85,000 tons
Price . . . $1,930 ton (1967)

Herbicides Currently Used		Rate kg/ha
Treflan	ppi	1.5
Promising Herbicides		
Planavin	ppi	3.5

Cotton

Cotton yields in the Tolima Valley and on the coast have almost doubled since 1960. Most research in cotton is conducted by the Cotton Federation, however, recently additional research has been initiated in cotton.

There are several well-established herbicide practices in Colombia. Treflan is used extensively and Cotoran, Herban, Lazo and Karmex are also sold commercially.

There are several problems in cotton research making economic evaluations difficult. Yields in experimental trials are difficult to achieve. Most herbicide practices control weeds for the first 30-40 days, at which time it becomes necessary to enter the fields with either mechanical or hand weedings.

Currently research is under way with several postemergence treatments as alternatives to hand and mechanical weeding practices.

Economic studies comparing chemical and mechanical weed control practices are needed. Competition studies in cotton are currently being carried out on a student thesis problem and will serve as a base for continued studies contributing to an economic evaluation.

In cotton areas the fee for hand weeding is 200 pesos/weeding and it requires an average of 2.5 weedings.

Cotton (1968)

Area. . . . 204,000 ha
Yield . . . 2,000 kg/ha seed
598 kg/ha fiber

Production. 265,227 tons seed
122,000 tons fiber

Price . . . $3,678 ton fiber + seed (1967)
$8,183 ton fiber (1967)

Herbicides Currently Used		Rate kg/ha
Treflan	ppi	1.5
Cotoran	pre	1.5-3.0
Herban	pre	3.5
Lazo	pre	2.0
Karmex	pre	1.2

Promising Herbicides

Herban + MSMA	post	
Herban + Karmex	post	
DSMA	post	
Planavin	ppi	1.5
Lazo + prometryne	pre	0.8

Cotton (cont'd)

Potential for Economic Study

Treflan vs. Cotoran vs. Herban
Herban pre vs. Herban + MSMA post

Sugar cane

Little research has been carried out by this program in sugar cane. Herbicide use in this crop is sharply divided by the type of enterprise.

Approximately 320,000 ha are grown for panela and 100,000 ha for commercial sugar production. Herbicide use on the latter is extensive, however, very little, if any, is utilized on sugar cane for panela. The major herbicides used commercially are diuron, 2,4-D, Herban, atrazine and TCA. There are several compounds in mixture that give good control.

The following is a table of data taken from an economic study in sugar cane in the Cauca Valley, conducted as a student thesis program. This is a good example of economic studies that could easily be initiated in many crops.

HERBICIDES IN SUGAR CANE

Thesis by Victor Calderon Delgado
Palmira, Colombia

Control Costs/ha

Treatment	Pesos	Rate
manual	750 (25/day x 10 days)	3 times
ametryne + atrazine + 2,4-D amine	1,134	2.5 kg/ha + 2.5 kg + 4 lb/ha
norea	1,130	12 lb/ha
fluometuron	1,250	5 kg
diuron	1,010	6 kg
ametryne + 2,4-D amine	860	3 kg + 4 lb/ha

Treatment	Yield	Cost	Net Return
check	9.5	0	13,600
manual	10.3	750	14,290
ametryne + atrazine + 2,4-D amine	17.4	1,134	26,686
diuron	18.2	1,010	28,250
ametryne + 2,4-D amine	18.4	860	28,760
norea	18.2	1,130	29,950
fluometuron	19.6	1,250	30,530

Treatment	Weed Control	Total Return	Return on Investment*
manual	750	18,540	24.67
ametryne + atrazine + 2,4-D amine	1,134	31,320	27.6
diuron	1,010	32,760	32.4
ametryne + 2,4-D amine	860	33,120	38.5
norea	1,130	34,580	30.6
fluometuron	1,250	35,280	28.2

---

* Return on $ investment in weed control

Note: Manual cost and yield of ametryne + 2,4-D

Sugar cane (1968)

Area. . . . 240,632 ha panela
99,880 ha sugar

Yield . . . 2,909 kg panela
6,658 kg sugar

Production. 665,000 tons sugar
700,000 tons panela

Price . . . $854 ton panela (1967)
$62.5 ton sugar (1967)

Herbicides Currently Used

diuron
2,4-D
Herban + atrazine
TCA

Promising Herbicides

terbacil
atrazine + Lazo
ametryne
ametryne + atrazine + 2,4-D
Dowpon (spot treatment)

Sorghum

Sorghum as a relatively new crop in Colombia has experienced relatively stable prices and increased production. Research with herbicides in sorghum has demonstrated yields of 2,000 kg/ha, near the national average to more than two and one-half times this yield in fertilized trials in the Tolima Valley. As a relatively new crop, there has not been sufficient research with which to make yield comparisons. There are several good herbicide treatments available for sorghum.

Sorghum (1968)

Area. . . . 45,000 ha
Yield . . . 2,222 kg/ha
Production. 100,000 tons
Price . . . $1,170 ton

Herbicides Currently Used		Rate kg/ha	Yield kg/ha
atrazine	pre	2.0	
2,4-D	post	0.75	
Herban	pre	3.5	

Sorghum (cont'd)

Promising Herbicides	Rate kg/ha
Herban + atrazine	2.0 + 1.0
propazine	2.0-4.0

Sources: 1. Production statistics taken from "Changes in Agricultural Production and Technology in Colombia". Foregin Agricultural Economics. Report No. 52.

2. Colombia Estadisticas Agropecuarias. 1966.

3. Research data from trials conducted in Colombia by Dr. Juan Cardenas and Instituto Colombiano Agropecuario.

ECONOMIC STUDIES INITIATED IN COLOMBIA

The OSU program in Colombia is interested in increasing food production with the introduction of economic weed control practices at the farmer level. As a result of rapid progress in building the fundamentals of weed control, it has become desirable to initiate trials that lend themselves to economic analysis.

In this semester, three economic trials were designed and established in corn. The following table is an example of the experimental design. This trial was selected for its simplicity in comparing two herbicides in other crops. The University of Nebraska Mission in cooperation with ICA has established a computer program to handle the analysis and the results will be made readily available in Colombia.

The economic study established in corn is as follows:

atrazine kg/ha	linuron kg/ha
0	0
0	0.6
0	1.2
0	1.5
0.6	0.3
0.6	0.6
0.6	0.9
1.2	0
1.2	0.3
1.2	0.6
1.2	0.9
1.2	1.2
1.8	0.3
1.8	0.6
1.8	0.9
2.4	0
2.4	0.6
0.3	0.3
0.3	0.6
0.3	0.9

days mechanical weeding after emergence:

10-30
15-45
15
25

Plot size 4 x 30 m, 2 replications

These trials are designed to compare mechanical hand weeded treatments with chemical application. The comparison to be made from these trials will determine the most economical mixture of atrazine and linuron as well as the comparison of the two treatments separately. All alternative practices will be compared with the mechanical treatments for economic advantage. The results, which will be made available at the completion of these trials, will give good information for recommendation for farmer practices. The same trial is being conducted in the highlands using rates of atrazine and Lasso in comparison with hand weeding.

Estimates of labor requirements for weed control in selected crops in Colombia

Crop	Weedings	Man days required
sesame	1	7
cotton	3	15-20
dryland rice	1	6
coffee	2	36
sugar cane	3	14
barley	1	3
beans	2	15
corn	2	10
potatoes	2	20
bananas	2	20
wheat	1	2
yucca	2	25

The average cost for man/day labor is 25 pesos. The lower figures of man/day requirements in the above table indicate herbicide usage and reflect application time. Examples are wheat and barley, sugar cane includes two chemical treatments plus a hand weeding. Dryland rice requires approximately six man days to apply the herbicides manually.

Weeding in cotton is done on a flat fee basis in many areas. This may be 200 pesos per weeding and requires about two and one-half weedings. If fields are badly infested with weeds, workers may not consider entering the fields. A cost that may not be recognized results from the necessity of replanting when fields are heavily infested with weeds.

AVERAGE PERCENTS OF CROP LOSSES
DUE TO WEEDS IN SELECTED CROPS IN COLOMBIA

Data Supplied by ICA Experiment Station in 1967

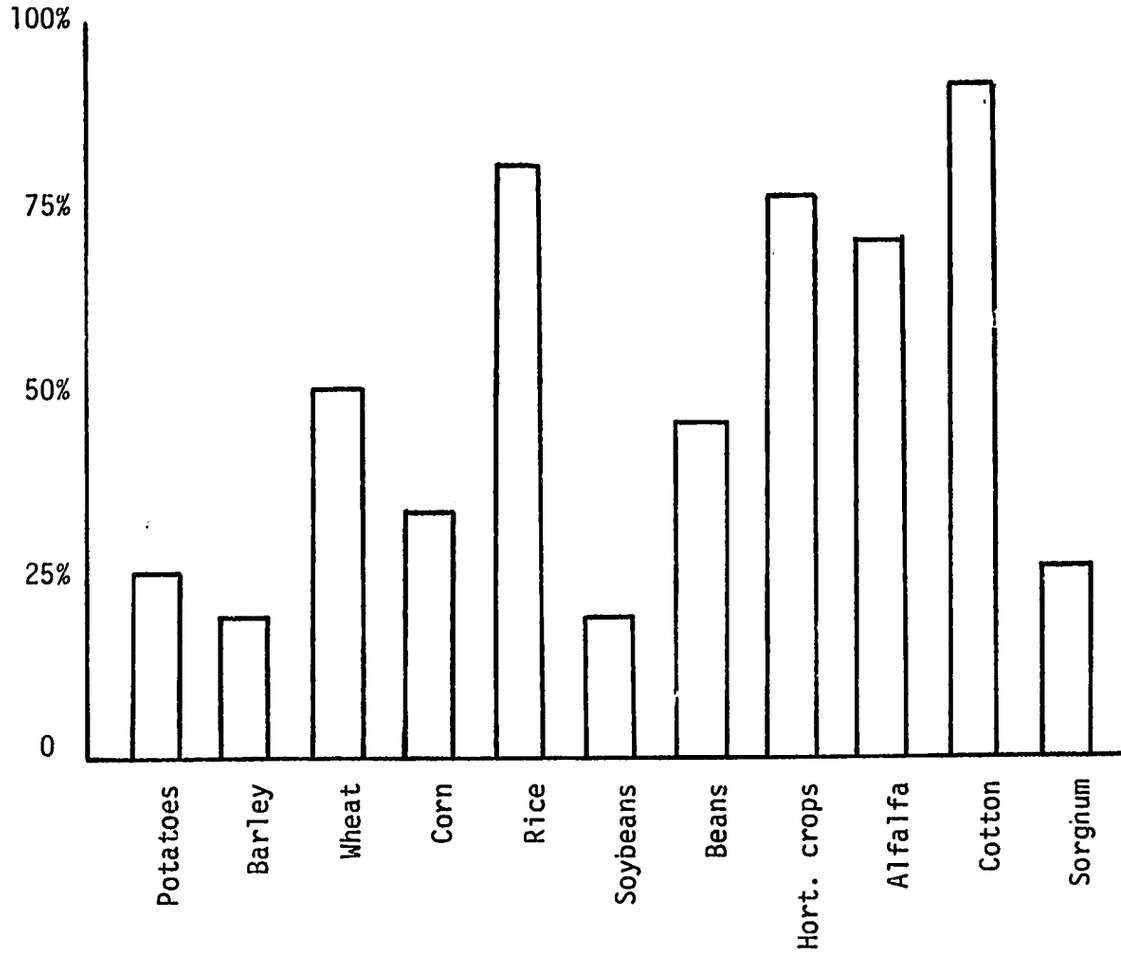
Crop	Experiment stations					
	Tibaitata	Palmira	Nataima	Tulio Ospina	Monteria	Obonuco
Potatoes	22.4[10]*					25.3[4]
Barley	22.0[10]					20.8[4]
Wheat	40.0[10]	50.0[2]	100.0[1]			28.3[4]
Corn	11.7[3]	28.3[7]	30.0[3]	29.3[6]	40.0[2]	
Rice		75.4[2]	83.5[3]			
Soybeans		20.0[2]				
Beans	30.2[4]	35.8[12]		45.4[13]		40.7[2]
Horticultural crops	75.8[2]					
Alfalfa				71.0[2]		
Cotton		95.5[1]				
Sorghum		23.2[1]				

* Number of years that loss data was taken to determine averages. These percentages were calculated comparing a mechanical weeded plot with an absolute check.

The reduction in crop yield from weed competition varies substantially by area depending on the weed spectrum found in each area. These figures give good estimates of losses. However, an integrated study of weed species, severity of competition, cost of control measures and crop response to improved varieties and fertilization by region is needed.

AVERAGE PERCENT OF LOSSES DUE TO

WEED COMPETITION IN SELECTED CROPS (ICA)



HERBICIDE CONSUMPTION IN COLOMBIA

Herbicide consumption in Colombia has been increasing at a substantial rate in the past few years. Colombia has risen from a dollar import level of $2.5 million in 1965 to $5.1 million in 1968, the largest consumer of herbicides in all Latin America. This represents approximately $8 million at the consumer level in 1968.

The major portion of the information presented here has been compiled in cooperation with some major companies dealing in herbicides in Colombia. In many cases it may represent estimates based on the various information sources.

Districution by crops

Rice: Rice was the largest herbicide application 1968.

The industrial dollar volume was $1.5 million of which $1.3 million was propanil, marketed as Stam F-34 and Rogue. The phenoxy herbicides are the other major herbicides used in rice. Of the 800,000 tons of rice produced in Colombia in 1968, approximately 50% of the acreage was treated with herbicides. The irrigated rice acreage accounts for about 90% of the treated area.

Cotton: Cotton acreage treated with herbicides has risen from 12% in 1966, 40% in 1967 to 60% of the acreage treated in 1968.

Cotton is currently the second largest dollar volume herbicide consumer at $1.1 million. The treated area is largely on the coast which comprises approximately 80% of the cotton acreage.

Approximately 130,000 ha of cotton were treated in 1968. The market was divided as follows:

Product	Acreage	% Market	$ Value*
Treflan	55,000 ha	67%	$1.2 million
Cotoran	12,000 ha	17%	$300,000
Herban	4,500 ha	9%	155,000
Lazo	4,000 ha	5%	90,000
Others**		2%	35,000

* The total value of herbicides in cotton represents $1.8 million at the consumer level.

** Others include: Karmex, MSMA and prometryne

Sugar cane: Sugar cane is the third largest herbicide application in Colombia, rising from $400,000 in 1967 to $1.0 million in 1968.

Approximately 90,000 ha of sugar cane is grown for commercial sugar production of which most is treated with herbicides. A large sugar cane acreage, 320,000 ha is grown for panela[1] and herbicide use in these numerous small proprieties is negligible.

The major herbicides used in sugar cane are:

Product	$ value
Karmex	$600,000
TCA	100,000
phenoxies	70,000
ametryne	-

Pastures: Pastures were the fourth largest consumer of herbicides in 1968. This group, not identified, amounted to $200,000 (CIF).

Others: The remaining crops which as a group consumed $1.0 million (CIF) are corn, coffee, bananas, wheat, African oil palm and industrial uses.

Distribution by herbicide

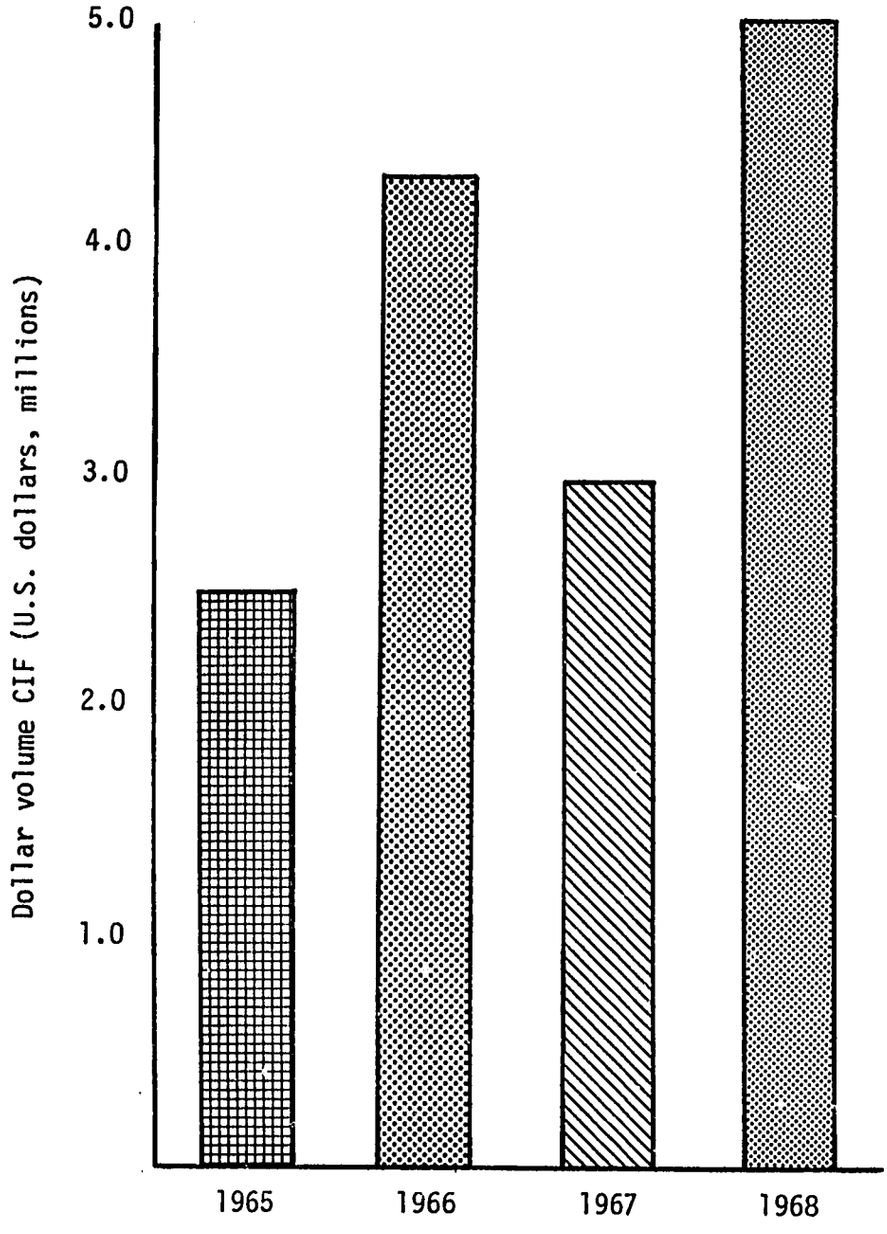
The following is a summary of dollar import value (CIF) in Colombia during 1968:

Stam F-34 (propanil)	$1.3 million
Treflan	1.2 million
diuron	$750,000
phenoxy group	600,000
Cotoran	200,000
linuron	120,000
Lazo	100,000
Herban	100,000
atrazine	100,000
ametryne	100,000
other triazines	50,000
paraquat (Gramoxone)	80,000
Tordon	30,000
others*	200,000

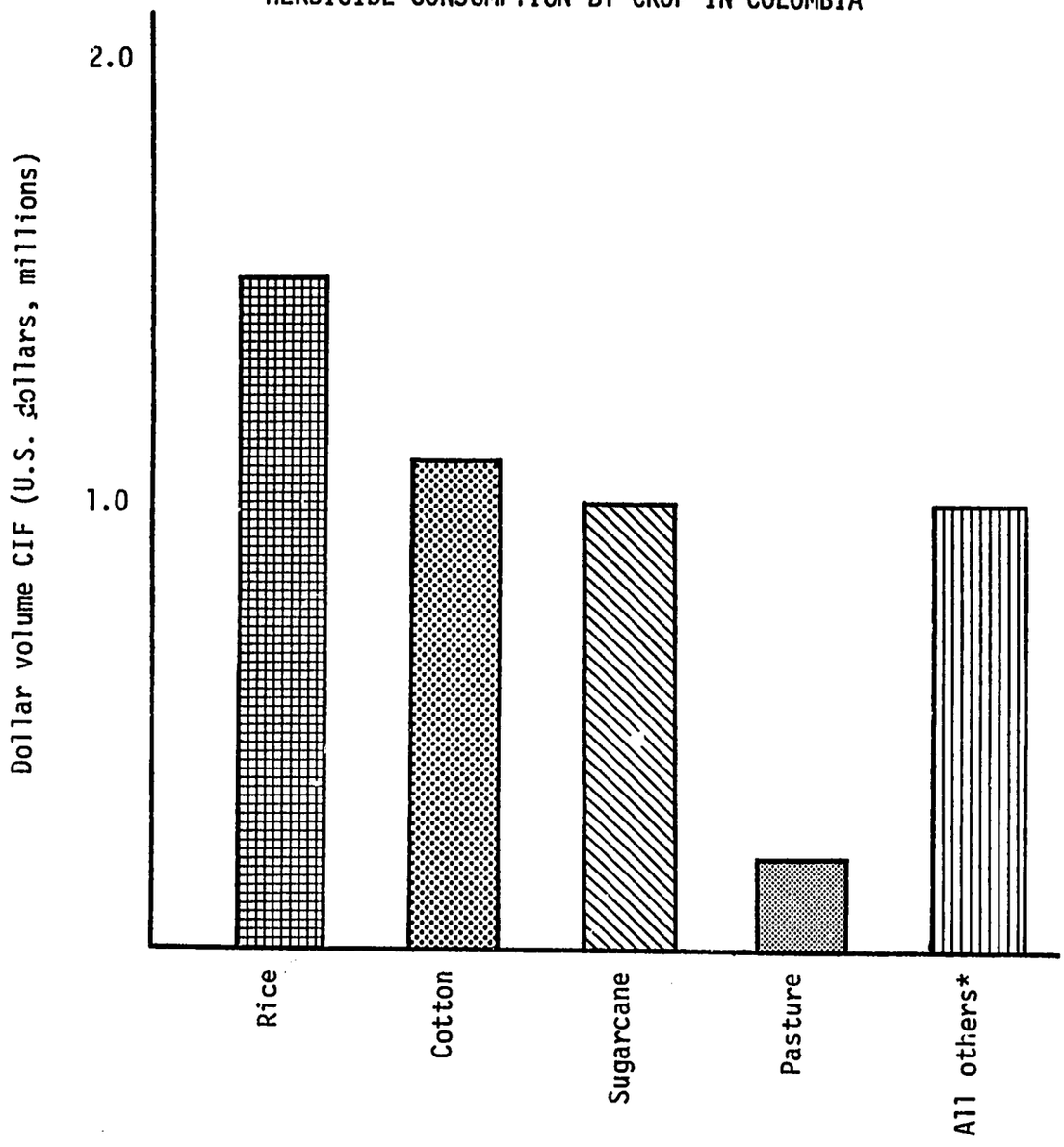
* TCA (60% of others)**, dalapon**, monolinuron**, MSMA, TOK, Ordram
** Princple herbicides in the others group.

1 Crude sugar for local consumption

TOTAL HERBICIDE CONSUMPTION IN COLOMBIA



HERBICIDE CONSUMPTION BY CROP IN COLOMBIA



* Corn, small grains, tobacco and coffee.

HERBICIDES COMMONLY USED IN COLOMBIA

The number of commercial herbicides available in Colombia is increasing substantially each year. There is a need for a current list of all products marketed in Colombia. Industry representatives have been contacted and requested to submit lists of all products available giving information as to:

1. companies handling sales in Colombia,
2. concentration of product, and
3. current prices.

This information will be compiled into an ICA publication available for distribution to farmers and researchers.

The following is a compilation of some of the more commonly used herbicides designed primarily for reference by researchers. It is advantageous that researchers become aware of the costs of weed control practices with which they work. This table, using ranges of practical application rates, gives the cost of product at a prescribed rate. These figures do not include cost of application and may not be realistic in all cases as a result of ranges in prices by quantity of product purchased. An attempt has been made to use prices that reflect large quantity purchases.

ACTUAL COSTS OF HERBICIDES COMMONLY USED IN COLOMBIA

Common name	Commercial name	Company	Concentration	Rate	Price pesos	Total cost
ametryne	Gesapax	Schering-Geigy	80%	4.0 5.0	123/kg	615.00 768.75
amiben	Amiben	Invequimica	2 lb/gal*	3.0	110-140/gal	299.2
atrazine	Gesaprim	Schering-Geigy	80%	2.0 2.5	83/kg	207.50 259.38
bromacil	Hyvar X	duPont	80%	4.0	80/lb	880.0
CP 50144	Lazo	Proficol-Monsanto	480 g/l** 4 lb/gal	1.5 2.0	75/liter	234.00 312.75
dalapon	Dowpon	Dow	85%	6.0	38.20/kg	269.69
diphenamid	Dymid	Elanco	80%	5.0	95/lb	103.6
diuron	Karmex	duPont	80%	1.0 1.5	88/kg	110.00 165.00
DNBP	Aretit	Hoechst	40%	2.0	24/kg	120.00
DNBP	Caldon	Hoechst	360 g/l	4.0	87/gal	254.90
DNBP	Premerge	Dow	3 lb/gal	4.0	90-103/gal	263.70
DNOC	Rafatox	Schering-Geigy	50%	4.0	19.8/kg	158.4

* lb/gal = pounds per gallon

** g/l = gram per liter

Common name	Commercial name	Company	Concentration	Rate	Price pesos	Total cost
DSMA	DSMA	duPont	64%	1.5	16.3/lb	83.9
fluometuron	Cotoran	Hoechst-CIBA	50%	1.5	105/kg	315.00
Herban + MSMA	Herban M	Shell-Hercules	1.6 lb Herban 3.3 lb MSMA/gal	5.0	200/gal	480.0
linuron	Afalon Lorox	Hoechst duPont	50% 50%	1.0	72-82/kg	144.00
MCPA	Agroxone 4	Proco-ICI	4 lb/gal	1.0	70/gal	38.5
monolinuron	Aresin	Hoechst	50%	1.0	72/kg	144.00
norea	Herban	Shell-Hercules	80%	3.5 2.0	110/kg	481.25 275.00
paraquat	Gramoxone	Proco-ICI	240 g/l 2 lb/gal	0.75 1.0	370/gal	284.92 379.88
picloram + 2,4-D	Tordon 101[1]	Dow	300 g/l 2.5 lb/gal	1.0	212-243/gal	186.56
prometryne	Gesagard	Schering-Geigy	80%	2.0	93-121/kg	232.50
propanil	Stam F-34	Rhinco-Rohm & Haas	360 g/l 3 lb/gal	3.5 4.5	120/gal 147.25/gal	307.20 394.00

[1] 64 g/l picloram + 240 g/l 2,4-D

Common name	Commercial name	Company	Concentration	Rate	Price pesos	Total cost
TCA	Nata	Hoechst	95%	10.0	15.6-10.5/kg	110.46
TCA	(Dow)	Dow	95%		11.1-12.65/kg	116.8
triallate	Avadex BW	Proficol-Monsanto	480 g/l 4 lb/gal	1.5	180/gal	148.50
2,4-D	Ceretox amina 4	CELA-Stauffer	4 lb/gal	0.75	53.4/gal	22.03
2,4-D	Ceretox amina 6	CELA-Stauffer	6 lb/gal	0.75	74-80/gal	20.35
2,4-D	Formula 40	Dow	480 g/l 4 lb/gal	0.75	56-68/gal	24.64
2,4-D + 2,4,5-T	Esteron 50-25	Dow	3 lb/gal	1.0	62-74/gal	45.26
2,4,5-T	Esteron T 334	Dow	3.34 lb/gal	1.0	100-121/gal	65.86
vernolate	Vernam	CELA-Stauffer	720 g/l	4.0	284-294/gal	414.64
aceite (oil)	Banana Spray Oil	Shell	-	1 liter/ha	15/gal	3.96
surfactante	SWK	duPont	-	0.5%[2]	85-113/gal	33.66

[2] 0.5% of total solution

NOTE: Total cost figures for rates given are calculated at the lower price figure when a range is given. Total costs are for herbicide only. These do not include application costs.