GLYPHOSATE (10.4 L/HA) AND THREE ADJUVANTS,

FOR THE CONTROL OF ILLICIT COCA CROPS, Erythoxilum spp.

AGRONOMIC EFFICACY TESTING OF DOSES OF GLYPHOSATE IN ILLICIT CROPS

FINAL REPORT

(Seal) Las Palmas

TECHNICAL DEPARTMENT

Bogota, July 2004

DOCUMENT TABLE OF CONTENTS

PROTOCOL FOR AGRONOMIC EFFICACY TESTING OF SOME 10.4 L/HA GLYPHOSATE MIXES WITH THREE DIFFERENT ADJUVANTS, FOR THE CONTROL OF ILLICIT COCA CROPS, Erythoxilum spp.

GLYPHOSATE (10,4 L/HA) AND THREE DIFFERENT ADJUVANTS, FOR ILLICIT COCA CROP (Erythoxylum spp.) CONTROL (AGRONOMY EFFICACY TESTING OF DOSES OF GLYPHOSATE IN ILLICIT CROPS)

1. INTRODUCTION

The United States Embassy Narcotics Affairs Section (NAS) supports the Colombian State's efforts in its strategic goal of reducing the drug supply by fighting drug production, trafficking, and distribution, including the destruction of existing illicit crops either manually or through aerial spraying with herbicides, as well as the illicit drug business support infrastructure.

Recently, the Government of the Republic of Colombia decided to **reinitiate** the eradication of illicit crops, using a dose of **10.4 liters** of a commercial formula (CF) of the herbicide glyphosate, along with an adequate adjuvant. That is why the need to forward agronomic efficacy testing became evident, in order to meet the standard requirements set by the Colombian Farming and Livestock Institute (ICA) and by the environmental authorities, as set forth in 1995 Ministry of Agriculture and Rural Development Resolution 3079.

The Colombian Government, along with the United States Government through its Narcotics Affairs Section (NAS), contracted Sociedad las Palmas Limitada's Technical Department to conduct and track the agronomic efficacy testing, using a dose of 10.4 L/ha. of a commercial formula of glyphosate and three different types of adjuvants in the provincial department of Guaviare, following the terms set forth in a Technical Protocol approved by ICA experts. The first phase of applying these treatments started on February 10, using the Colombia National Police (PNC) Anti-Narcotics Division Base located on the premises of the local airport, to spray commercial coca plots ***(Erythroxylum*** spp.).

Through the above-mentioned Protocol Efficacy Testing, we intended to evaluate the effectiveness of the different treatments with the three different adjuvants, test their effect on the environment, identify the main conditions that could improve the effect of the spraying and, thus, the efficacy of the Illicit Crop Eradication Program.

2. BACKGROUND AND JUSTIFICATION

The eradication of coca and other illicit crops is of major concern in all producing countries, and the fastest, safest alternative to controlling the harm caused by drugs, including deforestation and planting of new crops, is the eradication of the existing illicit crops.

The information obtained throughout the years while control has been enforced on illicit crops in Colombia using aerial spraying of glyphosate (30, 31) has demonstrated that the commercial formula of the herbicide glyphosate has been adequate, although it has raised some controversies. Sociedad Las Palmas Ltda.'s Technical Department was selected among the institutions invited to bid on doing the agronomic efficacy testing, and it was previously established that those tasks were to be carried out and performed following the parameters contained in a special Protocol to be approved and supported by ICA. All field testing was to be witnessed and supervised by ICA, National Directorate for Dangerous Drugs (DNE), and Ministry of the Environment, Housing and Territorial Development representatives, in addition to technical supervision by the United States Embassy NAS Office.

3. OBJECTIVES

Measure the effectiveness, in terms of actual plant termination, of a 10.4 L/ha dose of a commercial glyphosate herbicide formula with three different adjuvants during a term of 30, 60, 90 and 180 days after the date of aerial spraying on illicit coca crops.

3.1 SPECIFIC OBJECTIVES

3.1.1 Calculation of Deposit and Drift of Spray Mix Prepared with 10.4 L/ha of CF.

Do test spraying on 76 mm. x 26 mm. "water-sensitive" paper cards located at an approximate height of one meter above the surface of the soil, at 2 meters distance from one another. This testing is aimed at measuring the magnitude of the drift and the number and size of the spray particles that finally hit or intercepted the cards, taking into account the flight altitude and the environmental conditions at the time of the testing.

3.1.2 Spraying the Coca Crop Plots

Do spraying tests using the first three (3) treatments according to the specifications set forth in the Protocol approved by ICA for ***Erythroxylum*** genus and ***E. coca*** and/or ***E***. ***novogranatense*** species coca plots, with an adequate condition of development. Field design includes the use of four treatments, with three (3) replications. The Plot distribution is done at random as is the distribution of the treatments; the same dose must be sprayed from the aircraft on a same Plot or crop Plot at a minimum speed of 300 kph.

3.1.3 Sampling and Evaluation of Soil and Water Possibly Contaminated with Glyphosate

Measure the possible presence and magnitude of glyphosate and AMPA residues in water bodies (ponds and streams) and in the soil of the plots submitted to spraying. The precise tasks are listed below.

a) Determine the presence and persistence of herbicide glyphosate residues in the soil and in bodies of water on coca crops eradicated by spraying with glyphosate.
b) Calculate the magnitude of residues in the soil and in the water.

c) Use simulations of “extreme conditions” to evaluate the possible presence of residues detected in the water, by placing containers in the spray swath on a terrain plot, and taking water and soil samples from the terrain swath where the water-sensitive paper cards are placed during the discharge and drift testing done at the San Jose del Guaviare base of operation facilities.

3.1.4 Evaluation of the Effect of Glyphosate on Native Vegetation in the Sprayed Plot

In order to measure the effect of spraying on the vegetation in the sprayed plots, at the time of reading, observations of the presence and condition of development of the cover of botanical species other than coca occurring there.

4. TESTING CARRIED OUT BY WHOM, WHERE, AND WHEN

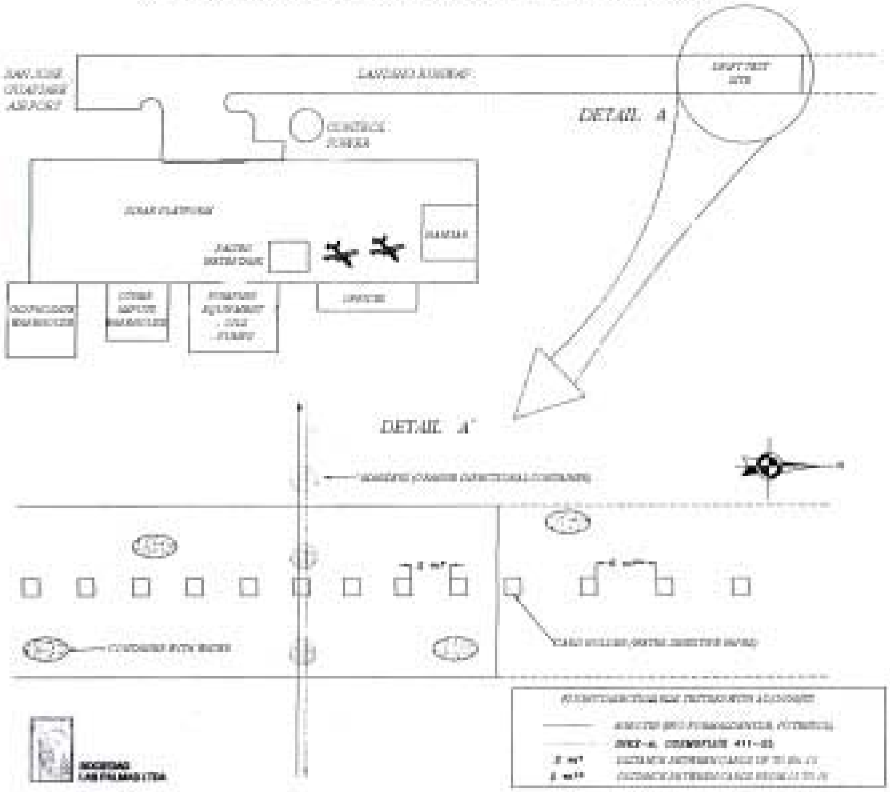
The Technical Personnel leader was Miguel Revelo Pepinosa, .I.A., Ph.D., in his condition as Sociedad las Palmas Ltda. Project Director and Technical Department Director. Our institution was contracted to do the testing and make the evaluations provided for in the Official Protocol. Specialist Revelo Pepinosa was assisted by several Engineers from the Technical Department, and he had the support of Forestry Engineer Juan de la Cruz Torres Cordero and that of experts appointed by the ILAM laboratory contracted for the water and soil sampling process. The Technical Group that carried out the experimental processes was supervised by ICA, NAS, Ministry of the Environment, and DNE experts, with the close cooperation of the Colombian National Police Anti-Narcotics Division.

The testing stipulated in the Official Protocol was done in two different stages; the first one took started on February 10, 2003 and corresponded to Plot selection activities, calibrating the aircraft equipment, spray mix equipment review, drift testing, and water and soil sample collection, in addition to meetings and field test preparation. The second stage started on March 19, 2003 with the collection of water and soil samples, followed by field spraying of *coca* and *ipadú* crops with adequate conditions of development.

The agronomic efficacy field test with glyphosate and three different adjuvants was done in the provincial department of Guaviare, near the Municipality of San José del Guaviare, on the industrial coca crops located in the terrain blocks identified on the map of the zone by numbers 156, 155, 136, and 189 (Commercial Control Treatment), located at an average distance of 20 to 25 miles from the operation base. The coca crops corresponded to the following varieties:

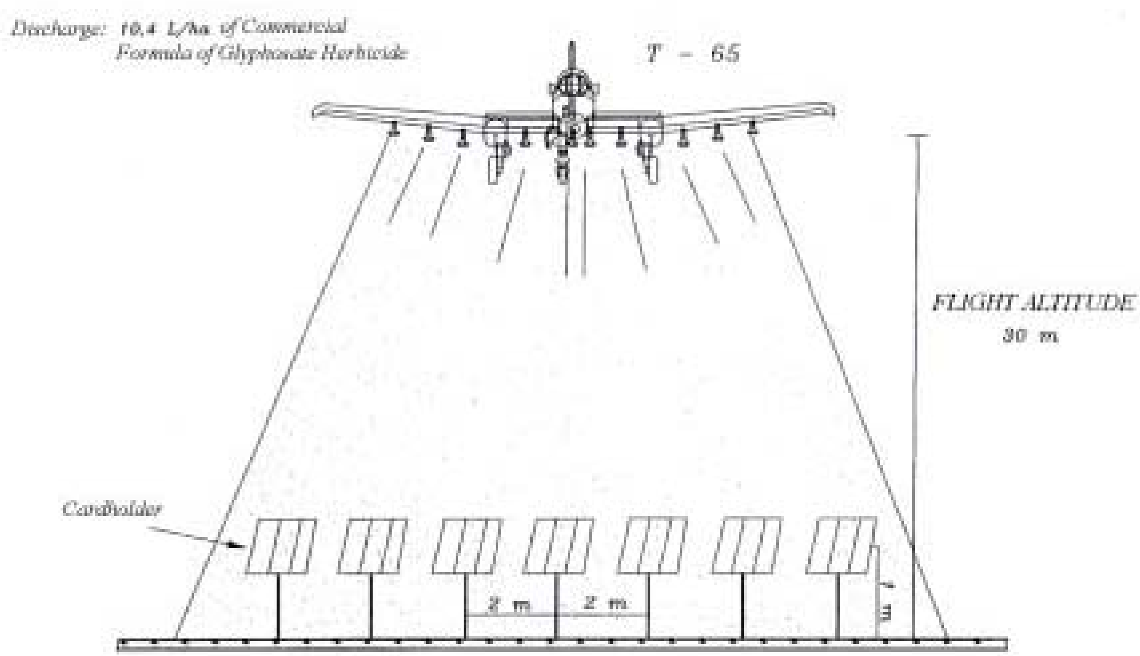
SCHEMA No. 1

LOCATION OF DRIFT TEST SITE AT SAN JOSE DEL GUAVIARE AIRPORT

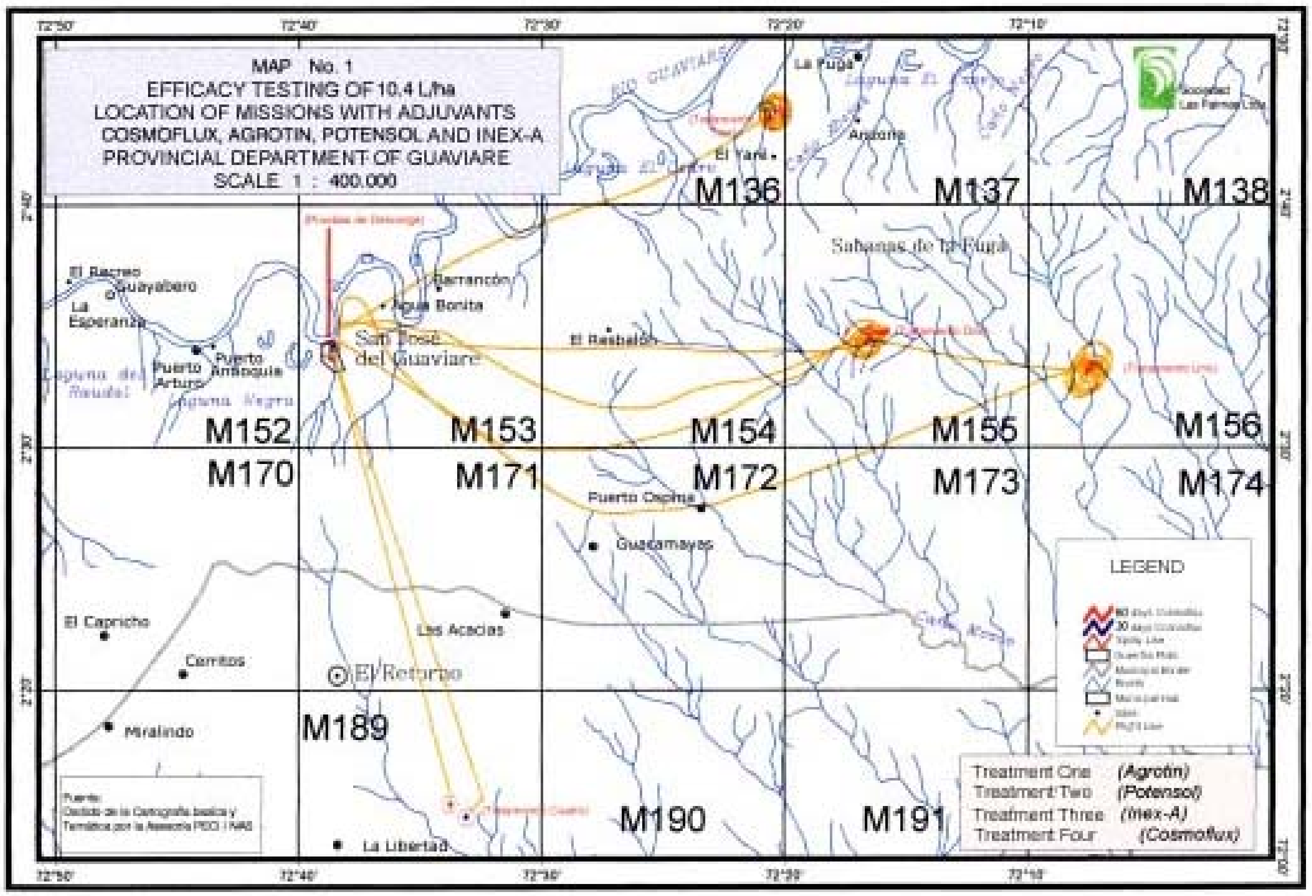


SCHEMA No. 2

PROCEDURE FOR INDICATING SPRAYING



Plot 156 Plot:	***<u>Erythroxylum</u> <u>coca</u>* – coca variety**
Plot 155 Plot:	***<u>Erythroxylum</u> <u>coca</u>* – Ipadú variety**
Plot 136 Plot:	***<u>Erythroxylum</u> <u>coca</u>* – coca variety**
Plot 189 Plot:	***<u>Erythroxylum</u> <u>coca</u>* – coca variety**



PROVINCIAL DEPARTMENT OF GUAVIARE
ADJUVANT VERIFICATION POINTS

5.0 LITERATURE REVIEWED

There is no information or experience regarding illicit crop eradication using aerial spraying of herbicides from altitudes greater than 10 meters in international technical literature. As a matter of fact, the most updated information may well be the Colombian experience related to the treatments and aircrafts used by the Illicit Crop Eradication Program (Briñez, 5), (Helling, 13), (Revelo, 30, 31, 32), for spraying from altitudes greater than those traditionally used in phytosanitary agronomic programs. We found no experiences other than the above-mentioned ones and those indirectly related to the topic found in different unpublished isolated reports or whose distribution is restricted. In some cases, they are specialized articles and in many cases, they are not reliable signed sources.

There is a report of interest prepared by Sociedad Las Palmas Ltda.'s Technical Department, in charge of Gemsi Ltda. (Revelo, 31), which documents discharge and drift testing experiences in T-65 aircraft from maximum altitudes of 20 meters. Through the search engines available on Internet, there is no information regarding aerial spraying of illicit crops from more than 20 meters of altitude.

Notwithstanding the above, it is worth mentioning that there are some good contributions made by Eng. Orlando Briñez (5), experts L. E. Parra, Lake Ellis and M. Revelo P., Eng. Jairo Pérez, from Consulting Firm EPAM and several bulletins prepared by the Tennessee University Engineering Department (46), USA, WRK from Manhattan, and by Bishop Equipment MFG., INC, Steward Agricultural Research Services Inc. (Missouri) USA, Spray Drift Task Force (33a) (Missouri), in addition to other sources of reference. In the specific case of Colombia, there are some publications that are also useful, written a few years ago by Ciba Geigy (8, 9) as part of phytosanitary technical advice to be used in food and industrial crops), Hernández (14), Calderón (6) and Angel (2), to name a few.

In addition to the above, in all experiences similar to those of Colombia which have taken place in Peru, Bolivia, and Panama (Helling, 13), the spraying was done from very low altitudes and, therefore, the corresponding technical parameters cannot be used as applicable references for the spraying done in Colombia.

6.0 MATERIALS AND METHODS

The materials and methodology selected correspond to the description included in the Official Protocol although, after we had to include the surfactant Inex A (alquil polyether alcohol etoxylate) to replace Extravon SL, due to the non-availability of the latter on the market, some minor operational details were added to the methodology of some of the tasks.

The discharge testing using water-sensitive paper cards was done in an area surrounding the San Jose del Guaviare airport runway, using a T-65 aircraft driven by professional Ricardo Vasconey. The area was first submitted to several test sprays to gauge the magnitude of the discharge of the projected dose.

6.1 HERBICIDE FARMING CHEMICAL FORMULAS EVALUATED IN THE TESTING

The farming chemical substances that were the object of our main evaluation were three types of adjuvants although, due to time limitations and other reasons, the evaluation process did not include all aspects nor the desired technique measures. The study of the three adjuvants was done using one sole dose of 10.4 L/ha of a commercial formula of glyphosate containing 480 g/L of N-glycine (Phosphonomethyl) isopropanolamine salt. This is similar to 360 g/L of acid equivalent of glyphosate, as the rest of the associated ion molecule does not have herbicide action.

6.1.1 Summary of the Physical-Chemical Characteristics of Glyphosate

The physical-chemical and toxicological information related to the herbicide glyphosate is extensive and may be found in several reference publications (1, 4, 10, 11, 12, 29, 30, 38, 40, 43, and others). It is worth mentioning that we used a commercial glyphosate formula with an active ingredient content equal to 480 g/L of ***glycine N-phosphonomethyl isopropilamine salt (360 g. of acid equivalent),*** which is usually considered the active ingredient by various technical international institutions and local government institutions, including ICA. The inert ingredients total nearly 690 g/L of each commercial formula, based on the manufacturer's information.

The commercial formula of glyphosate used for the testing has no selective action and was used only in post-emergency leaf applications. It is not nor does it acts as a soil sterilizing herbicide.

The particularity of glyphosate being a herbicide that acts systemically through the leaves means that the toxicological effect is initially evident in the inner part of the plant, right after the spray drops go through the epidermis of the leaves. If diluted in clean water, a homogenous, stable solution is obtained using any proportions. It has low vapor tension and, therefore, the formulas used in the field are not volatile.

The Official Protocol includes a **glyphosate** toxicological analysis. Therefore, we believe it worth mentioning that one of its important characteristics is its reduced toxic potential for human beings (9). The average oral lethal dose (LD 50) is approximately 4,900 to 5,000 mg/ kg. of live animal weight. (The skin LD 50 was superior to 5,000 mg/kg in rabbits, although that largely depends on the solvent used). There is no evidence of teratogenic or carcinogenous properties, and there is no bioaccumulation in adipose tissues.

It is not a long-lasting action herbicide and its effect is short-term in soil, especially in tropical areas. The molecule is biodegraded by microbial action and the particles that fall to the soil (29, 34, 35, 38, 41) may adhere by ***adsorptipn*** to clay, metal oxides and certain humic constituents. This process may be fast or slow and may also be reversible, depending on the environmental conditions.

Glyphosate metabolism can create various products such as CO2, water, nitrogen and certain phosphates. The aerobic and anaerobic degradation of the parental molecule creates at least six (6) metabolites, of which AMPA (amino methyl phosphonic acid) is the most important and most produced, as it is toxicologically inert.

6.1.2 Adjuvants Evaluated during the Testing

The adjuvants below were selected by NAS and ICA to be evaluated during the testing.

ADYUVANT NAME	COMMERCIAL PRODUCT	%
Cosmoflux 411 F : ICA Record 2186		
(Linear etoxilate alcohols +Arileto)	170 g/l	17.0 %
Agrotin SL - ICA Record 857		
(Goma Xanthan)-	79.48 g/lit	7.948 %
Potenzol 900 SL – ICA Record 1658		
Alquil aryl polyether alcohol	842 g/l.	84.20 %
Inex A SL - ICA Record 1498		
Alquil polyether alcohol etoxylate + Alq	88.06 g/l. + 62 g/l	15.00 %

6.1.3 Materials and Procedures Used in Discharge, Evaporation, and Drift Testing

This testing was done at the beginning of the San José del Guaviare airport runway. Spraying was done at 30 meters from ground level, and the cardholder device line was from North to South. The water-sensitive cards were at a distance of 2 meters from card to card up to Card 15; from that card on, they were placed every 5 meters up to 25 meters, facing both North and South, as may be appreciated in one of the photographs that appear in this document.

Along with some of the water-sensitive paper cards, we also placed four (4) plastic containers with 21 L of water, so that sprayed particles could be gathered, part of another of the experimental tasks included in the Official Protocol (to determine the amount of glyphosate residues in water).

The aircraft used for discharge, evaporation, and drift testing was a T-65; it was flown in from its operation base in Cúcuta operated by piplot Ricardo Vasconey.

6.2 AIRCRAFTS AND TECHNICAL-PRACTICAL PARAMETERS FOR GLYPHOSATE MIX SPRAYING

Taking into account that the Protocol discusses agronomic efficacy testing of the 10.4 L/ha dose of commercial glyphosate on illicit crops, along with a formula adjuvant of 23.4 L/ha, we established several parameters, related to the applications that could be made using T-65 aircraft, including those indicated below, although we feel it appropriate to mention that some of them may have varied, within certain limits, due to environmental conditions.

Foreseen Discharge: nearly 13.5 L/ha of the mix;

- *Aircraft Foreseen for Application: T-65;*
- *Flight Velocity: 207 miles (180 knots) per hour in an aircraft T-65;*
- *Foreseen Discharge: nearly 23.5 L/ha. of the mix;*
- *Theoretical Discharge from Spraying Equipment: 49.92 micrograms/cm^2 of technical glyphosate*,
- *Desired Deposit on Leaves: minimum 70% of the discharged material*
- *Applications under Wind Velocity Conditions: 0 to 6 knots;*
- *Ensure Effective Crop Eradication of Minimum 60%;*
- *Drift Not Intended to Exceed 10 m. from Edge of Crop;*
- *Relative Humidity of Minimum 80% at the Time of Spraying;*

- *To avoid ascending air currents (convection), we suggested not doing any spraying from 10:00 a. m. to 4:00 p.m.;*
- *Aircraft Flight Altitude: from 25 m. to 30 m. (T-65).*

Spraying was done on coca crops in Plots 156, 155, 136 and 189, from the Colombian National Police Anti-Narcotics Division base, using spray units attached to the T-65 aircrafts. This operation was carried out following the process described in the experimental design.

6.3 EXPERIMENTAL DESIGN USED IN SPRAY TESTING IN THE FIELD

We had foreseen using the Plot Design at random with three or four re-applications but, in the case of testing with spray equipment attached to the aircraft that must operate at 30 meters from ground level and travel at greater speeds than those used in traditional phytosanitary labors, the usual, commonly used design did not enable us to meet the requirement that stated that all plots should be located in a single terrain Plot (plantation). Nor was it easy, economic or practical to change the flight standards for that aircraft. The field design was modified so that the re-applications of each treatment were randomly selected in each of the four Plots and each treatment was individually sprayed in each Plot. This design was used because the plots with less than 5,000 to 10,000 coca plants per treatment could not be individually sprayed by the aircraft.

The latter enabled minimizing the magnitude of experimental error for differences to basically correspond to variations within each individual repetition (plot or sub-plot) and for the experimental units (plots or sub-plots) to have a high degree of homogeneity. The treatment that corresponds to the Commercial Control Treatment by Cosmoflux (Plot 189) followed the same procedure.

In the case of the Non Treatment Control (untreated coca plants) we used untreated sectors in Plots 189, 156, 155, and 136, in addition to commercial crops on which mortality variations could not be greater than 0.00%.

6.3.1 Size of Experimental Sub-Plots and Units

The size of each sub-plot included minimum 20 to 25 coca plants on each sub-plot used for each reading, and enabled making minimum 4 different readings of the mortality percentage during the time the field testing lasted.

The size of the plantations where sub-plots were located and used was minimum 10,000 to 15,000 coca plants per hectare, and each was one to two years old. In each Plot, a visual, random selection of plots was made in order to check 20 to 25 plants in each evaluation.

6.4 FIELD SPRAY TEST TREATMENTS

The following treatments were tested on the commercial coca crops. Treatment A was used as a Commercial Control Treatment, taking into account that it corresponds to the standard treatment normally used in the Illicit Crop Eradication Program

Treatments	Dose /ha. in c.c.	Commercial Product dose / ha., in c.c.	3 to 4 Re-applications
A Glyphosate with Cosmoflux 411 F, *	1.00%	0.236 l.	0.708 l.
B Glyphosate with Agrotin	1.00 %	0.236 l.	0.708 l.
C Glyphosate with Potenzol	1.00 %	0.236 l	0.708 l.
D Glyphosate with Inex A	1.00 %	0.236 l	0.708 l.
T Blind Sample (without Treatment)**			

NOTE 1. In the 10.4 L/ha of commercial glyphosate sprayed, 4.99 kg. as salt form.

NOTE 2. The herbicide and adjuvant must be diluted in 12.76 L of water.

NOTE 3. The COSMOFLUX 411 F, AGROTIN, POTENZOL and INEX A commercial adjuvants were used in Treatments A, B, C and D, respectively, at a dose of approximately 0.235 L/ha of commercial product, equal to 1 % of the mix/ha.

* In this test, Treatment A (glyphosate with Cosmoflux 411 F) was used as the Commercial Control Treatment for comparison purposes to analyze results.

** The unsprayed areas or crops equal the Non Treatment Control (Untreated, for comparison purposes).

The application of the treatments described in the Protocol created following the specifications previously supplied and approved by ICA experts was made on commercial plots of ***Erythroxylum coca*** species with ***coca*** and ***ipadú*** varieties in adequate conditions of development. We used the existing crops in commercial Plots that had not been submitted to control treatments. Treatments B, C and D were done on the coca crops in Plots 156, 155, and 136. Treatment A (the Commercial Control Treatment) was evaluated in Plot 189 commercial Plots and, for the purpose of comparing it to the Non Treatment Control, we decided to use the coca plants in the untreated areas of the plots submitted to testing.

The four (4) treatments were sprayed on ***Erithroxylum*** genus and ***E. coca*** and / or ***E. Novogranatense*** species coca plots in adequate conditions of development, using the experimental field design with three (3) re-applications. Although in the commercial coca crops other species can be used, and even crops sprouting from felling, for the purposes of the Eradication Program, the practical interest lies in the fact that the same dose of commercial glyphosate should provide a mortality level that is similar in all crops submitted to spraying.

6.5 EVALUATIONS AND MEASURES

The evaluation process of the results of the different tests had individual characteristics.

6.5.1 Discharge, Evaporation, and Drift Testing

In order to evaluate and understand the results of the tests included in the Official Protocol fairly, we deem it advisable to consider certain reference parameters, including the following:

The active Glyphosate ingredient is acid or salt; these ingredients are equal to 360 g per commercial formula liter for acid or 480 g. for salt. In the coca eradication spraying, 10.4 L/ha of commercial glyphosate is applied., in a formula of 23.4 L/ha., which includes 13.02 L. of water and 240 cc. of the corresponding adjuvant. Based on this value, in routine coca control spraying, 2.34 cc. of the mix are discharged per m^2 of crop. However, in theory, the soil cannot receive more than **0.468 cc. of the herbicide mix per m^2 of soil (equal to 74.88 mg. of the active ingredient)** because, according to several estimates, only 10% to 20% of the mix that could reach the surface of coca plant leaves is not intercepted by the leaves and could actually reach the soil surface.

We anticipated the need to calculate number, size and volume of the particles sprayed from an altitude of 30 meters from the spraying equipment attached to a T-65 aircraft, which were to impact the water-sensitive paper cards. In addition to the above, we also anticipated the need to measure the magnitude of drift caused by the wind, from the central point of the spray swath. The fact of not having included an evaluation of without adjuvants in the evaporation, discharge, and drift testing was due to personal instructions by the former NAS Technical Advisor, Luis Eduardo Parra, to not include the field evaluation of the glyphosate mix without an adjuvant because it was not needed, if we considered that (based on his information) the Anti-Narcotics Police Illicit Crop Eradication Program, a few years ago, had adopted a standard that provided that all Glyphosate spraying always had to be done adding an adjuvant. That is also why we decided not to include the Field Treatment in spraying of commercial formula glyphosate without an adjuvant. The original reading and/or its processing are included in a different section herein.

The calculation process consisted of applying some of the mathematical formulas available to transform into volume the average areas of the particles (stains) contained in a cm^2, using numerical expansion factors. We resorted to using the sole technical factors available for spraying from altitudes of maximum 10 meters., prepared by Ciba Geigy (8, 8A) and other experts (2, 32) and, although we made certain modifications and corrections using theoretical projections and rapid lab tests (made by the person who prepared this report), we must anticipate that the results obtained may be equal to maximum 90% of the quantity that may actually reach the surface of the intercepting cards.

Theoretical Discharge from Spraying Nozzles to Calculate Mix Volumes

Flat Micron diam.	**Diameter* Volume (Factor)**	**Sphere Diameter micron**	**Actual Area of the Stain in microns □^{2}**	**Volume of Each* Stain (micron gm^3)**
100	1.7	58.82	2,7170	x**
200	**1.7**	**117.11**	**10,770**	
250	**1.8**	**138.88**	**15,148**	
300	1.9	157.89	19,580	
400	**2.0**	**200.00**	**31,416**	
500	2.1	238.09	44,523	
600	2.1	285.71	64,114	
700	2.2	318.18	79,513	
750	**2.2**	**340.90**	**91,278**	18,154
800	2.3	347.82	95,020	
900	2.3	391.30	120,259	
1000	2.4	416.66	125,664	
1100	**2.4**	**458.33**	**164,988**	
1200	2.5			
1300	2.5			
1400	2.6			
1500	**2.6**	**576.92**	261,412	
1600	2.7			
1700	2.7			
1800	2.8			
1900	2.9			
2000	**3.3**	**606.06**	**288,484**	

* The expansion factors for stains with a magnitude superior to 750 microns are not found in any literature and, for discharge and drift testing purposes, we had to estimate them or interpolate them using values from some lab tests

made by the Project Director himself. For stains less than 750 microns, we used the factors calculated by Ciba-Geigy.

** Multiply by the number of stains per cm2.

NOTE
The actual particle (stain) diameter in microns may be calculated as follows: The stain diameter in microns, divided by the expansion factor, and multiplied by the value of the radius squared or by any other trigonometric formula available, in order to calculate sphere (particle) volume of 1.0 density spray in all of the mixes.

It is also worth mentioning that the discharge, evaporation, and drift testing had to be done under conditions that somehow differ from the conditions that prevail in the Eradication Program routine sprayings. This fact and the nature itself of the discharge and evaporation research testing do not enable us to expect a 100% match on the discharge results in both such tasks (one being experimental and the other practical). However, from a practical standpoint, we may decide that a coincidence or correlation of minimum 70% is adequate and sufficient.

It is also important to consider the fact that the testing done at the San José del Guaviare airport suffered some operational failures, and some of the testing had to be done taking advantage of the limited time and economic resources available with a T-65 aircraft brought in from a distant base. Some of the spraying had to be done under environmental conditions that, although not the most optimum, were within the allowable range of wind velocity and environmental temperature. The evaporation, discharge, and drift testing did not include the use of OV-10 airplanes, although those are the ones commonly used in the Colombian National Police Anti-Narcotics Division Eradication Program.

6.5.2 Evaluation of Field Spray Testing

In order to measure the level of control of glyphosate and adjuvant spraying of crops aimed at the production of coca base, we evaluated the mortality percentage of the sprayed plants, following the evaluation criteria suggested by (CIAT, 7) and by the Latin American Association of Weed and Plant Physiology Control (ALAM).

For our comparative readings of the Non Treatment Control treatment, we used unsprayed coca crop sectors (as was the case in a portion of Plot 156 and in other portions of sprayed Plots) with coca plants of the same age. Initially, we had planned to include a glyphosate base treatment without the Cosmoflux 411 F. adjuvant, but this task was abandoned due to a decision made by the NAS Technical Advisor because, as we previously mentioned, some time ago there was a technical and practical justification established to adopt the decision of always incorporating the Cosmoflux 411 F adjuvant as part of the glyphosate mix used in illicit crop eradication. The results of Treatments B, C and D should only be compared to the results in Treatment A.

The numerical data obtained (real or transformed) from each reading or evaluation of the mortality percentage of coca plants sprayed using each treatment, including those in the Commercial Control Treatment (Treatment A), will be submitted to statistical testing, taking into account the possibility that, if the sprayed crops are abandoned by their owners before the 180-day period foreseen in the tests, as they will have been destroyed far beyond the allowable economic limit (usually estimated at over 60%), in this case, the abandoned plot would be considered to have 100% mortality.

6.5.3 Evaluations of Water and Soil Samples

In order to take out the soil and water samples, the Technical Department contracted a specialized lab (ILAM Ltda.). Some soil samples were adequately prepared and packed for delivery to a processing laboratory in the United States. Another part of the soil samples and the water samples were sent to national laboratories for a different analysis process.

The water samples collected to detect glyphosate traces were tested in the ICA LANIA Lab available and approved for such purpose. The physical-chemical analyses foreseen in 2002 Ministry of the Environment Resolution 0108 were processed in the ILAM Lab. Soil samples were processed in a laboratory in the United States.

In the case of water and, taking into account the discharge, evaporation and drift testing results, and also the fact that the water bodies are static and may be nearly 20 cm. deep, in every mt^2 of a water source, 0.702 cc. of mix will fall, with 0.11232 mg. of acid equivalent or 0,1497 mg. of salt.

The tolerable limits of NOEL or NOEC (No Observable Effect Concentration) values are, based on IPCS criteria, Environmental Health Criteria No. 159 Glyphosate, 1994, 158 mg/kg of soil and 3.74 mg/L of water. These and other values have been adopted by the ICEP (29) as reference parameters.

The water and soil sampling process was carried out in the following points:

• Beginning of airport runway. Blind sample (white) no spraying.
• Beginning of airport runway. Area sprayed using glyphosate with adjuvant Agrotin.
• Beginning of airport runway. Area sprayed using glyphosate with adjuvant Potenzol.
• Beginning of airport runway. Area sprayed using glyphosate with adjuvant Inex A.
• Plot 1. Plot N_1 156. Blind sample (white) no spraying.
• Plot 1. Plot N_1 156. Area sprayed using glyphosate with adjuvant Agrotin.
• Plot 1. Plot N_1 155. Area sprayed using glyphosate with adjuvant Potenzol.
• Plot 1. Plot N_1 136. Area sprayed using glyphosate with adjuvant Inex A.

*   In this plot, a reading was obtained 30 days after treatment as a Commercial Control Treatment
** In this plot, a reading was obtained 60 days after treatment as a Commercial Control Treatment

The sampling done at the beginning of the airport was carried out on February 12, 2003. The first samples in the coca plots in Plots 156, 155, and 136 were collected on February 20, 2003. The sampling corresponding to 30 days in the previously mentioned Plot coca plots was done on March 26, 2003

6.5.4 Evaluations of the Effect of Glyphosate on the Vegetation covering in Sprayed Plots

In order to evaluate the possible impact of glyphosate on the vegetation covering in sprayed plots, we evaluated the germination, growth, ecological succession, and development process of the species of grasses or native plants that are common to the ecological zone with coca crop plots. We did this observation at the same time as the mortality evaluation on the sprayed coca plants.

7.0 RESULTS AND DISCUSSION

The results achieved in the different tests, analyses, and evaluations of various natures allow us to affirm that we met all of the Proposed Objectives, in spite of the fact that for some of them we had to design special procedures because, as we were dealing with spraying done from 30 meters of altitude, there are no parameters for reference in any other part of the world.

7.1 DISCHARGE, EVAPORATION, AND DRIFT TESTING

Despite the above, the general results of the testing done as part of the **OFFICIAL PROTOCOL** designed to measure the **AGRONOMIC EFFICACY OF A DOSE OF GLYPHOSATE** and of three (3) Adyuvants without Formaldehyde in the **ILLICIT CROP CONTROL** tests enabled us to draw several conclusions and inferences that **prove good efficacy and good agronomic behavior** of the dose used to control coca crops in field conditions.

7.1.1. Discharge, Evaporation, and Drift Testing

Below we include Charts 7.1.1, 7.1.2, 7.1.3, and 7.1.4 that correspond to the numerical data in the tests for the number of particles by average diameter and additional related numerical data, to calculate the magnitude of spraying using each glyphosate mix with the different adjuvants deposited on every square centimeter of the surface, on water-sensitive paper cards, in test spraying done from 30 meters of altitude. The next 12 pages include Graphs 7.1.Ga, 7.1.Gb, 7.1.Gc, 7.1.Gd, 7.1.Ge, 7.1.Gf, 7.1.Gg, 7.1.Gh, 7.1.Gi, 7.1.Gj, 7.1.Gk, and 7.1.Gl that correspond to the glyphosate mix with the surfactants Cosmoflux, Agrotín, Potenzol, and Inex, respectively.

Everything seems to indicate (32, 33a, 46) that, first in importance, evaporation and, second, drift are the greatest problems in aerial spraying, especially when it is done from altitudes of over 10 meters (8, 8[a]) and under environmental conditions that favor their occurrence (low relative humidity in the air and high environmental temperature, for example), or when it is done using inappropriate spraying equipment or without including procedures to counterattack the harmful effect of such conditions.

Sociedad las palmas ltda.

DISCHARGE AND DRIFT TESTING

TREATMENT	T_4 P_1 COSMOFLUX	**TEST No.**	1	**LOCATION**	San Jose del Guaviare
DATE	Feb. 12/03	**FLIGHT ALTITUDE**	30 m.	**TIME**	9:00 a 11 a.m.
TYPE OF AIRPLANE	T-35	**WIND VELOCITY**		**NOZZLE**	Aqua-flux

CARD No.	< 300 µ	301 - 500 µ	501 - 1000 µ	1001 - 2000 µ	> 2000 µ	TOTAL DROPS/cm²
20 S (a 25m)	0.33	0.33	0.00	0.00	0.00	0.66
19 S (a 20m)	6.33	0.00	1.00	0.00	0.00	7.33
18 S (a 15m)	3.33	1.33	1.00	0.00	0.00	5.66
17 S (a 10m)	2.33	0.66	0.66	0.33	0.00	3.98
16 S (a 5m)	0.33	1.33	0.00	0.00	0.00	1.66
15 S	0.00	2.00	1.00	0.00	0.00	3.00
14 S	0.00	0.00	1.33	0.00	0.00	1.33
13 S	4.33	1.66	0.66	0.66	0.00	7.31
12 S	4.66	2.00	1.66	0.33	0.00	8.65
11 S	1.33	0.00	2.00	0.66	0.00	3.99
10 S	2.66	1.00	2.66	0.00	0.00	6.32
9 S	7.00	1.00	2.66	0.66	0.00	11.32
8 S	6.00	0.66	2.66	0.66	0.00	9.98
7 S	2.33	1.00	2.00	0.33	0.00	5.66
6 S	5.00	3.00	2.00	0.66	0.00	10.66
5 S	20.33	0.33	3.00	0.66	0.00	24.32
4 S	8.33	0.66	1.00	0.66	0.00	10.65
3 S	3.33	0.00	1.00	0.66	0.00	4.99
2 S	2.66	0.33	2.66	0.33	0.00	5.98
1 S	0.00	0.66	1.66	0.00	0.00	2.32
0	30.00	5.00	0.66	1.33	0.00	36.99
1 N	14.00	1.33	1.00	1.33	0.00	17.66
2 N	0.00	0.00	0.00	0.00	0.00	0.00
3 N	0.00	0.00	0.00	0.00	0.00	0.00
4 N	0.00	0.00	0.00	0.00	0.00	0.00
5 N	0.00	0.00	0.00	0.00	0.00	0.00
6 N	0.00	0.00	0.00	0.00	0.00	0.00
7 N	0.00	0.00	0.00	0.00	0.00	0.00
8 N	0.00	0.00	0.00	0.00	0.00	0.00
9 N	0.00	0.00	0.00	0.00	0.00	0.00
10 N	0.00	0.00	0.00	0.00	0.00	0.00
11 N	0.00	0.00	0.00	0.00	0.00	0.00
12 N	0.00	0.00	0.00	0.00	0.00	0.00
13 N	0.00	0.00	0.00	0.00	0.00	0.00
14 N	0.00	0.00	0.00	0.00	0.00	0.00
15 N	0.00	0.00	0.00	0.00	0.00	0.00
16 N	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**124.61**	**24.28**	**32.27**	**9.26**	**0.00**	**190.42**
AVERAGE	**5.66**	**1.10**	**1.46**	**0.42**	**0.00**	**8.66**
µg/cm²	**7.92**	**4.60**	**30.28**	**21.17**	**0.00**	**63.97**
Porcentage of Recovery						**27.33**

DISCHARGE AND DRIFT TESTING

TREATMENT $T_1 P_1$ (AGROTIN)	TEST No.1		LOCATION San Jose del Guaviare
DATE Feb. 12/03	FLIGHT ALTITUDE	30 m.	TIME 9:00 a.m.
TYPE OF AIRPLANE T-6	WIND VELOCITY		NOZZLE Aqua-flux
DISTANCE BETWEEN CARDS			

CARD No	< 300 µ	301 - 500 µ	501 - 1000 µ	1001 - 2000 µ	> 2000 µ	TOTAL DROPS/cm²
10 N	0.00	0.33	0.00	0.00	0.00	0.33
9 N	0.00	0.33	0.00	0.00	0.00	0.33
8 N	3.33	1.00	0.66	0.00	0.00	4.99
7 N	5.33	4.66	1.33	0.00	0.00	11.32
6 N	4.66	4.66	1.33	0.00	0.00	10.65
5 N	7.66	7.33	1.66	0.00	0.00	16.65
4 N	20.33	9.66	2.66	0.00	0.00	32.65
3 N	10.66	7.00	4.66	0.00	0.00	22.32
2 N	14.66	5.66	6.33	2.33	1.00	29.98
1 N	20.66	3.33	5.00	1.33	0.66	30.98
0	93.00	8.33	7.66	2.00	0.66	111.65
1 S	42.33	7.66	6.66	1.00	0.33	57.98
2 S	24.00	8.00	3.33	1.00	0.00	36.33
3 S	18.66	6.33	1.33	1.33	0.33	27.98
4 S	44.00	5.66	3.00	1.66	0.00	54.32
5 S	24.66	4.66	1.33	0.00	0.33	30.98
6 S	11.66	5.66	0.66	0.33	1.00	19.31
7 S	14.00	3.33	1.33	0.33	0.33	19.32
8 S	24.66	2.33	1.33	1.00	0.33	29.65
9 S	15.66	1.00	2.66	1.33	0.00	20.65
10 S	10.00	1.33	4.66	1.33	0.00	17.32
11 S	3.33	2.00	2.33	0.66	0.00	8.32
12 S	11.00	2.00	1.33	2.00	0.00	16.33
13 S	7.00	1.00	5.00	1.66	0.00	14.66
14 S	6.33	4.66	3.00	1.33	0.00	15.32
15 S	23.66	4.66	3.66	1.66	0.00	33.64
16 S (a 5m)	5.66	2.33	2.66	0.00	0.00	10.65
17 S (a 10m)	10.00	6.66	3.00	0.00	0.00	19.66
18 S (a 15m)	3.66	2.00	2.33	0.00	0.00	7.99
TOTAL	**480.56**	**123.56**	**80.89**	**22.28**	**4.97**	**712.26**
AVERAGE	**16.57**	**4.26**	**2.79**	**0.77**	**0.17**	**24.56**
µg/cm²	**23.19**	**17.80**	**57.86**	**38.81**	**19.81**	**157.47**
Percentage of Recovery						**67.31**

Sociedad las palmas ltda.

DISCHARGE AND DRIFT TESTING

TREATMENT	$T_2 P_1$ (POTENZOL)	**TEST No.**	1	**LOCATION**	San Jose del Guaviare
DATE	Feb. 12/03	**FLIGHT ALTITUDE**	30 m.	**TIME**	9:00 a 11 a.m.
TYPE OF AIRPLANE	T-65	**WIND VELOCITY**		**NOZZLE**	Aqua-flux

CARD No.	< 300 µ	301 - 500 µ	501 - 1000 µ	1001 - 2000 µ	> 2000 µ	TOTAL DROPS/cm²
19 N	0.00	0.00	0.00	0.00	0.00	0.00
18 N	0.00	0.00	0.00	0.00	0.00	0.00
17 N	0.00	0.00	0.00	0.00	0.00	0.00
16 N	0.00	0.00	0.00	0.00	0.00	0.00
15 N	0.00	0.00	0.00	0.00	0.00	0.00
14 N	1.00	0.33	0.00	0.33	0.00	1.66
13 N	0.00	0.00	0.00	0.00	0.00	0.00
12 N	0.00	0.00	0.00	0.33	0.00	0.33
11 N	0.00	0.00	0.66	0.00	0.00	0.66
10 N	0.00	0.33	0.00	0.00	0.00	0.33
9 N	0.00	0.00	0.33	2.00	0.00	2.33
8 N	26.66	4.00	3.66	2.33	0.33	36.98
7 N	0.00	0.66	1.00	2.33	0.66	4.65
6 N	10.33	1.00	2.66	1.00	1.00	15.99
5 N	12.00	1.33	1.00	2.00	0.00	16.33
4 N	39.33	5.33	3.66	1.33	0.00	49.65
3 N	1.00	1.00	2.66	2.00	0.33	6.99
2 N	9.33	2.33	2.00	0.66	0.33	14.65
1 N	4.33	2.33	2.00	1.33	0.33	10.32
0	4.66	2.00	1.66	1.33	0.33	9.98
1 S	2.33	0.33	2.66	1.00	1.66	7.98
2 S	1.33	0.00	0.66	0.66	0.66	3.31
3 S	6.33	1.33	1.33	1.33	0.66	10.98
4 S	1.66	1.00	1.00	2.00	1.00	6.66
5 S	1.33	0.00	2.00	1.00	1.00	5.33
6 S	1.00	0.00	0.00	1.33	1.00	3.33
7 S	6.33	2.00	3.33	2.00	0.00	13.66
8 S	1.66	0.66	0.66	1.00	0.66	4.64
9 S	3.66	0.33	2.00	0.66	1.00	7.65
10 S	2.00	1.00	3.00	1.33	0.00	7.33
11 S	0.00	0.00	0.66	0.33	0.00	0.99
12 S	3.00	0.66	1.66	0.00	0.00	5.32
13 S	0.33	0.33	2.33	0.66	0.00	3.65
14 S	2.00	4.66	1.66	0.00	0.00	8.32
15 S	7.33	3.00	2.33	0.00	0.00	12.66
16 S (a 5m)	0.00	0.00	1.00	0.00	0.00	1.00
17 S (a 10m)	0.00	0.33	1.33	0.00	0.00	1.66
18 S (a 15m)	0.00	0.00	0.33	0.00	0.00	0.33
19 S (a 20m)	0.66	0.66	0.66	0.00	0.00	1.98
20 S (a 25m)	0.00	0.00	1.33	0.00	0.00	1.33
TOTAL	**149.59**	**36.93**	**51.22**	**30.27**	**10.95**	**278.96**
AVERAGE	**4.40**	**1.09**	**1.51**	**0.89**	**0.27**	**8.20**
µg/cm²	**6.16**	**4.55**	**31.31**	**44.86**	**31.47**	**118.35**
Porcentage of Recovery						**50.58**

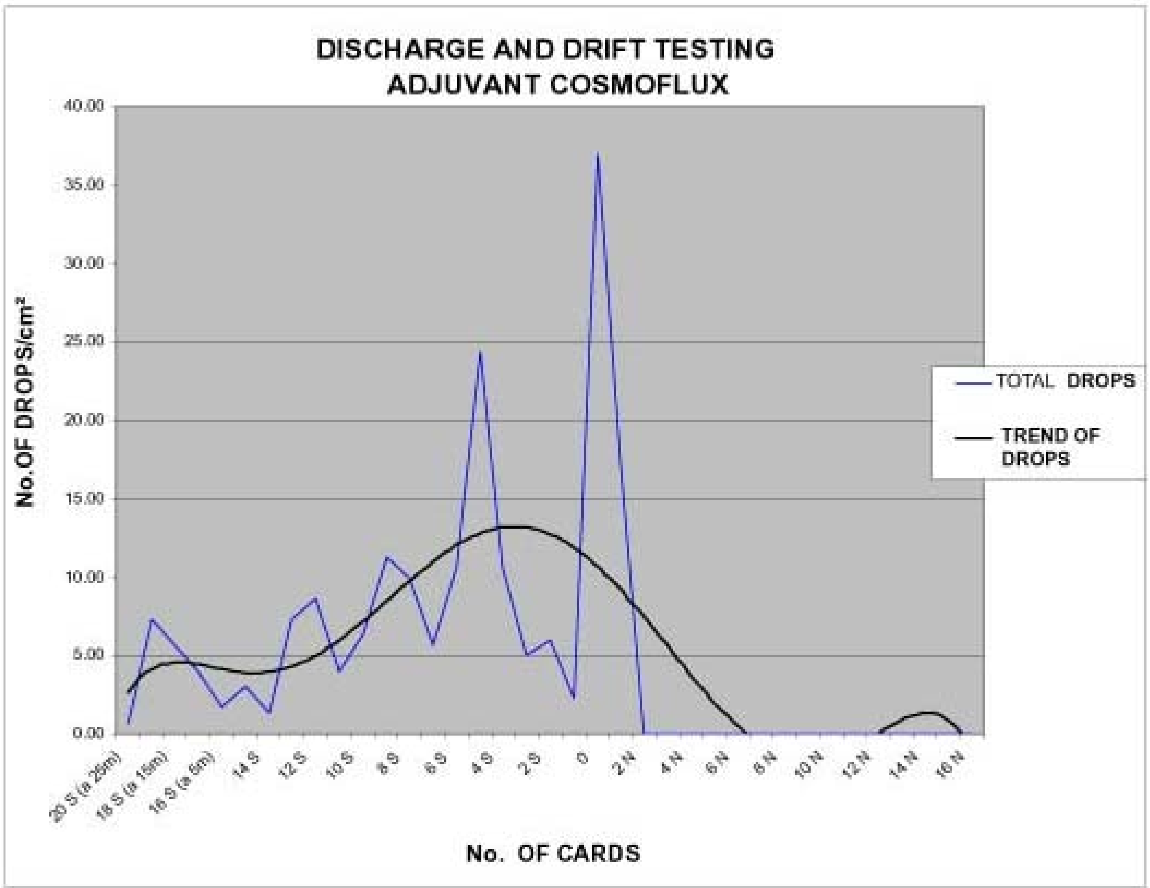
25

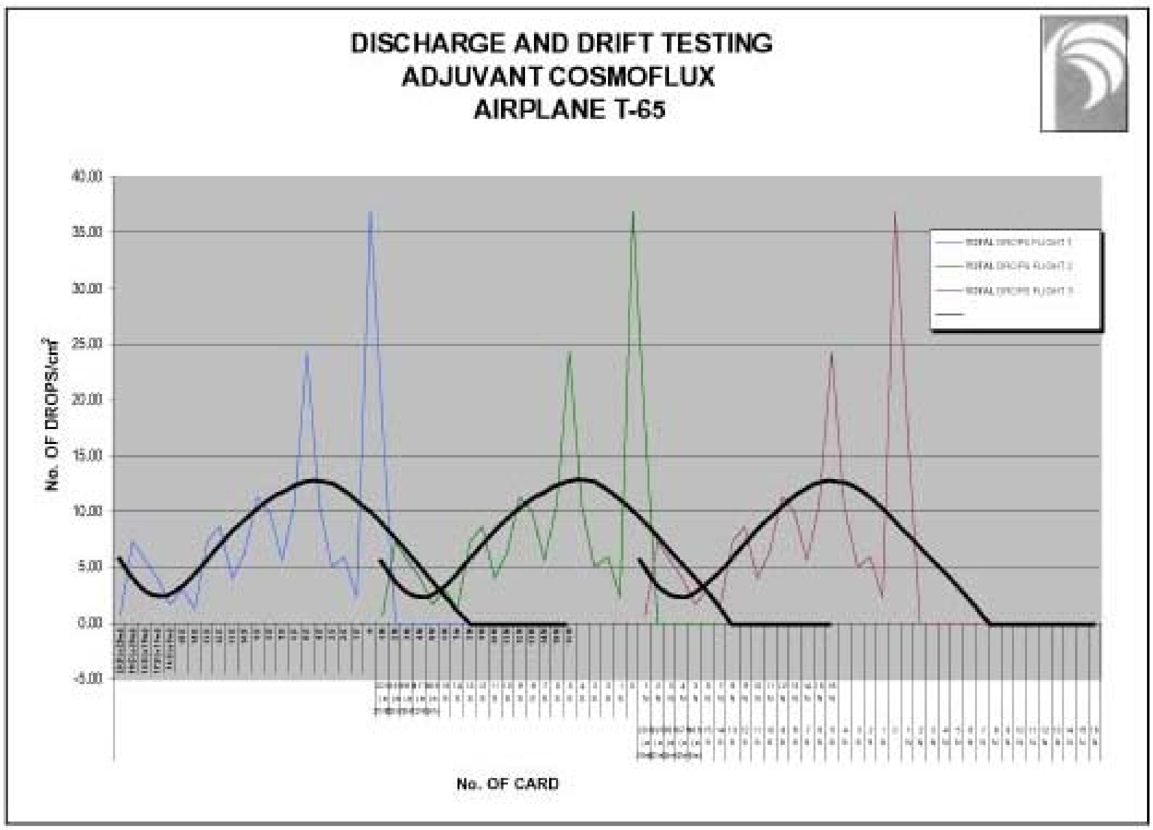
DISCHARGE AND DRIFT TESTING

TREATMENT T_3 P_1 (INEXA)	**TEST No.** 1	**LOCATION** San Jose del Guaviare	
DATE Feb. 12/03	**FLIGHT ALTITUDE** 30 m.	**TIME** 9:00 a 11 a.m.	
TYPE OF AIRPLANE T-65	**WIND VELOCITY**	**NOZZLE** Aqua-flux	

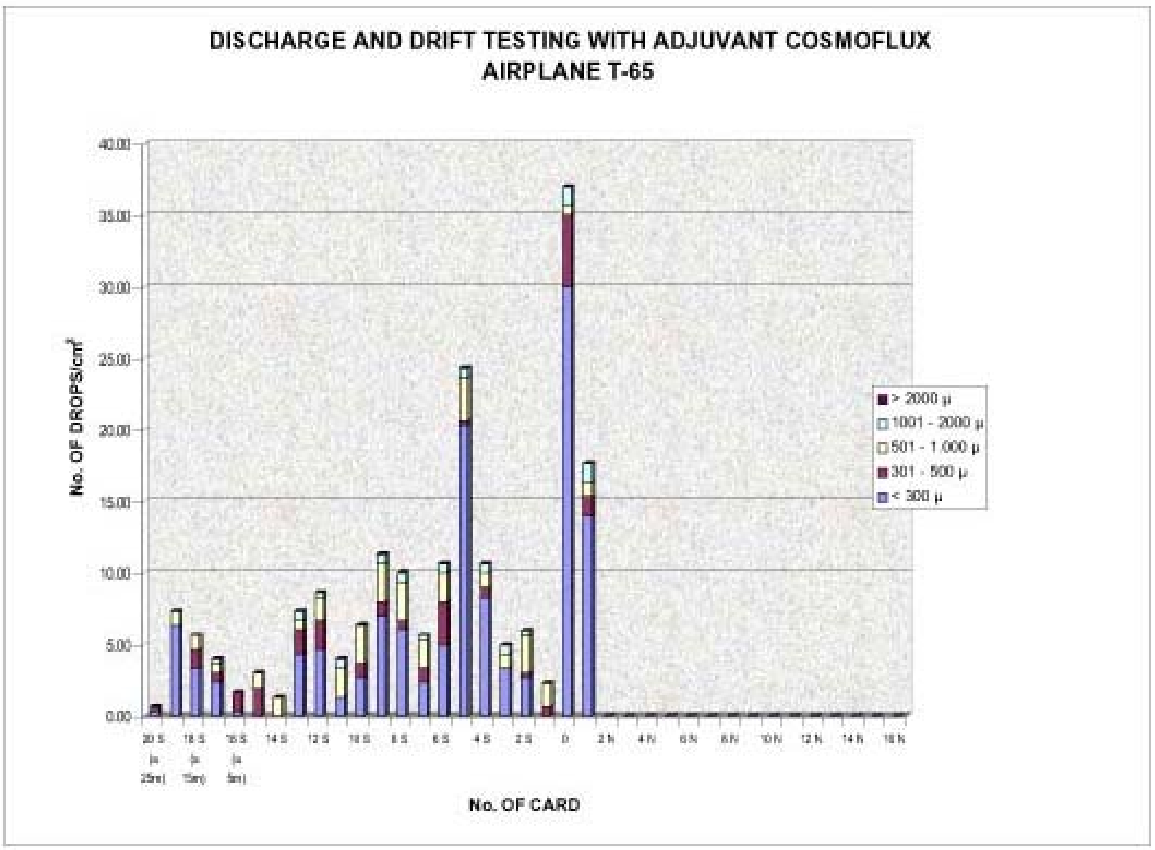
CARD No.	< 300 µ	301 - 500 µ	501 - 1000 µ	1001 - 2000 µ	> 2000 µ	TOTAL DROPS/cm²
20 S (a 25m)	2.66	2.66	0.33	0.00	0.00	5.65
19 S (a 20m)	3.00	2.66	1.33	0.00	0.00	6.99
18 S (a 15m)	5.33	3.33	1.33	0.00	0.00	9.99
17 S (a 10m)	5.00	3.00	1.00	0.33	0.00	9.33
16 S (a 5m)	5.33	2.66	0.66	0.33	0.00	8.98
15 S	2.33	2.33	1.00	1.33	0.00	6.99
14 S	3.66	4.33	2.33	0.66	0.00	10.98
13 S	2.33	2.33	2.00	1.66	0.00	8.32
12 S	5.66	4.00	2.66	0.00	0.00	12.32
11 S	2.33	2.66	1.00	1.66	0.00	7.65
10 S	16.33	2.66	1.66	0.66	0.00	21.31
9 S	3.33	3.66	1.66	0.33	0.00	8.98
8 S	3.33	1.00	2.00	0.66	0.33	7.32
7 S	4.00	2.66	3.33	0.66	0.00	10.65
6 S	12.66	4.33	3.33	0.66	0.66	21.64
5 S	28.33	5.33	3.00	0.66	0.00	37.32
4 S	18.33	7.33	4.66	0.00	0.33	30.65
3 S	22.66	6.00	4.33	0.00	0.00	32.99
2 S	14.33	2.66	4.33	0.66	0.00	21.98
1 S	16.00	4.33	3.00	0.00	0.00	23.33
0	6.00	2.66	4.33	1.66	0.33	14.98
1 N	0.00	0.00	0.33	0.66	0.66	1.65
2 N	3.00	1.00	0.33	0.00	0.33	4.66
3 N	0.00	0.00	0.00	0.00	0.00	0.00
4 N	0.00	0.00	0.00	0.00	0.00	0.00
5 N	0.00	0.33	0.00	0.00	0.00	0.33
6 N	0.00	1.00	0.00	0.00	0.00	1.00
7 N	0.00	0.33	0.00	0.00	0.00	0.33
8 N	0.66	0.66	0.00	0.00	0.00	1.32
9 N	0.00	0.66	0.00	0.00	0.00	0.66
10 N	0.00	0.33	0.00	0.00	0.00	0.33
11 N	1.33	0.33	0.00	0.00	0.00	1.66
12 N	0.00	0.33	0.33	0.00	0.00	0.66
13 N	0.00	0.66	0.00	0.00	0.00	0.66
14 N	0.00	0.33	0.33	0.00	0.00	0.66
15 N	0.00	0.33	0.33	0.00	0.00	0.66
16 N (a 5m)	0.00	0.66	0.00	0.00	0.00	0.66
17 N (a 10m)	4.00	0.66	0.00	0.00	0.00	4.66
18 N (a 15m)	0.00	0.66	0.00	0.00	0.00	0.66
TOTAL	**191.92**	**80.85**	**50.92**	**12.58**	**2.64**	**338.91**
AVERAGE	**5.19**	**2.19**	**1.38**	**0.34**	**0.07**	**9.16**
µg/cm²	**7.27**	**9.15**	**26.62**	**17.84**	**8.15**	**69.03**
Percentage of Recovery						**30.05**

Sociedad las palmas ltda.

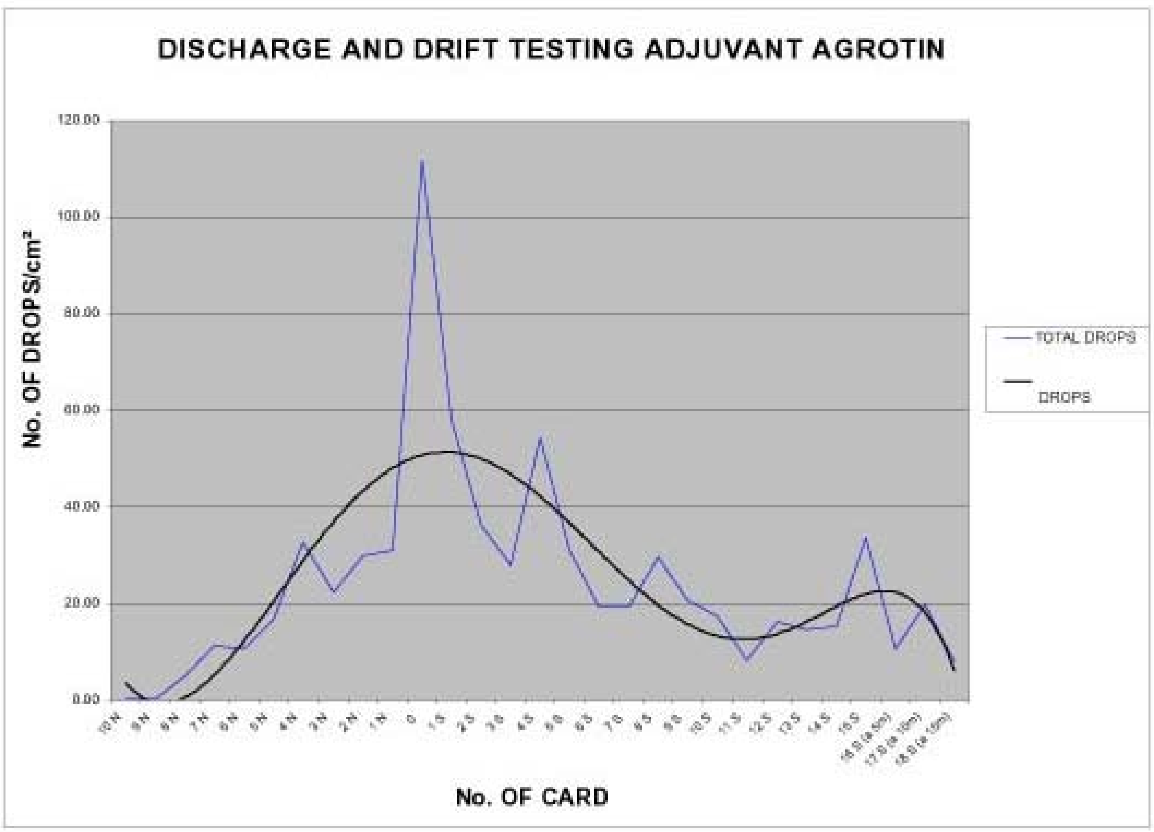


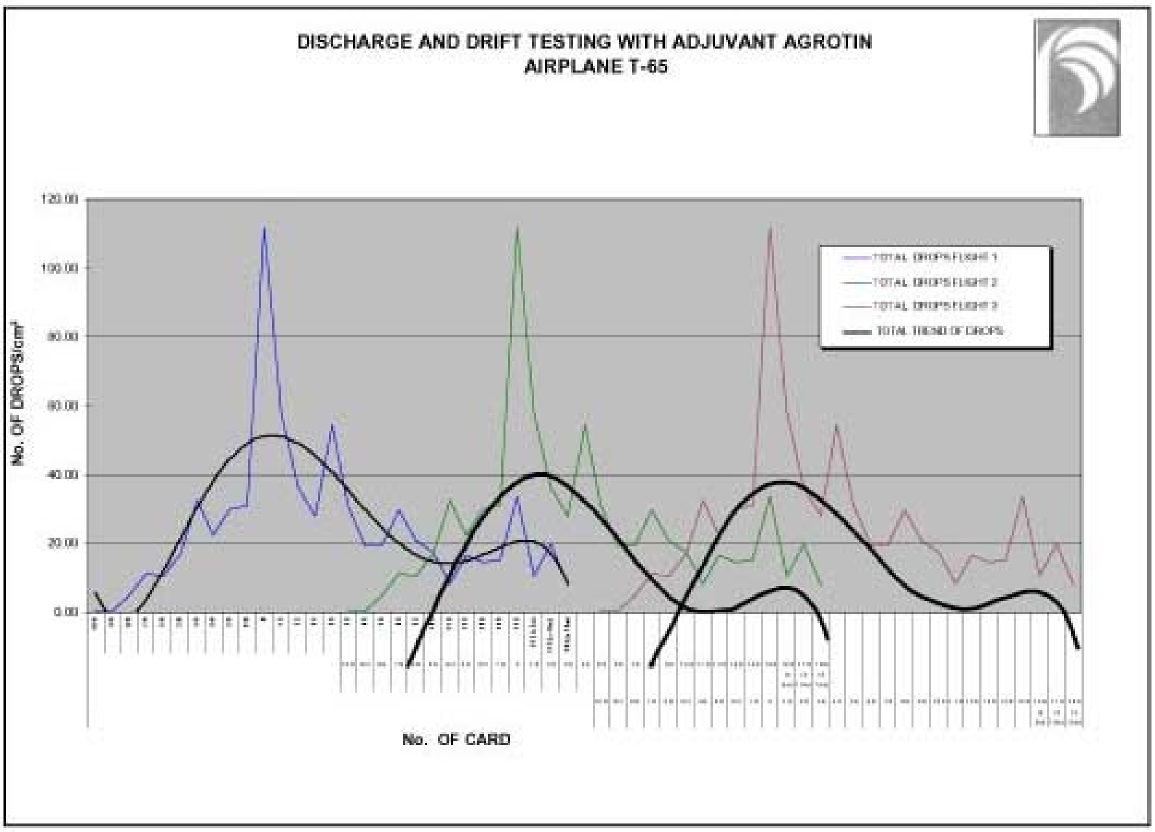

DISCHARGE AND DRIFT TESTING
ADJUVANT COSMOFLUX
AIRPLANE T-65
No. OF DROPS/cm²
No. OF CARD

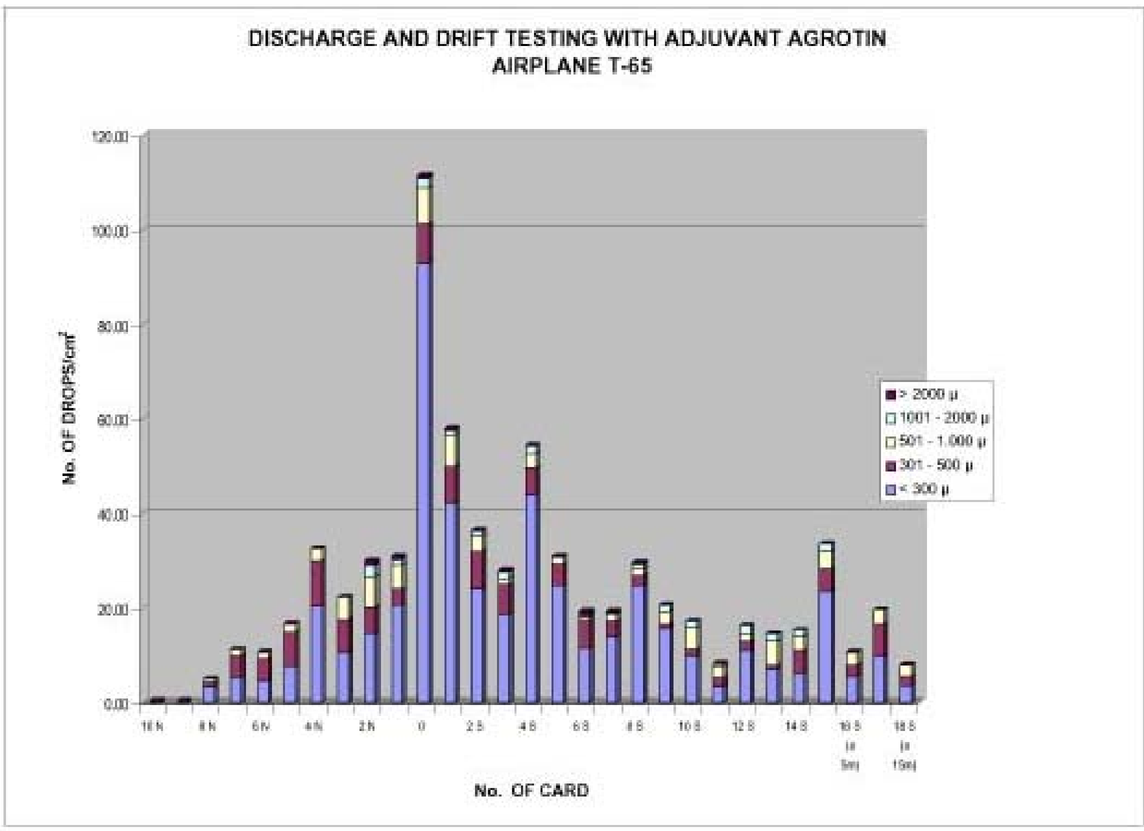
28

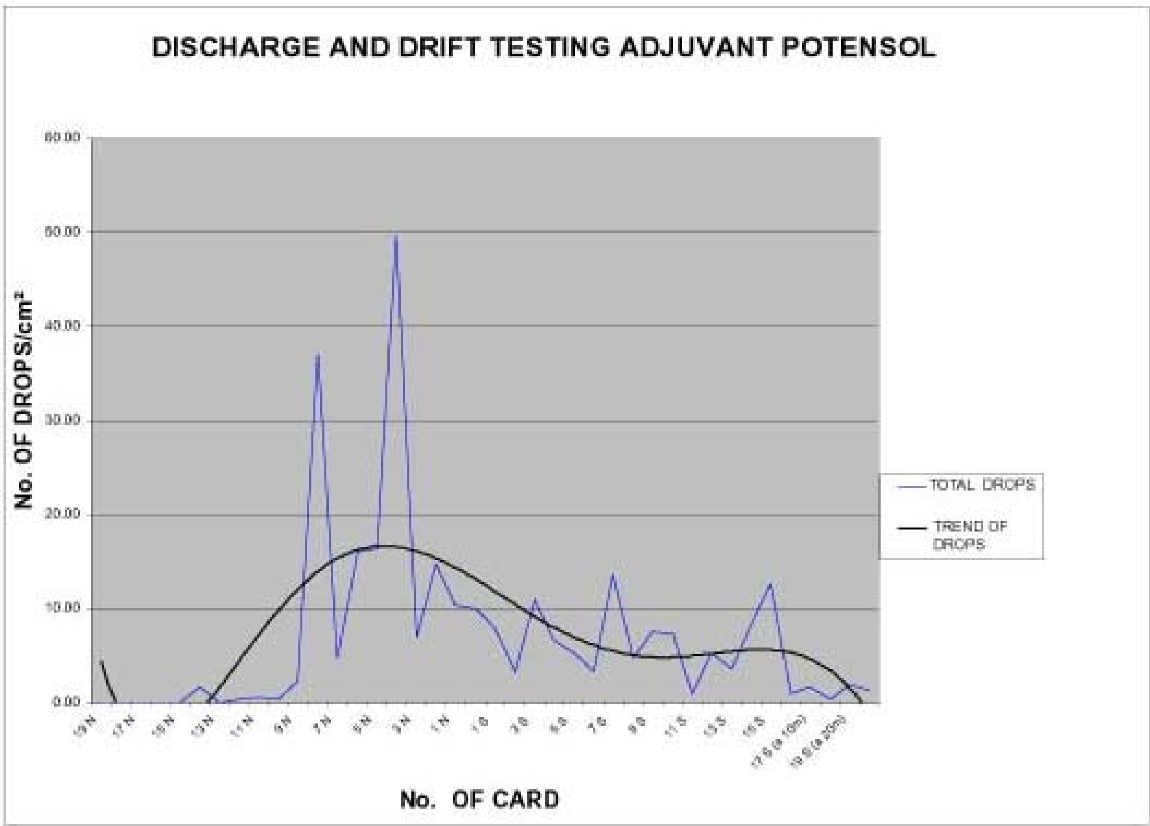

DISCHARGE AND DRIFT TESTING WITH ADJUVANT COSMOFLUX
AIRPLANE T-65
No. OF DROPS/cm²
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
> 2000 μ
1001 - 2000 μ
501 - 1.000 μ
301 - 500 μ
< 300 μ
20 S
14 S
12 S
4 S
2 S
0
2 N
4 N
6 N
10 N
12 N
No. OF CARD

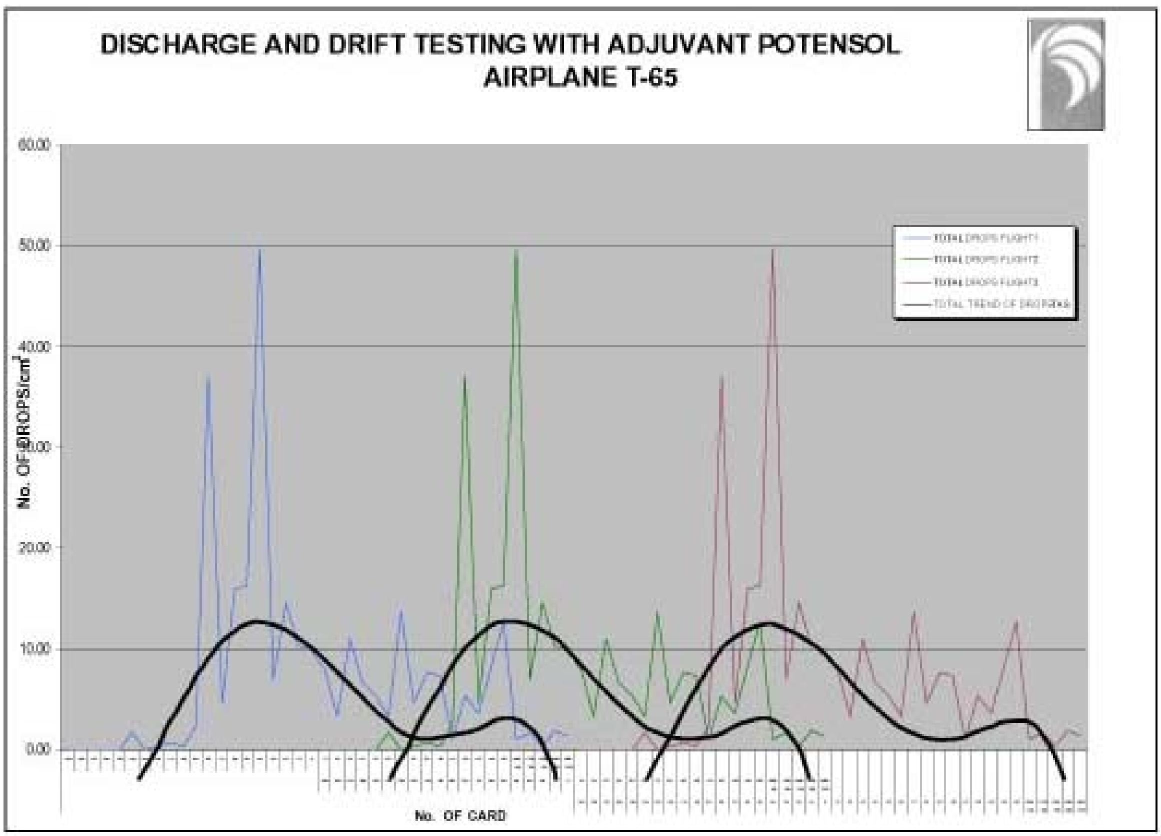
Sociedad las palmas ltda.

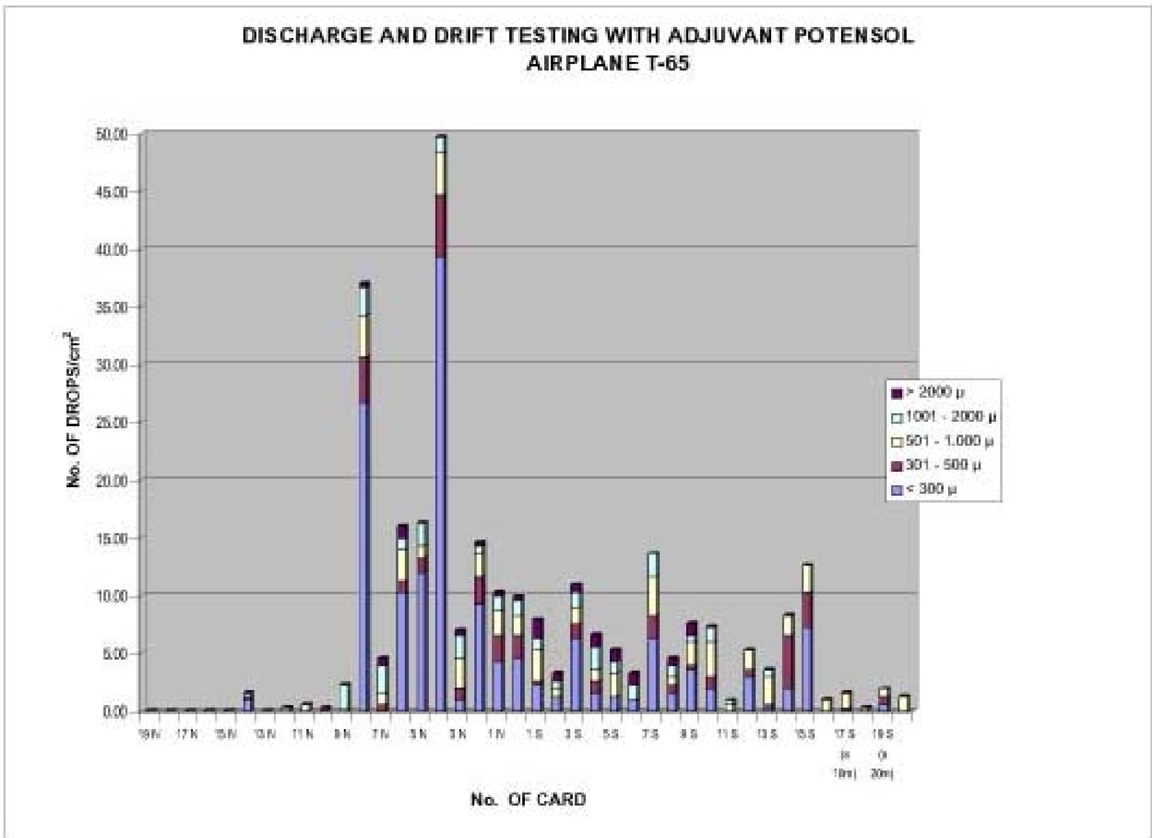


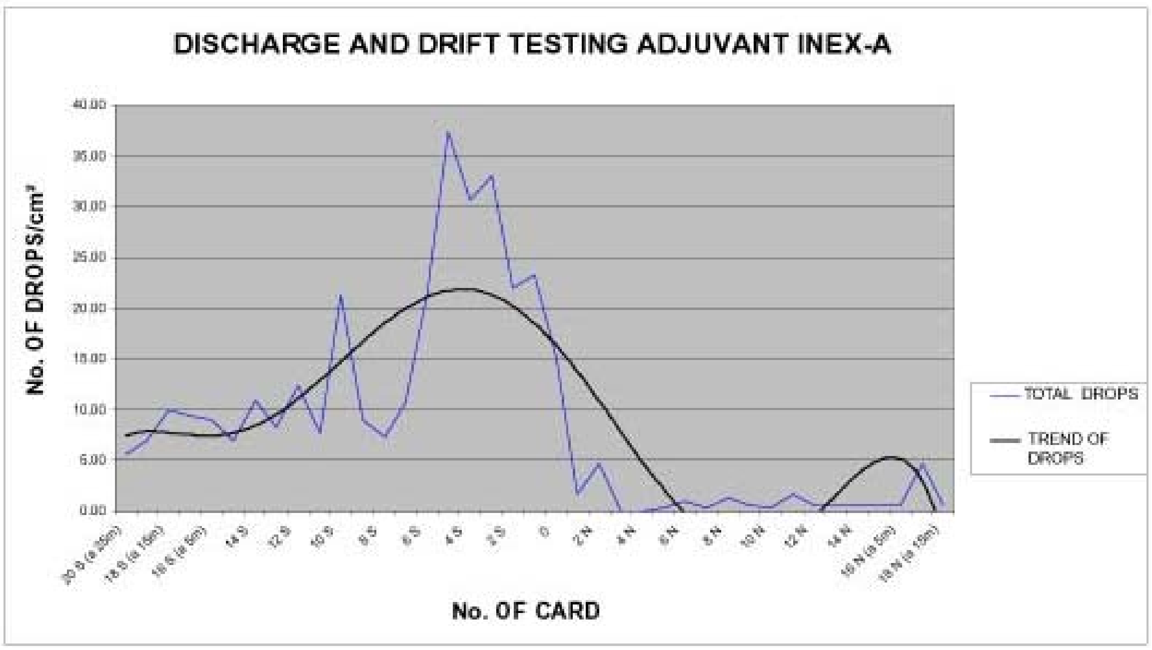

DISCHARGE AND DRIFT TESTING WITH ADJUVANT AGROTIN
AIRPLANE T-65
No. OF DROPS/cm²
No. OF CARD
TOTAL DROPS FLIGHT 1
TOTAL DROPS FLIGHT 2
TOTAL DROPS FLIGHT 3
TOTAL TREND OF DROPS


DISCHARGE AND DRIFT TESTING WITH ADJUVANT AGROTIN
AIRPLANE T-65
No. OF DROPS/cm²
120,00
100,00
80,00
60,00
40,00
20,00
0,00
> 2000 µ
1001 - 2000 µ
501 - 1.000 µ
301 - 500 µ
< 300 µ
No. OF CARD

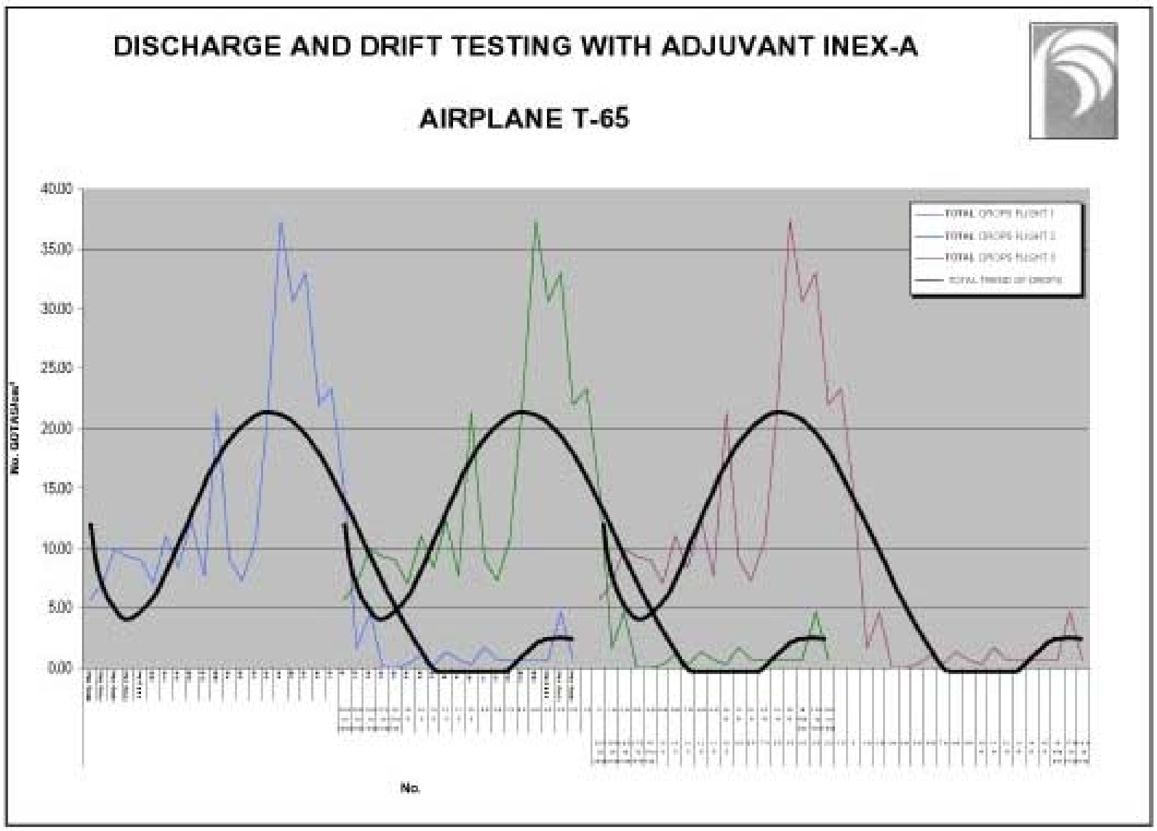

DISCHARGE AND DRIFT TESTING ADJUVANT POTENSOL
No. OF DROPS/cm²
No. OF CARD
TOTAL DROPS
TREND OF DROPS
0.00
10.00
20.00
30.00
40.00
50.00
60.00

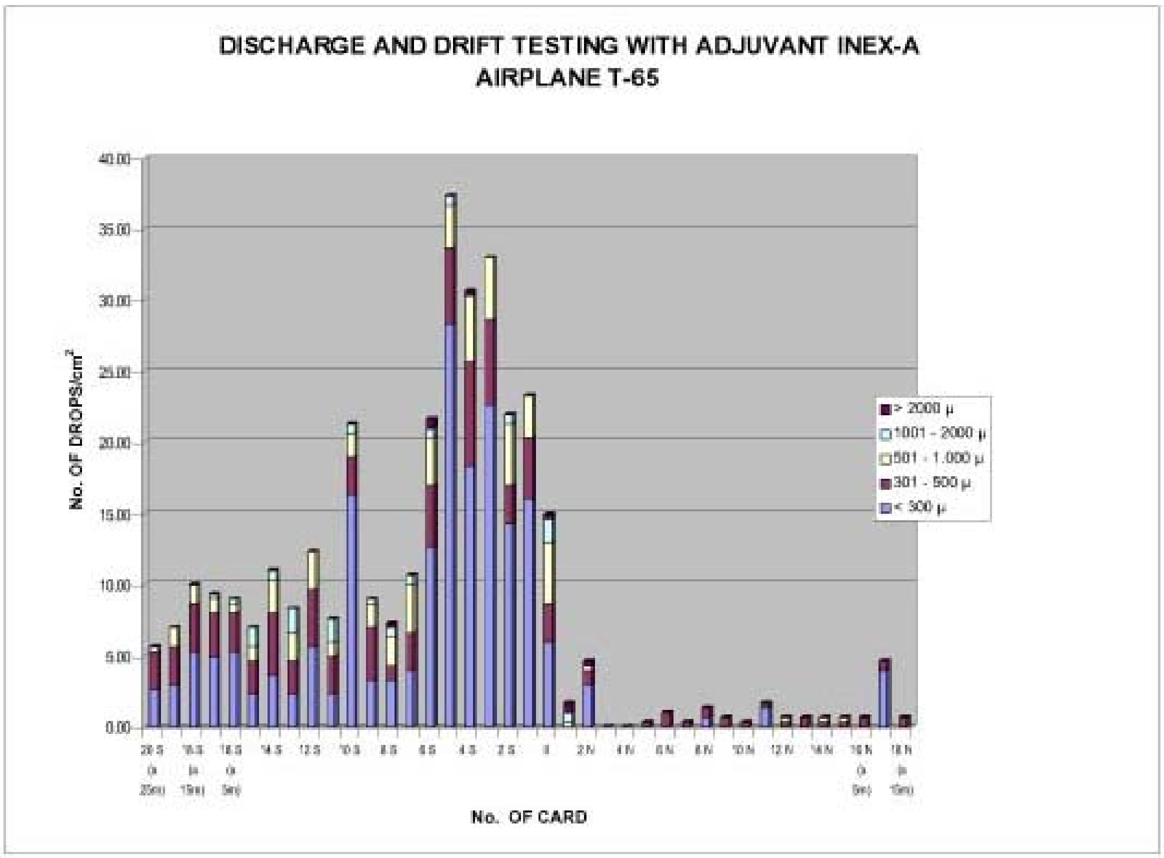

DISCHARGE AND DRIFT TESTING WITH ADJUVANT POTENSOL
AIRPLANE T-65
60.00
50.00
40.00
20.00
10.00
0.00
No. OF DROPS/cm²
No. OF CARD


DISCHARGE AND DRIFT TESTING WITH ADJUVANT POTENSOL
AIRPLANE T-65
No. OF DROPS/cm²
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
> 2000 µ
1001 - 2000 µ
501 - 1,000 µ
301 - 500 µ
< 300 µ
19 N
17 N
15 N
13 N
11 N
9 N
7 N
5 N
3 N
1 N
1 S
3 S
5 S
7 S
9 S
11 S
13 S
15 S
17 S
19 S
No. OF CARD



DISCHARGE AND DRIFT TESTING ADJUVANT INEX-A
No. OF DROPS/cm²
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
14 S
12 S
10 S
0
2 N
4 N
6 N
8 N
10 N
12 N
14 N
No. OF CARD
TOTAL DROPS
TREND OF DROPS


DISCHARGE AND DRIFT TESTING WITH ADJUVANT INEX-A
AIRPLANE T-65
40,00
35,00
30,00
25,00
20,00
15,00
10,00
5,00
0,00
No.


DISCHARGE AND DRIFT TESTING WITH ADJUVANT INEX-A
AIRPLANE T-65
No. OF DROPS/cm²
No. OF CARD
> 2000 µ
1001 - 2000 µ
501 - 1.000 µ
301 - 500 µ
< 300 µ
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00

The Project Technical Director was concerned that the labor did not include studies related to the effect of certain properties of each adjuvant concerned, but, taking into account that the terms in the Technical Protocol could not be modified after approval, the discharge testing had to be done leaving various technical aspects out and without including any comparison spraying for data of a discharge using a formula with a 10.4-liter glyphosate mix without adjuvants.

Reviewing the data in the Charts and Graphs in Section 7.1.1 herein enabled us to identify various results of great importance for any spraying program. Among them, we highlight the following:

a) Although the environmental conditions under which the discharge, evaporation, and drift testing was done were not ideal, they were not outside the acceptable margins adopted in the Colombian National Police Anti-Narcotics Division Illicit Crop Eradication Program.

b) There was much variation in the "losses" of the product due to evaporation, drift or other causes, in the mixes being tested, but we have no adequate evidence to identify the magnitude and individual causes of such variation and, with no no facts to the contrary, we could think that some portion of the variations may be due to some of the physical-chemical characteristics of the adjuvants used, including the effect of differences in the quantities of the active ingredient applied in the tested mixes. Also, the lack of results of comparison to a glyphosate-based treatment without adjuvants does not enable us to know to what point the reducing effect of the surface tension of some or all of the adjuvants tested could have acted.

c) The greatest losses occurred in the glyphosate mix using the adjuvant Cosmoflux 411 F (the Commercial Control Treatment), representing losses of 72.67% and the least losses, based on the data available, was 32.69% using the glyphosate mix with the adjuvant Agrotin, according to the numerical data obtained. The mixes using the adjuvants Potenzol and Inex-A gave intermediate values, as may be appreciated by reviewing the average data on the actual discharges, which appears in the charts and graphs included in this section of the report.

d) The results of the testing enabled us to calculate that the theoretical spray discharge should be 0.250 mg/cm^2 of mix, in which 16% would correspond to the equivalent acid of glyphosate, that is to say, 0.0374 mg/cm^2, or 21.33 % of isopropylamine salt, that is to say, 0.04992

mg/cm^2. Reviewing the records of the original readings and analyzing the water-sensitive paper cards enabled us to calculate that this value was not reached in any of the spraying operations, as may be seen below.

CHART 7.1.1. d 1

DISCHARGE CALCULATED BY PROCESSING THE DATA FROM THE CARDS

	mg. of Recovery	% of Recovery
Glyphosate with Cosmoflux 411 F	0.06397 mg/cm^2	27.33% recovery
Glyphosate with Agrotin	0.15747 mg/ cm^2	67.31% recovery
Glyphosate with Potensol	0.11837 mg/cm^2	50.58% recovery
Glyphosate with Inex-A	0.07034 mg/cm^2	30.05% recovery

e) Based on the experiences of aerial spraying using pesticides in phytosanitary programs (Aerial Application of Agrochemicals, 1979), we already expected the spray particles with less than 200-micron average diameters to be very susceptible to the effect of evaporation, if the discharge from the spraying equipment is done from more than 5 meters of altitude, and especially if conditions of temperature, relative humidity, and rising or transversal air currents facilitate evaporation. This phenomenon appears to have occurred in some of the test spraying done at the beginning of the San José del Guaviare Airport runway, if we keep in mind that no stains less than 250 microns in diameter were identified on the water-sensitive paper cards. The experiences in phytosanitary handling also indicated to us that even in the most refined spraying equipment calibration processes (8, 8a. – Ciba-Geigy), a good portion of the particles of the sprayed material breaks down into particles smaller than 200 microns in diameter, which can evaporate in a few seconds while falling to the ground. Due to the above, it was not too adventurous for us to estimate that most of the particles smaller than 300 microns in diameter would not reach the surface of the water-sensitive paper cards and that they were lost due to evaporation or transversal drift during their fall, before reaching the ground.

f) In one part of the testing (Cosmoflux and Inex-A), without a doubt, we saw the phenomenon of drift evidenced by a lateral shift of some stains on the paper of up to 10 meters of distance, from the central axis of the spray swath, due to a transversal wind current. We were able to certify the shift of a portion of the spray particles by seeing that some cards did not intercept the spray particles.

g) The Official Protocol terms of reference established that the adjuvants should be added in a dose equal to 1% of the mix being used, without taking into account the percentage of the active ingredient in the commercial presentation of each commercial formula. Using these adjuvants, without taking into account variations in the concentration of the active ingredient, did not allow us to measure any effect related to this aspect, although the variations in the concentration were very small.

h) Although we could not positively identify the causes that determined the better behavior of the glyphosate mix with the adjuvant Agrotín, there is sufficient justification to make us think that the least spray losses witnessed in the 30-meter fall from the spraying equipment nozzles to the surface of the intercepting water-sensitive paper cards occurred using the glyphosate mix with the adjuvant Agrotín. We would also like to mention that the adjuvant Agrotín seems to be the element that gave the best protection against losses due to evaporation and drift, although we must acknowledge that the particles less than 300 microns in diameter disappeared during the fall and therefore could not reach the respective intercepting cards.

7.2 RESULTS OF PLANT CONTROL IN COCA CROP PLOTS

Charts 7.2. C 1 and 7.2. C 2 show the original data regarding the percentage of mortality estimated in the evaluation processes carried out 30, 60, 90, and 180 days after the date of the spraying and the results of the Statistical Analyses, respectively. The figures in these two charts serve as a basis for justifying the conclusions and comments that we make in later paragraphs.

ORIGINAL READINGS ON MORTALITY PERCENTAGES ON GROUPS FROM 10 TO 20 COCA PLANTS IN EACH REPLICATION

REFERENCE EXPLANATORY NOTES

1. The time allowed by the military support groups for us to stay in each plot was 3 to 5 minutes.
2. The readings were visual by groups of plants, using one or more scales adopted by ALAM. Depending on the characteristics of each plot, 3 and 5 readings were taken of each group of plants in each replication.
3. The plants in plots commercially treated were read as Blind Sample Treatment.
4. The DNE technical representative was allowed to go into the plot only for the 90-day reading.

30-DAY READINGS IN PLOTS 189 (COMMERCIAL BLIND SAMPLE), 156, 155 AND 136

March 26, 2003

Commercial Control Treatment Plot 189 Treatment T_1
Cosmoflux 411 F

	Plant Rating		Mortality %	
First Replication :	80-85-95-75-80	:	Average	83.00%
Second Replication:	85-80-80-100-75	:	Average	84.00%
Third Replication :	80-70-80-95-85	:	Average	82.00%

First Plot 156 Treatment T_2
(Agrotín SL- Density 1.10- Concentration)

	Plant Rating		Mortality %	
Replication I	76-65-70-95-90	= 395/5	= Average	79.00%
Replication II	95-85-86-90	= 355/4	= Average	88.75%
Replication III	91-88-89-90	= 358/4	= Average	89.50%

Second Plot 155 Treatment T_3
(Potenzol Density 1.035- Concentration)

	Plant Rating		**Mortality %**	
Replication I	100-100-98-99	= 397 /4	= Average	99.25%
Replication II	100-100-87.5	= 287.5 /3	= Average	95.83%
Replication III	100-95-95	= 290 /3	= Average	96.66%

Third Plot 136 Treatment T_4
(Inex A- Density 1.05- Concentration)

	Plant Rating		**Mortality %**	
Replication I	80-85-85-90	= 340 /4	= Average	85.00%
Replication II	88-80-80-	= 248.5 /3	= Average	82.75%
Replication III	80-85-95-80	= 340 /4	= Average	85.00%

60-DAY READINGS IN PLOTS 189, 156, 155, and 136

April 28-30, 2003

Commercial Control Treatment Plot Treatment T_1 **(after 60 days)**
Cosmoflux 411 F.

	Plant Rating		**Mortality %**	
First Sector :	90-75-85-80-95-	:	Average	85.00%
Second Sector :	60-80-90-80-95-	:	Average	81.00%
Third Sector :	75-75-80-85-100	:	Average	83.00%

First Plot 156 Treatment T_2

	Plant Rating		**Mortality %**	
Replication I	76-65-70-95-90	= 395/5	= Average	79.00%
Replication II	95-85-86-90	= 355/4	= Average	88.75%
Replication III	91-88-89-90	= 358/4	= Average	89.50%

The visit started when the helicopter dropped the evaluators into Plot 156. They did not take new mortality readings but decided to wait until the 90-day readings because they noticed that many green leaves (estimated at 3% of the original quantity of leaves) were in a recovery process, assisted and stimulated by the coca growers themselves. Some crop sectors were very affected and the growers themselves had not replanted there. Normal new sprouts were not found in that sector.

Second Plot 155 Treatment T_3

(This Plot could not be found and, due to the limited time for which we had the aircraft, we decided to wait until the next reading.)

Third Plot 136 Treatment T_4

	Plant Rating	**Mortality %**	
Replication I:	70-78-80-90-75	Average	78.6%
Replication II:	68-80-75-70-75	Average	73.6%
Replication III:	75-85-75-75	Average	77.5%

90-DAY READINGS IN PLOTS 189(Commercial Control Treatment), 156, 155, and 136

May 21 –22, 2003

Commercial Control Treatment Plot (189) - Treatment T_1 **90 days after treatment**

According to the evaluation readings, more than 96.6% of the Plot was destroyed.

	Plant Rating	**Mortality %**	
First Replication	100- 85-100	Average	= 95.00%
Second Replication	100-100-95	Average	= 98.33%
Third Replication	100-100-90	Average	= 96.66%
		General Average: =	**96.66%**

Plot 156 Treatment T_2

	Plant Rating	**Mortality %**	
First Replication	100-100-100	Average	= 100.00%
Second Replication	100-75-75-50	Average	= 75.00%
Third Replication	50-65-60	Average	= 58.33%
		General Average:	**= 75.00%**

There were attempts to recover the first portion of the Plot using plant fertilizer and agronomic labors; some new base sprouts were seen. On the edge of the Plot, where the spraying was effective, the plants were dead. Our general evaluation of the Plot is that lethal affectation was 70% to 75 %.

Plot 155 Treatment T_3

This Plot was abandoned and we found it full of weeds. We accepted the first reading adding 10% damage. We calculated 90% to 95% destruction.

	Plant Rating	Mortality %	
First Replication	100-100-100	Average :	= 100.00%
Second Replication	100-90	Average :	= 95.00%
Third Replication	100-90-95	Average :	= 95.00%
		General Average: =	**96.66%**

Plot 136 Treatment T_4

There is some significant recovery in some portions of this Plot although the new sprouts are abnormal and have little probability of total recovery. This was due to the effect of the vegetation covering. The plantain plants showed a good degree of recovery.

	Plant Rating	Mortality %	
First Replication	50-65-80	Average	= 65.00%
Second Replication	100-75-80	Average :	= 85.00%
Third Replication	90-95-70	Average :	= 85.00%
		General Average: =	**78.33%**

180-DAY READINGS IN PLOTS 189 (Commercial Control Treatment), 156, 155 and 136

AUGUST 27, 2003

Plot 189 Treatment T_1
(Commercial Control Treatment)

Plant Rating	Mortality %
Abandoned, had weeds	100%

Plot 156 Treatment T_2

Plant Rating	Mortality %
Abandoned, had weeds	100%

Plot 155 Treatment T_3

	Plant Rating	Mortality %
	Abandoned, had weeds	100%

Third Plot 136 Treatment T_4

	Plant Rating	Mortality %
	Abandoned, had weeds	100%

180-DAY VISIT AND EVALUATIONS – August 26 and 27, 2003

We made the evaluations from the air, due to the lack of appropriate aircraft to enable us to physically visit the Plots and observe previously sprayed crops.

We took photographs from the helicopters and confirmed that the Plots that had shown had presented some plants partially affected during our May visit were now abandoned. It is worth highlighting that, for example, the Blind Sample Plot treated with glyphosate and Cosmoflux seemed to have been raked, as if it were in the initial stages of replanting a new coca crop or some other type of crop.

For the purpose of the Statistical Analysis, one alternative could be to use the last evaluation data gathered 90 days after the treatment date.

AGRONOMIC EFFICACY TESTING OF THE 10.4 L/ha DOSE
WITH 4 DIFFERENT ADJUVANTS
ANALYSIS OF VARIANCE

A.1 GROUPING OF DATA FROM THE FIRST, SECOND AND THIRD EVALUATIONS

COCA PLANT MORTALITY PERCENTAGE DATA
90 DAYS AFTER SPRAYING

REPETITIONS	TREATMENTS					
	T_1	T_2	T_3	T_4	Total	Average
I	87.67	86.00	99.63	76.20	349.50	87.38
II	87.77	84.17	95.42	80.45	347.81	86.95
III	87.22	79.11	95.83	82.50	344.66	86.17
Total Treatments	**262.66**	**249.28**	**290.88**	**239.15**	**1,041.97**	**260.4935**
Average	**87.55**	**83.09**	**96.96**	**79.72**	**347.32**	**86.83**

T_1: Mix with adjuvant Cosmoflux
T_2: Mix with adjuvant Agrotín
T_3: Mix with adjuvant Potenzol
T_4: Mix with adjuvant INEX-A

2. ANALYSIS OF VARIANCE (ANOVA)

Variation Source	Error Buffer	Sum of Squares	SEM	Calculated F	F critic level
Repetitions	2	3.02	1.51	0.167	5.14 NS
Treatment	3	503.11	167.70	14.13	4.76 *
Experimental Error	6	54.06	9.01		
Total	11	560.19	178.22		

NS: Non-significant
* Significant
** Highly Significant

Number of means: 4
Error buffer: 6
Error SEM = 9.01

3. DUNCAN TEST

Null hypothesis: Ho =$m_{T1} = \mu_{T2} = \mu_{T3} = \mu_{T4}$

Alternate hypothesis H_1: There is at least one significant difference between treatment averages µi µn

a. **S**x estimator calculation (Experimental SEM) in the VA ANA table.

$$S X = \sqrt{\frac{9.01}{3}} = 1.73$$

b. From the table with Duncan comparison values we obtained the degree of error buffer and the number of treatments.

- Error buffer (EB) = 6
- # of treatments = 4

EB	TREATMENTS		
	T_2	T_3	T_4
6	3.461	3.587	3.619

c. Duncan comparison factor calculation (D * Sx) for each one of the comparison values

- The treatments are organized in a hierarchical manner

VALUES	TREATMENTS		
	T_3	T_1	T_2
Duncan Value (D) 0.5	3.461	3.587	3.619
Sx Value	1.73	1.73	1.73
Duncan Comparison Factor (D * Sx)	5.987	6.205	6.261

d. Determining significant differences among treatment averages

TABLE OF DIFFERENCES AMONG AVERAGES

TREATMENTS					
	T_3 96.96	**T_1 87.55**	**T_2 83.09**	**T_4 79.72**	**Duncan Comparison Factor**
T_3: 96.96	0	9.41*	13.87*	17.24 *	-
T_1: 87.55		0	4.46	7.83NS	6.261
T_2: 83.09			0	3.37NS	6.205
T_4: 79.72				0	5.987

According to the above table, the result is as follows:

T_3	T_1	T_2	T_4
A	B	B	C

This means that Treatment 3 containing the glyphosate mix with adjuvant Potenzol shows the highest agronomic efficacy (96.96%) as compared to the other three treatments 90 days after spraying. This agronomic efficacy is statistically significant at 95%, according to the Duncan Test. Treatments T_1 (Cosmoflux) and T_2 (Agrotín), have a homogeneous behavior, that is, they show similar agronomic efficacy. Treatment T4 shows the lowest agronomic efficacy of the testing done (79.72%).

AGRONOMIC EFFICACY TESTING OF THE 10.4 L/ha DOSE
WITH 4 DIFFERENT ADJUVANTS
ANALYSIS OF VARIANCE

B.1 GROUPING OF DATA FOR THE SECOND EVALUATION AFTER 60 DAYS

COCA PLANT MORTALITY PERCENTAGE DATA
60 DAYS AFTER SPRAYING

REPETITIONS	TREATMENTS					
	T_1	T_2	T_3	T_4	Total	Average
I	85.0	93.0	99.33	90.0	367.33	91.83
II	81.0	98.0	95.33	88.0	362.33	90.58
III	83.0	99.0	96.66	88.25	366.91	91.73
Total Treatments	**249.0**	**290**	**291.32**	**266.25**	**1096.57**	**274.14**
Average	**83.0**	**96.66**	**97.11**	**88.75**	**362.52**	**91.38**

2. ANALYSIS OF VARIANCE (ANOVA)

Variation Source	Error Buffer	Sum of Squares	SEM	Calculated F	F critic level
Repetitions	2	3.85	1.925	0.325	5.14^{NS}
Treatment	3	413.65	137.88	23.29	4.76 **
Experimental Error	6	35.5	5.92		
Total	11	453.0	145.725		

NS: Non-significant
* Significant
** Highly Significant

Number of means: 4
Error buffer: 6
Error SEM = 5.92

3. MULTIPLE COMPARISON TEST (DUNCAN TEST)

Null hypothesis: Ho $= \mu_{T1} = \mu_{T2} = \mu_{T3} = \mu_{T4}$

Alternate hypothesis H_1: There is at least one significant difference between treatment averages $\mu i \quad \mu n$

a. **S**x estimator calculation (Experimental SEM) in the VA ANA table.

$$\mathbf{S}\,X = \sqrt{\frac{EAS}{n}} = \sqrt{\frac{5,9}{3}} = 2,146$$

Sx: Standard error of the average
EAS: Error SEM
n: Number of repetitions

b. From the table with the Duncan comparison values, we obtained the degree of error buffer and the number of treatments.

- Error buffer (EB) = 6
- # of treatments = 4

EB	TREATMENTS		
	T_2	T_3	T_4
6	3.461	3.587	3.619

c. Duncan comparison factor calculation (D * Sx) for each one of the comparison values

- The treatments are organized in a hierarchical manner

VALUES	TREATMENTS		
	T_3	T_2	T_4
Duncan Value (D) 0.5	3.587	3.461	3.619
Sx Value	1.404	1.404	1.404
Duncan Comparison Factor (D * Sx)	5.036	4.859	5.081

d. Determining significant differences among treatment averages

TABLE OF DIFFERENCES AMONG AVERAGES

TREATMENTS					
	T_3 **97.11**	T_2 **96.66**	T_4 **88.75**	T_1 **83.00**	**Duncan Comparison Factor**
T_3: 96.96	0	0.45^{NS}	8.36*	14.11*	-
T_2: 87.55		0	7.91*	13.66^{NS}	5.081
T_4: 83.09			0	5.65^{NS}	4.859
T_1: 79.72				0	5.036

According to the above table, the result is as follows:

T_3	T_2	T_4	T_1
A		B	C

This means that 60 days after the aerial spraying, Treatment 3 contains the glyphosate mix with adjuvant Potenzol and Treatment 2 containing the glyphosate mix with adjuvant Agrotín behave practically the same and show the highest agronomic efficacy (T_3: 97.11%, T_2: 96.66), with a statistical significance of 95% according to the Duncan Test. These treatments have an agronomic efficacy superior to that of treatments T_4 and T_1. Also, treatments T_4 (INEX-A) and T_1 (Cosmoflux) behave in a different manner, T_4 being better than T_1.

AGRONOMIC EFFICACY TESTING OF THE 10.4 L/ha DOSE
WITH 4 DIFFERENT ADJUVANTS
ANALYSIS OF VARIANCE

C.1 GROUPING OF DATA FOR THE SUM OF EVALUATIONS 1 AND 2 (30 AND 60 DAYS)

COCA PLANT MORTALITY PERCENTAGE DATA
30 + 60 DAYS AFTER SPRAYING

REPETITIONS	TREATMENTS					
	T_1	T_2	T_3	T_4	Total	Average
I	84.0	85.66	99.33	87.50	356.49	89.12
II	82.5	93.17	95.33	85.38	356.38	89.10
III	82.5	94.33	96.66	86.63	360.12	90.03
Total Treatments	**249.0**	**273.16**	**291.32**	**259.51**	**1,072.99**	**268.25**
Average	**83.0**	**91.05**	**97.11**	**86.50**	**357.66**	**89.42**

2. ANALYSIS OF VARIANCE (ANOVA)

Variation Source	Error Buffer	Sum of Squares	SEM	Calculated F	F critic level
Repetitions	2	2,264	1,132	0.125	5.14 NS
Treatment	3	334.43	11.48	12.36	4.76 *
Experimental Error	6	54,106	9,017		
Total	11	390.80	121,629		

NS: Non-significant
* Significant
** Highly Significant

Number of means: 4
Error buffer: 6
Error SEM = 5.92

3. MULTIPLE COMPARISON TEST (DUNCAN TEST)

Null hypothesis: Ho $=\mu_{T1} = \mu_{T2} = \mu_{T3} = \mu_{T4}$

Alternate hypothesis H_1: There is at least one significant difference between treatment averages μi   μn

a. **S**x estimator calculation (Experimental SEM) in the VA ANA table.

$$\mathbf{S}\,X = \sqrt{\frac{9.017}{3}} = 1,733$$

b. **S**x: Standard average error
EAS: Error SEM
n: Number of repetitions

b. From the table with the Duncan comparison values, we obtained the degree of error buffer and the number of treatments.

- Error buffer (EB) = 6
- # of treatments = 4

EB	**TREATMENTS**		
	T_2	T_3	T_4
6	3.461	3.587	3.619

c. Duncan comparison factor calculation (D * Sx) for each one of the comparison values

- The treatments are organized in a hierarchical manner

VALUES	**TREATMENTS**		
	$\mathbf{T_3}$	$\mathbf{T_2}$	$\mathbf{T_4}$
Duncan Value (D) 0.5	.3587	3.461	3.619
Sx Value	1.733	1.733	1.733
Duncan Comparison Factor (D * Sx)	6.216	5.997	6.271

d. Determining significant differences among treatment averages

TABLE OF DIFFERENCES AMONG AVERAGES

TREATMENTS					
	T_3 97.11	**T_2 91.01**	**T_4 88.75**	**T_1 83.00**	**Duncan Comparison Factor**
T_3: 96.96	0	6.06^{NS}	10.61*	14.11*	-
T_2: 87.55		0	4.55^{NS}	8.05*	6.274
T_4: 83.09			0	3.50^{NS}	5.997
T_1: 79.72				0	6.216

According to the above table, the result is as follows:

T_3 T_2 T_4 T_1

A

B

C

The above means that 60 days after the aerial spraying, Treatment 3 containing the glyphosate mix with adjuvant Potenzol and Treatment 2 containing the glyphosate mix with adjuvant Agrotín behave practically in same and show the highest agronomic efficacy (T_3: 97.11%, T_2: 96.66), at statistical significance of 95% according to the Duncan Test. Also, treatments T_2 and T_4 have similar agronomic efficacy being T_2 higher than T_4. Treatments T_4 and T_1 show similar agronomic efficacy although T_4 is better than T_1. To conclude, Treatment 3 has better agronomic efficacy than treatments T_2, T_4, and T_1.

NOTE:
There are no analyses of data corresponding to readings made 180 days after the treatments because the crop owners had abandoned the crops as a consequence of the damage, which was almost total, caused by spraying using the glyphosate mix with the different adjuvants.

FIRST, SECOND AND THIRD EVALUATION DATA AFTER 30, 60, AND 90 DAYS

	I	**II**	**III**	**AVERAGE 1**	**AVERAGE 2**	**EVALUATION**
T_1 Potenzol	83.0	84.0	82.0	83.0		30 days
	85.0	81.0	83.0	83.0		60 days
	95.0	99.33	96.66	96.66	87.55	90 days
T_2 Potenzol	79.0	88.75	89.50	85.75		30 days
	79.0	88.75	89.50	85.75		60 days
	100.0	75.0	58.33	77.77	83.09	90 days
T_3 Potenzol	99.25	95.83	96.66	97.25		30 days
	0	0	0	0		60 days
	100.0	95.0	95.0	96.67	96.96	90 days
T_4 Potenzol	85.0	82.75	85.0	84.25		30 days
	78.6	73.60	77.50	76.57		60 days
	65.0	85.0	85.0	78.33	79.72	90 days

Objective: “Estimate Agronomic Efficacy”, in terms of the effective mortality of the plants, after being treated with a “Dose” of 10.4 liters per hectare (L/ha) of a commercial formula of glyphosate, to which three different adjuvants were added, 30, 60, 90, and 180 days after the date of the “spraying”. To do so, it was necessary to carry out several precise tasks, including the prior determination of the **magnitude of the active ingredient** that was ultimately deposited on the coca leaves, after completing the minimum 30-meter fall from the instant when the spray particles were discharged from the spraying equipment nozzles, and to support the effect of evaporation and the rest of the factors responsible for the losses.

The results of the **CONTROL** of the sprayed coca crops using the different mixes of glyphosate were very good as it achieved the proven mortality of the coca plants to a degree that surpassed the minimum allowable level of damage. This criterion was justified when we analyzed the fact that the percentages of effective mortality of the coca plants sprayed using the 10.4 liters of glyphosate in some cases reached 100% and in none was less than 85%, despite the fact that using some of the mixes the losses due to the action of evaporation, drift, and other causes, as demonstrated by the results of the discharge, evaporation and drift testing, vary from 30% to 70% of the sprayed product. We mention other precise conclusions below.

a) If the result of the discharge, evaporation, and drift testing (see Chart 7.1.1.d.1) is similar to the values of the losses that may have occurred in the field spraying, that allows us to deduce that the quantity of glyphosate that was ultimately deposited on the leaves of the crops to be eliminated, with all of the tested treatments, surpassed the necessary requirements for causing the mortality of the coca plants. This conclusion could explain the fact that in the Blind Sample Treatment, based on the discharge, evaporation, and drift testing, the glyphosate mix using Cosmoflux 411 F had losses of near 70% of the spray and, despite that, provided control percentages equal or superior to those of the mix with Agrotín, for which spray losses did not exceed 30%.

b) If we accept the fact that the results achieved in the discharge, evaporation, and drift testing are near 90% credible, then we may also deduce that all of the fractions of the dose which reached the coca plant leaves were quite adequate to achieve a degree of control of at least 85% **of the coca plants**, in spite of the fact that in some cases the loss of the product was almost 70%.

c) The mortality readings prove that the fraction of the product that reached the plants was more or less 27.33% in Treatment A (glyphosate mix with Cosmoflux 411 F), which equals approximately 1,364 grams of active ingredient per hectare and, in spite of that, that treatment provided a degree of control similar to the degree of control in Treatment B, for which the dose that reached the plants was more than two and a half times the dose in Treatment A.

d) Another explanation to help us understand the good behavior of all the mixes tested is the concept that a discharge of around 5.00 kilograms per hectare of the active ingredient of glyphosate more than compensates the losses that occur during the 30-meter fall after the discharge from the spraying equipment.

e) It was not possible for us to identify which of the treatments submitted to evaluation proved the best from a "total point of view" of agronomic efficiency. All of them, including the Commercial Control Treatment, provided excellent percentages of mortality of the coca plants sprayed.

f) One aspect that deserves a special comment has to do with the coca plants in Plot 136. Since the first evaluations, we closely followed the behavior and evolution of the coca plants because, as a consequence of the plantain and yucca vegetation covering, some of our team thought that some new coca plant sprouts had been able to progress and produce functional leaves. Finally we were able to see that that had not happened and that not only had the yucca plants on top but also the coca plants underneath been lethally affected by the action of the glyphosate. Although some of the plantain plants seem to have better supported the effect of the glyphosate, during our last visit we saw that the owners of the plot had definitively decided to abandon the coca crop.

g) During out last two vists to the coca crop plots, we observed that the growers themselves use glyphosate for directed weed control labors against the weeds that grow among the coca crops. That explains the fact that in some of the analyses of residues in soil samples (Charts 7.3.1 C 1 and 7.3.1 C 2) additional remnants of the herbicide appear, before and after our test treatments.

h) Even though we accept the fact that the results of the discharge, evaporation, and drift testing may be up to 90% accurate, the control percentage obtained during the sprayed coca crop field control does not appear to have a similar correlation to the extent that we had expected and, although it is not recommendable to completely "extrapolate" the reference values from this testing, we could expect that the degrees of control (mortality) vary in proportion to the magnitude of the glyphosate deposited on the coca plant leaves. This is not the case because all of the Treatments provided degrees of control over 85%, in spite of the losses during the fall, showing differencies of up to 100%, at lest between Treatment A and Treatment B. The most credible explanation is still the use of doses of glyphosate high enough to compensate the losses that occur in the fall from the spraying equipment to the leaves.

i) In the sprayed coca crop control operations in the field, each experimental plot was characterized by having individual ecological features; for example, we would like to mention that there is evidence that suggests that the presence of neighboring trees may have interfered with the aircrafts' flight more in some plots than in others. This seems to be the case of Plot 156 where a good portion of the coca crop did not receive the same quantity of spray because the aircraft piplot could not totally control the spraying, due to the difficulty of flying by the tall trees that surround the plot. The same occurred in Plot 189 where we saw an area ("rabbit hole" means a gap in phytosanitary jargon) of plants that had escaped the effect of the spray.

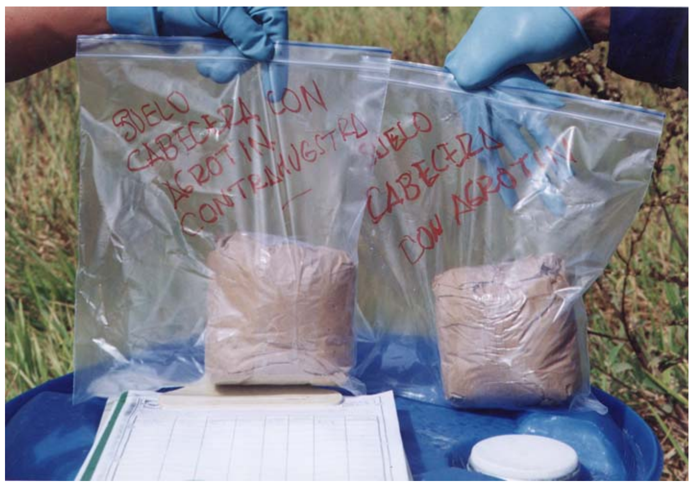
j) In aerial spraying, the danger of drift or shift of the spray particles does not seem to have the degree of affectation on the surrounding vegetation that one would think. In the plots sprayed with Treatments A, B, C, and D, we did not witness notorious or permenant damage to the surrounding vegetation. To illustrate, it is appropriate for us to once again mention our Blind Sample Treatment plot (Plot 189) where we observed that the presence of high trees had forced the piplot to deviate and the result was that he left a "rabbit hole" in the coca plot being treated. The edge of the sector with untreated coca was not more than 5 meters away from the coca plants that had been lethally affected by the action of the glyphosate mix. The photographs that appear on the following pages show a sequence of the plots during each treatment as of the date of the spraying using the glyphosate mix with the different adjuvants.

TESTING INSTALLATION

Installing the test

Placing supports for the cards

Taking soil samples at the beginning of the airport runway



Packing soil samples

ADJUVANTS USED

Packing soil and water samples

Recipients containing the adjuvants used in the testing

Recipients containing the adjuvants used in the testing

PLOT No. 155

PLOT No. 155 Plot before spraying using the glyphosate mix with the adjuvant Potenzol

PLOT No. 189 – A

PLOT No. 189 plot, 0 days after spraying

PLOT No. 189 – A

PLOT No. 189 plot, 30 days after spraying

PLOT No. 189 plot, 60 days after spraying

PLOT No. 189 plot, 30 days after spraying

PLOT No. 189 plot, 60 says after spraying

PLOT No. 189 - A

PLOT No. 189 plot, 90 days after spraying

PLOT No. 189 plot, at 90 days after spraying

PLOT No. 189 Plot, 180 days after spraying

PLOT No. 156 – B

PLOT No. 156 plot, 30 days after spraying

PLOT No. 156 plot, 60 days after spraying

PLOT No. 156 plot, 30 days after spraying

PLOT No. 156 – B

PLOT No. 156 plot, 90 days after spraying

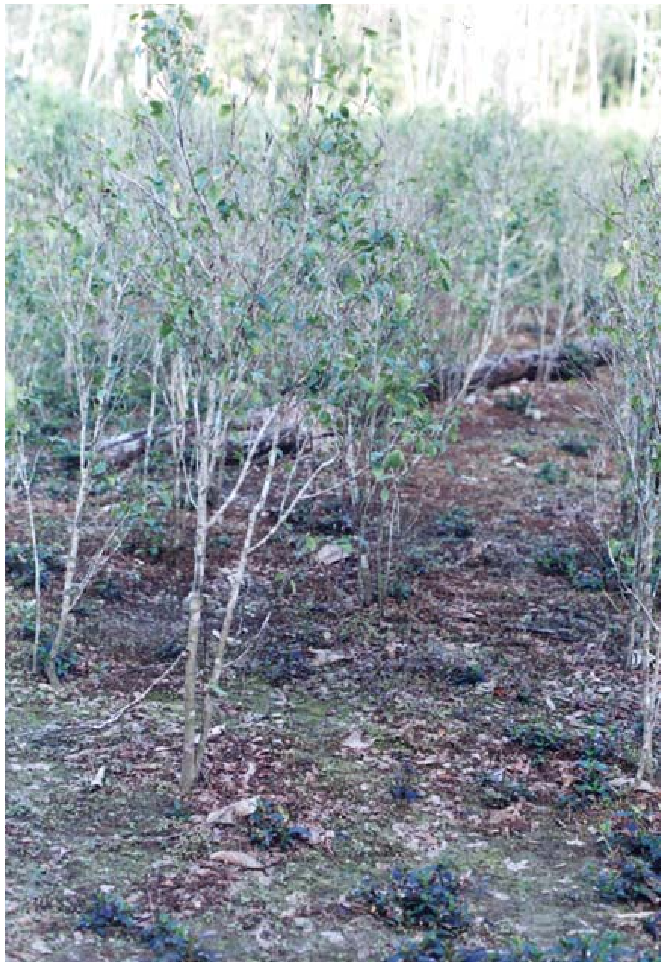
PLOT No. 156 plot, 180 days after spraying

PLOT No. 155 – C

PLOT No. 155 plot, 30 days after spraying

PLOT No. 155 plot, 30 days after spraying

PLOT No. 155 plot, 30 days after spraying


PLOT No. 155 plot, 60 days after spraying

PLOT No. 155 – C

PLOT No. 155 plot, 90 days after spraying

PLOT No. 155 plot, 90 days after spraying

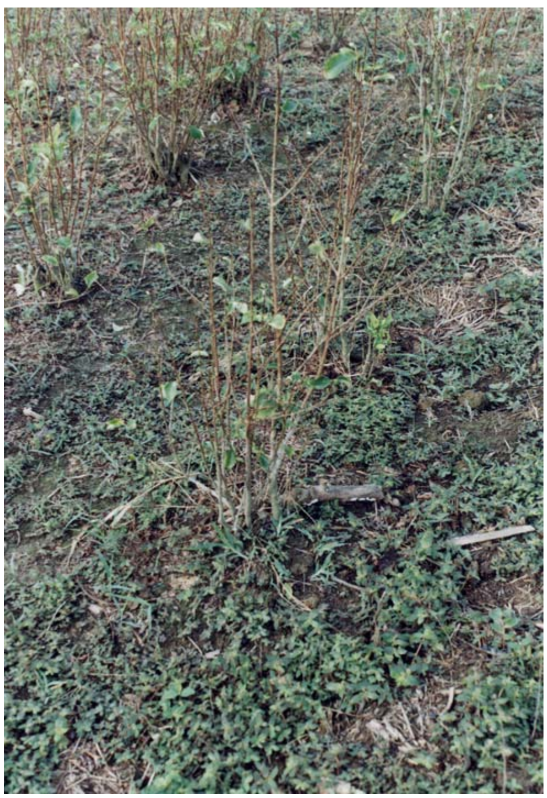
PLOT No. 155 – C

PLOT No. 155 plot, 180 days after spraying

PLOT No. 155 plot, 180 days after spraying

PLOT No. 136- D

PLOT No. 136 plot, 30 days after spraying



PLOT No. 136 plot, 30 days after spraying

PLOT No. 136- D

PLOT No. 136 plot, 60 days after spraying

PLOT No. 136 plot, 60 days after spraying

PLOT No. 136- D

PLOT No. 136 plot, 90 days after spraying

PLOT No. 136 plot, 90 days after spraying

PLOT No. 136- D

PLOT No. 136 plot, 180 days after spraying

PLOT No. 136 plot, 180 days after spraying

k) Although in the results of the discharge, evaporation, and drift testing, we can detect certain differences among the treatments used in the testing of a magnitude that could be considered notoriously significant in the experimental environment, in the Eradication Program "commercial" or routine spraying, these differences appear to lose importance. The behavior of Treatment B is as good as the behavior of the glyphosate mix with Inex-A, if we take into account that the degree of mortality of the sprayed coca plants was similar, in spite of the marked differences in the magnitude of the discharges of glyphosate. Furthermore, it is important to once again mention that frequently when a commercial coca plot is more or less 40% to 50% destroyed, it is normally no longer profitable for its owners and this forces them to abandon it or replace it with other crops.

l) It is important to mention that, if losses in the sprayed fields due to evaporation and drift and other causes are similar to those found in the discharge, evaporation, and drift testing, the quantity that could utlimately arrive at the plant leaf surface **would not be 0.234 c.c. (100% of the total theoretical discharge) but 0.1567 c.c. (67% of the theoretical discharge) of the glyphosate mix with Agrotín**, per square meter, equal to **0.03344** g. of salt (67%) or **0.02505** g. of acid equivalent (67%) of 10.4L/ha. of commercial glyphosate. In spite of the above, the percentages of mortality of sprayed coca plants were superior in Treatment A although the quantity estimated to have reached the coca plant leaf surface may have actually been less than half of those values.

m) The results of the field testing also seems to suggest that we could somehow broaden the tolerance ranges or buffers for the parameters related to some of the environmental conditions (temperature, hours of operation, wind currents, etc...), and still obtain perfectly acceptable results. Such possible "broadening" of ranges of the conditions for the Program aircraft to be able to operate would not significantly reduce the spraying efficiency, but would reduce some of the restrictions that hinder increasing the hours that the aircraft is able to operate.

7.3 SAMPLING AND EVALUATION OF SOILS AND BODIES OF WATER CONTAMINATED WITH GLYPHOSATE

The information contained in Numbers 7.3.1 and 7.3.2 correspond to the results of the samples from soils and bodies of water contaminated with glyphosate residues, as well as pertinent comments.

7.3.1 Comments and Discussions on Soil Sampling and Analysis

The information contained in Charts 7.3.1 C.1 and 7.3.1 C.2 facilitates an appropriate interpretation of the results of the testing done to evaluate soil contamination with glyphosate residues.

Chart 7.3.1 C.1 – CODES USED IN SOIL SAMPLING AND ANALYSIS

Sample Codes, Sampling Locations, Task Identification, and Date

Sample	Treatment	Location	Terrain	Date
1	Blind Sample	Airport	Untreated	February 12, 2003
2	T1P1	Airport	glyphosate + Agrotin	February 12, 2003
4	T2P1	Airport	glyphosate + Potenzol	February 12, 2003
6	T3P1	Airport	glyphosate + Inex-A	February 12, 2003
10	Plot 156	Plot 1	glyphosate + Agrotin *	February 20, 2003
11	Plot 156	Plot 1 (T1)	glyphosate + Agrotin **	February 20, 2003
16	Plot 155	Plot 1 (T2)	glyphosate + Poptenzol **	February 20, 2003
21	Plot 136	Plot 1 (T3)	glyphosate + Inex-A **	February 20, 2003
24	Plot 156	Plot 1 (T1)	glyphosate + Agrotin ***	March 23, 2003
25	Plot 155	Plot 1 (T2)	glyphosate + Poptenzol ***	March 23, 2003
26	Plot 136	Plot 1 (T3)	glyphosate + Inex-A ***	March 23, 2003
28	Plot with Plantain	Individual Farm	glyphosate residues	March 26, 2003
29	Plot with Corn	Individual Farm	glyphosate residues	March 28, 2003

* Sampling before spraying using the glyphosate mix with an adjuvant
** Sampling after spraying using the glyphosate mix with an adjuvant
*** Sampling 30 days after spraying using the glyphosate mix with an adjuvant.

Colombia Soil Samples

Sample Name	ng Gly per g soil	ng AMPA per g soil
N:1 Spike	304.27517	404.164137
N:1 Spike	259.589592	366.750094
24 Plot 156 Spik	997.983797	847.08785
24 Plot 156 Spik	1004.67114	773.705418
N:1	185.382357	0
N:1	142.799074	0
N:2	819.320693	133.570286
N:2	926.121996	142.341718
N:4	95.7851704	62.6435605
N:4	86.0270737	44.0039338
N:6	927.578941	511.064388
N:6	745.70003	403.497905
N:10	500.925905	643.57708
N:10	468.910157	598.911996
N:11	6857.47922	578.197827
N:11	6400.02363	580.165343
N:16	4666.32381	1074.69393
N:16	3520.98419	920.806729
N:21	4529.19166	479.995578
N:21	3852.3208	397.821336
24 Plot 156	691.363545	523.899965
24 Plot 156	643.203612	466.532221
25 Plot 155	4588.08732	1257.18801
25 Plot 155	5553.16433	1475.39823
26 Plot 136	467.333889	617.230463
26 Plot 136	513.824882	664.318098
28 De Platano	60.9013102	369.142772
28 De Platano	79.7298864	365.89586
29 De Bore	25.5415354	97.5581066
29 De Bore	25.5415354	47.1026556

<u>Gly Spiking Expt.</u>

	N:1 Spike	N:1	Difference	%Recovery
	304.27517	185.382357		
	259.589592	142.799074		
Avg	281.932381	164.090716	117.841666	26.1870368
	24 Plot 156			
	Spike	no spike		
	997.983797	691.363545		
	1004.67114	643.203612		
Avg	1001.32747	667.283579	334.043889	74.2319753

<u>AMPA Spiking Expt.</u>

	N:1 Spike	N:1		
	404.164137	0		
	366.750094	0		
Avg	385.457115		385.457115	85.6571367
	24 Plot 156			
	Spike	no spike		
	847.08785	523.899965		
	773.705418	466.532221		
Avg	810.396634	495.216093	315.180541	70.0401203

Post-it™ Transmisión por Fax 7671	FECHA/DATE Mayo 6/03	Nº DE PAGINAS/# OF PAGES 4.
PARA/TO Miguel Revelo	DE/FROM Sandra Moreno	
COMPAÑIA/CO. Sociedad Las Palmas	COMPAÑIA/CO. NAS	
DEPARTAMENTO/DEPT.	TELEFONO/PHONE # 3832886	
FAX 527 71 37	FAX 3832007.	

Chart 7.3.1 C.2 SUMMARIZED LABORATORY ANALYSIS RESULTS

(Original Data in Nanograms (ng) per Gram of Soil, Reported by the U.S. Laboratory)

PLOT	Glyphosate mg/g/soil	AMPA mg/g/soil
1	185.382357	0.0
1 (2nd reading)	142.799074	0.0
2	819.320693	133.570286
4	95.7851704	62.6435605
6	927.578941	511.064388
10 156*	500.925905	643.57708
10 156* (2nd reading)	468.910157	598.911996
11 156*(T1)**	6,857.47922	578.197827
11 156 (T1)** (2nd reading)	6,400.02363	580.165343
16 155 (T2)**	4,666.32381	1,074.69393
16 155 (T2)** (2nd reading)	3,520.98419	920.806729
21 136 (T3)**	4,529.19166	479.995678
21 136 (T3)** (2nd reading)	3,852.3208	397.821356
24 156 (T1)***	691.363545	523.899965
24 156 (T1)*** (2nd reading)	643.203612	466.532221
25 155 (T2)***	4,588.08732	1,257.18801
25 155 (T2)*** (2nd reading)	5,553.16433	1,475.39823
26 136 (T3)***	467.333889	617.230463
26 136 (T3)*** (2nd reading)	513.824882	664.318098
28 Plot / plantain	60.9013102	369.142772
28 Plot / plantain (2nd reading)	79.7298864	365.89586
29 Plot / corn	25.5415354	97.5581066

***Equivalencies*:**

1,000 nanograms (ng) equals 1 microgram.

Micrograms per gram of soil (1,000 ì**g** equals 1 mg.)

Milligrams per gram of soil.

Upon reviewing the results of the soil sample analyses, we deduced the following:

a) In the sampling done in Plot 156 coca crop soils treated using 10.4-liter Commercial Formula glyphosate with the adyuvant Agrotin, the soil samples showed the presence of minimum quantities of residues of glyphosate and of its metabolite AMPA. If we take into account that for the soil samples from Plot 11 (glyphosate mix with Agrotín) the US laboratory reported the presence of 6,857.4792 nanograms (ng) of glyphosate and 578.1978 nanograms (ng) of AMPA per gram of soil, respectively, that means that the presence of that magnitude of toxic residues has no importance from a toxicological point of view because the no observable effect level is established at 158 mg. per kg. of soil (24-29), which means that the residues of glyphosate or of its metabolite AMPA are very inferior to the tolerance established by international and national health entities.

   If we take into account the physical-chemical characteristics of glyphosate (Numeral 6.1.1), we may deduce that, if the glyphosate contained in the glyphosate mix with Agrotín contaminated the first 10-centimeter deep square meter of soil of the first layer of soil, and if it were necessary to estimate the contamination with acid and with salt based on one kilogram of soil, that value would have to be divided by 200 because the quantity of soil contained in that 10-cm. deep layer of soil would weigh around 200 kg., considering an average density of 2.0. Thus, the maximum possible contamination would be 0. 374 mg. of acid equivalent per kg. of soil. If we were dealing with the glyphosate mix with Agrotín, the glyphosate residue would be 0.284 mg. and if it were the glyphosate mix with Cosmoflux 411 F, the residue would be maximum 0.112 mg. .

b) In the sampling done in Plot 155 coca crop soils treated using the 10.4 L/ha formula of Commerical Formula glyphosate with the adjuvant Potenzol, the soil samples also showed the presence of non-significant quantities of the parental molecule of glyphosate and of its metabolite AMPA.

c) In the sampling done in Plot 136 coca crop soils treated with the 10.4 L/ha of Commercial Formula of glyphosate with the adjuvant Inex-A, the soil sample analyses also showed the presence of non-significant quantities of glyphosate and of its metabolite AMPA.

d) The presence of residues in the soil samples taken 30 days after spraying using the glyphosate mixes suggested, as was proven later on, that the coca growers themselves used glyphosate as a herbicide to control weeds and undesireable plants, using mechanical protection devices fastened to manual spraying equipment. The presence of residues of the metabolite AMPA that, to form, requires a metabolization process several days long (30), was evident although the magnitude of the residues still represents a minimum quantity.

e) The presence of such different values among the soil samples in the three coca crop plots suggests the incorporation of differential quantities of glyphosate and, we should take into account that the Plot 155 crop looks abandoned as if there had been no agricultural labor or attempts of agronimical recovery, therefore we assume that there was no use of glyphosate in agronomic handling.

f) During the corresponding 90-day review, we observed that the weed cover in Plot 155 was widespread and we also observed that the owners had abandoned the Plot and had made no attempt to recover it. This appears to be the same case for a good protion of the crop in Plot 156 where we even found fertilizaer substance containers and packaging normally used for legal crops.

   In Plot 136 we also observed that the owners had attempted some process of partial recovery, judging by how clean the crop was and the presence of containers of substances for agronomic use.

g) The results of the analysis of the soil samples taken at the beginning of the airport runway, as well as those from other crop sites, also indicate the presence of glyphosate residues that do not correspond to the spraying done in the Agronomic Efficiency Protocol Testing. Such residues could have come from leftovers in aircraft tanks from the aircraft that carry out the spraying operations for the Eradication Program and fly over this area when flying back to their operation base every day.

h) It is worth mentioning that the quantities of residues of the parental molecule of glyphosate and of its metabolite AMPA found in the soil samples are of a magnitude much smaller than the tolerable limits (29) under NOEC or NOEL parameters.

i) If we take into account that the allowable limit of glyphosate set by competent authorities is 158 mg. of Technical Glyphosate per kilogram of soil, the values that were found in the soil samples taken in the terrains at the beginning of the San José del Guaviare Airport runway enable us to deduce that there is no danger to human health or to environmental conditions. The magnitude of the residues is much smaller than the allowable limit (29).

j) The presence of glyphosate and AMPA residues (Duplicated Codes 11, 16, and 21) in all of the soil samples taken immediately after the treatments showed values similar to those in the samples with Codes 24, 25, and 26, which correspond to the samples taken almost a month after the treatments were applied. Although the values are very similar, we also have reason to believe that some of those residues may have somehow increased as a result of additional glyphosate applied by the coca growers themselves during their weed control. The magnitude of the residues, however, is still non-significant (29) to health.

7.3.2 Comments Related to Sampling in Bodies of Water

In the following subsections, we comment on the most relevant aspects related to the results of the laboratory analyses of the samples of water contaminated with glyphosate residues, taking into account the figures that appear in **Chart 7.3.2 C.1** on page 75, which correspond to the report supplied by the laboratory in charge of the determinations.

a) In the results of the water analyses processed by the Colombian Faming and Livestock Institute (ICA) LANIA Laboratory, we may appreciate that in the samples for spray discharge, evaporation, and drift testing taken at the beginning of the San José del Guaviare Airport runway, which correspond to "extreme simulation" conditions of stagnant water, the magnitude of the glyphosate residue was 1.30-1.69 and 1.72 mg./L of water on an average. These values barely reach 50% of the limit established as NOEC or NOEL (11, 29), the limits that have been adopted as a reference parameter by the Illicit Crop Eradication Program (ICEP) and the values have no toxicological significance.

b) The water samples taken before spraying the lentic bodies located in or near the coca crop plots did not indicate the presence of residues of glyphosate or of its metabolite AMPA; neither did the water samples taken after spraying.

MINISTRY OF AGRICULTURAL AND RURAL DEVELOPMENT

ICA – COLOMBIAN FARMING AND LIVESTOCK INSTITUTE

In your answer, refer to this number

L.A.N.I.A.	**ASSAY REPORT**	**AC – RC - 20** **PG. 1 / 1**

CLIENT	**CB 3226 SOCIEDAD LAS PALMAS LTDA**	**LANIA CODE**	ER - 019
RECEIPT DATE	**MARCH 3, 2003**	**ISSUANCE DATE**	**APRIL 7, 2003**
DENOMINATION	**T3P1-BEGINNING OF SAN JOSE DEL GUAVIARE AIRPORT RUNWAY; TYPE OF MATERIAL: WATER**		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	**APRIL 5, 2003**

RESULTS:

	Result (mg/L)	LD (µg/L)
GLYPHOSATE:	**1.69 ± 0.12**	
AMPA (Amino Methyl Phosphonic Acid)	**N.D.**	**9.0**

N.D.: Not Detected
L.D.: Detection Limit

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

(Seal) PARTIAL OR TOTAL TRANSCRIPTION IS PROHIBITED. National Farming and Livestock Inputs Laboratory. ICA.

“FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE”

CALLE 37 No. 8-43 PISOS 4o y 5o APARTADO AÉREO 7984. FAX # 285 4351 – 288 2771

PBX: 285 5520 – 288 4800 – 332 3700. Web page: www.ica.gov.co . BOGOTA, D.C. COLOMBIA

MINISTRY OF AGRICULTURAL AND RURAL DEVELOPMENT

ICA – COLOMBIAN FARMING AND LIVESTOCK INSTITUTE

In your answer, refer to this number

L.A.N.I.A.	**ASSAY REPORT**	**AC – RC - 20**
		PG. 1 / 1

CLIENT	**CB 3226 SOCIEDAD LAS PALMAS LTDA**	**LANIA CODE**	ER - 020
RECEIPT DATE	**MARCH 3, 2003**	**ISSUANCE DATE**	**APRIL 7, 2003**
DENOMINATION	**PLOT 1 PLOT 136 # 2 43'34" E 72º 20.73' AA TIME 9:05; TYPE OF MATERIAL: WATER**		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	**APRIL 5, 2003**

RESULTS:

	Result (mg/L)	**LD (µg/L)**
GLYPHOSATE:	**N.D.**	**10.0**
AMPA (Amino Methyl Phosphonic Acid)	**N.D.**	**9.0**

N.D.: Not Detected
L.D.: Detection Limit
The sample has solids in suspension.

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

(Seal) PARTIAL OR TOTAL TRANSCRIPTION IS PROHIBITED. National Farming and Livestock Inputs Laboratory. ICA.

"FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE"

CALLE 37 No. 8-43 PISOS 4o y 5o APARTADO AÉREO 7984. FAX # 285 4351 – 288 2771

PBX: 285 5520 – 288 4800 – 332 3700. Web page: www.ica.gov.co . BOGOTA, D.C. COLOMBIA

MINISTRY OF AGRICULTURAL AND RURAL DEVELOPMENT

ICA – COLOMBIAN FARMING AND LIVESTOCK INSTITUTE

In your answer, refer to this number

L.A.N.I.A.	**ASSAY REPORT**	**AC – RC - 20** **PG. 1 / 1**

CLIENT	**C.B - 3226 SOCIEDAD LAS PALMAS LTDA**	**LANIA CODE**	ER - 021
RECEIPT DATE	**MARCH 3, 2003**	**ISSUANCE DATE**	**APRIL 7, 2003**
DENOMINATION	**TIPI BEGINNING OF RUNWAY; TYPE OF MATERIAL: WATER**		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	**APRIL 5, 2003**

RESULTS:

	Result (mg/L)	LD (µg/L)
GLYPHOSATE:	**1.30 ± 0.09**	
AMPA (Amino Methyl Phosphonic Acid)	**N.D.**	**9.0**

N.D.: Not Detected
L.D.: Detection Limit

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

(Seal) PARTIAL OR TOTAL TRANSCRIPTION IS PROHIBITED. National Farming and Livestock Inputs Laboratory. ICA.

"FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE"

CALLE 37 No. 8-43 PISOS 4o y 5o APARTADO AÉREO 7984. FAX # 285 4351 – 288 2771

PBX: 285 5520 – 288 4800 – 332 3700. Web page: www.ica.gov.co . BOGOTA, D.C. COLOMBIA

MINISTRY OF AGRICULTURAL AND RURAL DEVELOPMENT

ICA – COLOMBIAN FARMING AND LIVESTOCK INSTITUTE

In your answer, refer to this number

L.A.N.I.A.	**ASSAY REPORT**	**AC – RC - 20**
		PG. 1 / 1

CLIENT	**CB 3226 SOCIEDAD LAS PALMAS LTDA**	**LANIA CODE**	ER - 022
RECEIPT DATE	**MARCH 3, 2003**	**ISSUANCE DATE**	**APRIL 7, 2003**
DENOMINATION	**T3 PLOT 1 PLOT 136 N: 02º 43-34' E 72º 20.73' aa- INEX TIME: 9.10; TYPE OF MATERIAL: WATER**		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	**APRIL 5, 2003**

RESULTS:

	Result (mg/L)	**LD (µg/L)**
GLYPHOSATE:	**N.D.**	**10.0**
AMPA (Amino Methyl Phosphonic Acid)	**N.D.**	**9.0**

N.D.: Not Detected
L.D.: Detection Limit
The sample has solids in suspension.

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

(Seal) PARTIAL OR TOTAL TRANSCRIPTION IS PROHIBITED. National Farming and Livestock Inputs Laboratory. ICA.

"FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE"
CALLE 37 No. 8-43 PISOS 4o y 5o APARTADO AÉREO 7984. FAX # 285 4351 – 288 2771
PBX: 285 5520 – 288 4800 – 332 3700. Web page: www.ica.gov.co . BOGOTA, D.C. COLOMBIA

MINISTRY OF AGRICULTURAL AND RURAL DEVELOPMENT

ICA – COLOMBIAN FARMING AND LIVESTOCK INSTITUTE

In your answer, refer to this number

L.A.N.I.A.	**ASSAY REPORT**	**AC – RC - 20**
		PG. 1 / 1

CLIENT	**CB 3226 SOCIEDAD LAS PALMAS LTDA**	**LANIA CODE**	ER - 023
RECEIPT DATE	**MARCH 3, 2003**	**ISSUANCE DATE**	**APRIL 7, 2003**
DENOMINATION	**PLOT 1 PLOT 156 N: 02° 33.14' E 72° 07.59' AA TIME: 7:15; TYPE OF MATERIAL: WATER**		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	**APRIL 5, 2003**

RESULTS:

	Result (mg/L)	**LD (µg/L)**
GLYPHOSATE:	**N.D.**	**10.0**
AMPA (Amino Methyl Phosphonic Acid)	**N.D.**	**9.0**

N.D.: Not Detected
L.D.: Detection Limit

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

(Seal) PARTIAL OR TOTAL TRANSCRIPTION IS PROHIBITED. National Farming and Livestock Inputs Laboratory. ICA.

"FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE"

CALLE 37 No. 8-43 PISOS 4o y 5o APARTADO AÉREO 7984. FAX # 285 4351 – 288 2771

PBX: 285 5520 – 288 4800 – 332 3700. Web page: www.ica.gov.co . BOGOTA, D.C. COLOMBIA

In your answer, refer to this number

L.A.N.I.A.	ASSAY REPORT	AC – RC - 20 PG. 1 / 1

CLIENT	CB 3226 SOCIEDAD LAS PALMAS LTDA	LANIA CODE	ER - 024
RECEIPT DATE	MARCH 3, 2003	ISSUANCE DATE	APRIL 7, 2003
DENOMINATION	T2P1 BEGINNING OF RUNWAY; TYPE OF MATERIAL: WATER		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	APRIL 5, 2003

RESULTS:

	Result (mg/L)	LD (µg/L)
GLYPHOSATE:	**1.72 ± 0.12**	**-**
AMPA (Amino Methyl Phosphonic Acid)	**0.02 ± 0.002**	**-**

N.D.: Not Detected
L.D.: Detection Limit

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

"FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE"

MINISTRY OF AGRICULTURAL AND RURAL DEVELOPMENT

In your answer, refer to this number

L.A.N.I.A.	**ASSAY REPORT**	**AC – RC - 20** **PG. 1 / 1**

CLIENT	**CB 3226 SOCIEDAD LAS PALMAS LTDA**	**LANIA CODE**	ER - 025
RECEIPT DATE	**MARCH 3, 2003**	**ISSUANCE DATE**	**APRIL 7, 2003**
DENOMINATION	**T2 PLOT 1 PLOT 155 No. 02º 34.44' E 72 º 16.54' aa POTENZOL TIME 8:25; TYPE OF MATERIAL: WATER**		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	**APRIL 5, 2003**

RESULTS:

	Result (mg/L)	LD (µg/L)
GLYPHOSATE:	**N.D.**	**10.0**
AMPA (Amino Methyl Phosphonic Acid)	**N.D.**	**9.0**

N.D.: Not Detected
L.D.: Detection Limit

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

"FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE"

CALLE 37 No. 8-43 PISOS 4o y 5o APARTADO AÉREO 7984. FAX # 285 4351 – 288 2771

PBX: 285 5520 – 288 4800 – 332 3700. Web page: www.ica.gov.co . BOGOTA, D.C. COLOMBIA

MINISTRY OF AGRICULTURAL AND RURAL DEVELOPMENT

In your answer, refer to this number

ICA – COLOMBIAN FARMING AND LIVESTOCK INSTITUTE

L.A.N.I.A.	**ASSAY REPORT**	**AC – RC - 20**
		PG. 1 / 1

CLIENT	**CB 3226 SOCIEDAD LAS PALMAS LTDA**	**LANIA CODE**	ER - 026
RECEIPT DATE	**MARCH 3, 2003**	**ISSUANCE DATE**	**APRIL 7, 2003**
DENOMINATION	**PLOT 1 PLOT 155 N: 02º 34.44' E 72º 16.54' aa TIME 8:20; TYPE OF MATERIAL: WATER**		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	**APRIL 5, 2003**

RESULTS:

	Result (mg/L)	**LD (µg/L)**
GLYPHOSATE:	**N.D.**	**10.0**
AMPA (Amino Methyl Phosphonic Acid)	**N.D.**	**9.0**

N.D.: Not Detected
L.D.: Detection Limit

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

(Seal) PARTIAL OR TOTAL TRANSCRIPTION IS PROHIBITED. National Farming and Livestock Inputs Laboratory. ICA.

"FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE"

CALLE 37 No. 8-43 PISOS 4o y 5o APARTADO AÉREO 7984. FAX # 285 4351 – 288 2771
PBX: 285 5520 – 288 4800 – 332 3700. Web page: www.ica.gov.co . BOGOTA, D.C. COLOMBIA
MINISTRY OF AGRICULTURAL AND RURAL DEVELOPMENT

In your answer, refer to this number

L.A.N.I.A.	**ASSAY REPORT**	**AC – RC - 20** **PG. 1 / 1**

CLIENT	**CB 3226 SOCIEDAD LAS PALMAS LTDA**	**LANIA CODE**	ER - 027
RECEIPT DATE	**MARCH 3, 2003**	**ISSUANCE DATE**	**APRIL 7, 2003**
DENOMINATION	**T1 PLOT 1 PLOT 156 E 72º 07.59 aa AGROTIN TIME 7:20; TYPE OF MATERIAL: WATER**		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	**APRIL 5, 2003**

RESULTS:

	Result (mg/L)	**LD (µg/L)**
GLYPHOSATE:	**N.D.**	**10.0**
AMPA (Amino Methyl Phosphonic Acid)	**N.D.**	**9.0**

N.D.: Not Detected
L.D.: Detection Limit

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

(Seal) PARTIAL OR TOTAL TRANSCRIPTION IS PROHIBITED. National Farming and Livestock Inputs Laboratory. ICA.

"FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE"

L.A.N.I.A.	ASSAY REPORT	AC – RC - 20 PG. 1 / 1

CLIENT	CB 3226 SOCIEDAD LAS PALMAS LTDA	LANIA CODE	ER - 031
RECEIPT DATE	MARCH 3, 2003	ISSUANCE DATE	APRIL 7, 2003
DENOMINATION	PLOT 1 PLOT 136 TREATMENT 3 (INEX-A) VERIFICATION TAKEN ON MARCH 26/03 TIME 7:35 BY WILLIAM VILLAMIL; TYPE OF MATERIAL: WATER		
REPORT SCOPE	We are pleased to communicate the results of the analysis that you requested. These results only apply to the sample sent; they do not are not considered part of the Official Control of which ICA is in charge.		

METHOD	**Glyphosate:** High efficiency liquid chromatography, post-column derivation, and detection via fluorescence, pursuant to Standard AR-NE-05

DATE OF THE ANALYSIS	APRIL 5, 2003

RESULTS:

	Result (mg/L)	LD (µg/L)
GLYPHOSATE:	0.03 ± 0.002	-
AMPA (Amino Methyl Phosphonic Acid)	N.D.	9.0

N.D.: Not Detected
L.D.: Detection Limit

(Signed) by Ruth Analida Betancourt C. for **CARLOS A. SALCEDO SALAZAR** **Coordinator of the Quality Group for Farming and Livestock Inputs and Residues**	(Signed) by Martha patricia Vela Florez for **RENE A. CASTRO JIMENEZ PQ-0824** Chemist

(Seal) PARTIAL OR TOTAL TRANSCRIPTION IS PROHIBITED. National Farming and Livestock Inputs Laboratory. ICA.

"FARMING AND LIVESTOCK PROTECTION – WE ARE COMMITTED TO PEACE"

CALLE 37 No. 8-43 PISOS 4o y 5o APARTADO AÉREO 7984. FAX # 285 4351 – 288 2771
PBX: 285 5520 – 288 4800 – 332 3700. Web page: www.ica.gov.co . BOGOTA, D.C. COLOMBIA

c) In the water sample taken 30 days after spraying from a pond (stagnant water) near Plot 136, we detected the presence of residues at around 0.03 mg/L, which allows us to deduce that the residues correspond to some application of a phytosanitary nature made by the crop owners in their attempts to control the presence of weeds and facilitate some percentage of recovery of the coca plants partally protected by the yucca and plantain cover.

d) The comments in Letters b) and c) enable us to clarify that ICEPG spraying does not appear to be the cause of harmful contamination of water bodies in or near coca crop plots and any residue that could eventually contaminate them has a non-significant magnitude and no toxicological importance (29).

7.4 EVALUATION OF THE EFFECT ON THE ECOSYSTEM OF THE SPRAYED PLOTS

There has always been concern that glyphosate possibly destroys the vegetation covering sprayed for a prolonged period of time and some persons have even propagated the aventurous and erred conjecture that soil sprayed using glyphosate would almost permanently remain sterile. In reality, this is not true and, at least in the Colombian tropical ecosystems (13), there is sufficient evidence to affirm quite the opposite. The following comments are related to visual observations and evaluations regarding the ecological sequence and reestablishment of the vegetation covering in plots planted with coca and submitted to the effect of glyphosate spraying.

In all of the plots sprayed, we saw that, one month after the spraying, the native vegetation covering, made up of gramineous and broad leaf species, began to repopulate the space where the soil had been sprayed. During the second visit (30 days after the date of the spraying) we could already see the presence and normal development of at least 10 botanical species from the existing seed 5 cm.deep in the soil. 60 days after the spraying, we observed no less than 15 to 20 gramineous botanical species and just as many broad leaf ones, and when we returned 90 days after the spraying, we could see that Plot 155 was totally covered in weeds and native plant species, among which we noted the presence of almost all of those listed below. They did not appear to be affected and the process of vegetation covering reinfestation seemed normal.

7.4.1 Population of Predominant Weeds and "Native Plants" in the Ecosystem of Coca Crop Plots

GRAMINEOUS WEEDS

Scientific Name	**Common Name**	**Aggressivity**
Andropogon bicornis L.	Meadow Foxtail	High
Brachiaria decumbens Stapf	Guinea Millet	High
Cenchrus echinatus L.	Souther Sandbar	Average
Cynodon dactylon l (Pers.)	Silverweed	High
Cyperus diffusus Vahl	Diffused Flatsedge	Average
Cyperus ferax Rich.	Odorous Flatsedge	Average
Cyperus rotundus L.	Tiririca Flatsedge	Average
Digitaria decumbens Stent	Pangola Grass	Average
Homolepsis aturensis HBK	Cumin Grass	Average
Imperata cilindrica L. Beauv.	Lalang Grass	High
Panicum fasciculatum Sw.	Switchgrass	Average
Panicum maximum Jacq.	Guinea Grass	High
Paspalum paniculatum L	Turf Grass	Average
Paspalum virgatum	Passiflora	High

BROAD LEAF WEEDS

Scientific Name		
Achranthes indica L.	Glenwood Grass	Average
Amaranthus dubius Mart.	Redroot Pigweed	Average
Amaranthus spinosus L.	Spiny Amaranth	Average
Bidens pilosa L.	Hairy Beggarticks	Average
Boerhaavia erecta L.	Hogweed	Average
Cassia tora L.	Sickel Senna	Average
Cleome spinosa Jacq	Spiny Spider Flower	Average
Clidemia hirta (L) D.	Koster's Curse	Average
Desmodium tortuosum (Sw.) D.C.	Dixie Ticktrefoil	Average
Heliconia bihal L.	Heliconia	Average
Ipomoea heterifolia L.	Pink Morning Glory	High
Ipomoea tiliacea (Willd.)	Star Vine	High
Lantana camara L.	Lantana	Average
Malachra aceifolia Jacq	Mallow	Average
Mimosa pudica L.	Touch-me-not	Average
Portulaca oleracea L	Purslane	Average
Sida acuta Burm f.	Wireweed	Average
Urera baccifera L. Gaudich	Nettle	Low

We evaluated damage to nearby vegetation visually. 30 days after treatment, we saw some effects on the surrounding vegetation, such as leaf necrosis, in a few cases up to more or less 20 meters beyond the foreseen limit of the spraying, although we should also mention that on one of the plots treated using the glyphosate mix with Cosmoflux 411 F, considered for comparison purposes, we saw that one portion of the plot had not been affected (a "rabbit hole" meaning a gap in phytosanitary jargon), due to some failure of the spraying equipment or to the presence of trees obstaculizing the spraying process, although the coca plants affected were less than 5 m. to 10 m. away.

8.0 CONCLUSIONS AND RECOMMENDATIONS

After concluding the field testing and laboratory tests stipulated in the Experimental Protocol designed to measure the efficiency of the spraying using 10.4 L/ha commercial formula of glyphosate with one of four adjuvants selected to be part of the 23.4 L/ha formula used, we drew the conclusions that we summarize below.

8.0.1 Calculation of Spray Deposit and Drift, Using 10.4 L./ha Commercial Formula of Glyphosate

a) We would like to say that the results foreseen in this objective could have been better if we had not had the limitations of resources, materials, and time stipulated in the Official Protocol. Despite the above, the results achieved were very satisfactory.

b) The glyphosate mix with Agrotín had least losses in the 30-meter fall from the spraying equipment nozzle to the coca plant leaves, followed by the glyphosate mix with Potenzol. However, with the results of the discharge, evaporation, and drift testing, we still cannot explain for certain why these two mixes were superior to the glyphosate mix with Inex-A and the glyphosate mix with Cosmoflux 411 F (27). Not having included a glyphosate mix without any adjuvant in the testing impeded us from being able to evaluate the effect of glyphosate without those adjuvants, because, even the commercial formula already comes with a special adjuvant.

8.0.2 Aerial Spraying of the Coca Crop Plots

a) Although all of the mixes used provided a degree of coca crop control superior to 85%, with the data available, we could not identify for certain which was the most or least effective. Nonetheless, we can affirm that the 10.4 L/ha dose of glyphosate was efficient and effective from an agronomic point of view.

b) Although we do not know the causes due to which the glyphosate mix with Agrotín so notoriously reduced losses from evaporation and drift and we still do not know the economic surfactance threshhold of that adjuvant, we could recommend adopting the glyphosate mix with Agrotín, as an alternative to the glyphosate mix with Cosmoflux, in spite of the fact that the treatment using the glyphosate mix with Cosmoflux provided degrees of mortality of the sprayed coca plants at percentages equal or superior to the glyphosate mix with Agrotín or the glyphosate mix with Potenzol.

8.0.3 Sampling and Evaluation of Bodies of Water and Soils Likely Contaminated with Glyphosate

We met this specific objective completely. In addition, we would like to mention that no harmful effects on the plants that could have absorbed water with glyphosate residues were identified.

8.0.4 Evaluation of the Effect of Glyphosate on Native Vegetation in Sprayed Plots

We met this specific objective satisfactorily and we can affirm that no degrading impacts on the soil or the flora in the coca plots treated with the glyphosate mixes were identified.

8.1 CONCLUSIONS AND SUGGESTIONS

The following comments may summarize the overall evaluation of the results of the research process called "Protocol for Agronomic Efficacy Testing of a Dose of Glyphosate with Three Different Adjuvants, for the Control of Illicit Crops".

ONE

The results of the CONTROL of the sprayed coca crops using the diferent glyphosate mixes are very good and overwhelmingly exceed 85% mortality of the sprayed crops, as may be appreciated by reviewing the summary of the Statistical Analyses. The AGRONOMIC EFFICIENCY (coca plant control) of the Illicit Crop Eradication Program is very good, although it could be better from another perspective.

TWO

Based on the results of the discharge, evaporation, and drift testing, the quantity of glyphosate that is deposited on the coca plant leaves, in some cases, is barely near one third part of the quantity discharged from 30 meters of altitude. In spite of the above, the quantity that is deposited on the plant leaves is sufficient to cause the mortality of the coca plants.

THREE

With the data from spraying the commercial coca crops, we believe that all of the mixes tested were very effective, including the glyphosate mix with Cosmoflux 411 F, corresponding to the Commercial Control Treatment, despite the fact that it is the mix using with losses of more than 70% of the quantity discharged from 30 meters of altitude.

FOUR

The results of the discharge, evaporation, and drift testing, do not enable us to recommend for certain the adjuvant that most contributes to coca crop control and, although there are several technical reasons that suggest that AGROTIN is the best, followed by POTENZOL, we cannot yet recommend them without any reservation, in spite of them being the most opted adjuvants to incorporate into the eradication program.

The technical data from the testing done as part of the Experimental Protocol indicates that, in addition to using the appropriate calibration for the spraying equipment, the adjuvants can also contribute to reducing losses from evaporation, drift, and other causes, to the benefit of the agronomic efficiency of the dose of glyphosate.

FIVE

If we take into account the NOEL or NOEC (Non Observable Effect Concentrations) values of 158 mg. of technical-grade glyphosate per kg. of soil and of 3.74 mg. per liter of water, the Eradication Program spraying using 10.4 L/ha of commercial-grade glyphosate does not cause soil contamination in the coca crop plots or in the water bodies in or near the coca crop plots and any residue that may possibly contaminate a lentic body is of a non-significant value and of no toxicological or environmental importance (29).

9.0 SUMMARY

We designed a Technical Protocol that was reviewed and appraised by ICA and NAS to individually measure the **Agronomic Efficacy** of aerial spraying from 30 meters of altitude using Cosmoflux under the Illicit Crop Eradication Program. The testing was done on the illicit coca crops located in the Provincial Department of Guaviare.

To have some reference estimates on the coca plants to be eliminated, we designed a test to measure the values of the discharge and losses from evaporation and drift in the operation base failities. This testing was done at the airport, not on the coca crops when they were sprayed for control purposes (which would have been the most desireable and appropriate thing to do), for security reasons and for not being in a position to do the testing on the commercial coca crop plots themselves.

As part of the objectives stipulated in the Experimental Protocol, we also evaluated the effect of possible glyphosate contamination of the soil and bosies of water, in addition to the vegetation covering in the sprayed illicit crops.

Another part of the Experimental Protocol was the task of measuring the losses of the mix sprayed from 30 meters of altitude due to evaporation, drift, and other causes. The results that we came up with were: using the glyphosate mix with the adjuvant Agrotín, the losses were 36.69%; using the glyphosate mix with Potensol they were 49.32%; using the glyphosate mix with Inex they were 69.95% and using the glyphosate mix with Cosmoflux (the treatment that we used as the Commercial Control Treatment) they were 72.67%. Using the glyphosate mix with Agrotín there were least losses, but we must clarify that, the particle recovery cards did not identify particles less than 300 microns in diameter using any of the mixes.

The cover of all of the plant species native to the ecological area where the illicit crops grow was not significantly affected and two to three months later the cover looked the same as it had before the spraying.

We saw the effect of drift using one of the mixes when the wind velocity exceeded tolerable limits. The spray particles traveled up to 10 meters away from the foreseen discharge point.(See datas and diagrams corresponding to Inex-A).

Field spraying using the four mixes over commercial coca crops provided us with mortality percentages superior to 85% and they were very similar among the different mixes. Although losses of the mix were highest using the Treatment (glyphosate mix with Cosmoflux) that we used as a Commercial Control Treatment for comparison purposes, the mortality percentage was equal or superior to the glyphosate mix with Agrotín, despite it being the adjuvant that had least losses during the fall from the spraying equipment.

The photographs of Plot 189A, at 30 days and at 60 days enabled us to confirm that the spray travels a short distance if we take into account that the coca plants that did not receive the effect of the spray appear at a short distance from those that were affected by the glyphosate.

The absolute blind sample, that is to say, coca plants that did not receive any of the formulas used, corresponds to unsprayed plots or to plants in or portions of the plots where coca was growing in Plots 136, 155, and 156, which were not treated with the respective glyphosate formulas. Those plants received the qualification of 0.0% control, but we decided not to take those figures into account in our Statistcial Analyses because they were always the same and because our priority was to measure the possible differences between the Commercial Control Treatment and the three treatments being tested.

The contamination due to glyphosate particles in the soil and in nearby water bodies had a very reduced magnitude and the quantities detected were very much under allowable limits.

The results of the CONTROL of the sprayed coca crops using the different Glyphosate mixes are very good and overwhelmingly exceed 85%.

10.0 LITERATURE CONSULTED

The bibliographical references correspond to the CONSULTED BIBLIOGRAPHY. Here, in one or several parts of each publication or document, the reader may find the technical aspects regarding which references are made in the text of this Final Report.

BIBLIOGRAPHY

(1) Agriculture Canada Food Production and Inspection Branch. Pesticides Directorate.
1991 - Session document: Pre- harvest use of glyphosate. Ottawa (Canada), November, 1991

(2) Angel G., Humberto
1979 - Aplicación Aérea de Agroquímicos. Temas de Orientación Agropecuaria (Aerial Application of Agrochemicals. Farming and Livestock Orientation Topics). Nº 141; 102 pp

(3) Ashton, F.M. and A.S. Crafts.
1973 - Mode of action of herbicides. John Wiley & Sons. N. York. 504 pp.

(4) Benson, W.R.
1969 - The chemistry of pesticides. Ann. N. York Acad. of Sci. 160 : 7-29.

(5) Briñez, O.
1978 - Aplicación aérea de plaguicidas (Aerial Application of Pesticides). Unpublished Mimeograph Report. ICA .Bogota.

1977 - Técnicas de Aplicación Aérea de Agroquímicos (Aerial Application Techniques of Agrochemicals). Unpublished Mimeograph Report. Ciba Geigy. Bogota, Colombia

(7) CIAT
1977 - Manejo y control de malezas en el trópico (Handling and Control of Weeds in the Tropical Lands). Series GS-18. J. Doll, Editor. October.

(8) Ciba-Geigy
Undated Correct Aerial Application of Pesticides. Basil, Switzerland. 30 pp

(8a) ________
Undated Application Service, A.G 7.3. CH- 4002, Basil, Switzerland.

(9) Codex Alimentarius Committee. Joint FAO/WHO
1976 - Food Standard’s Program. Eleventh Session. Report of the Eight Session of the Codex Committee on Pesticides Residues, The Hague, 1975. Alinorm 76/24. 91 pp.

(10) Freedman, B.
1990 - Controversy over the use of herbicides in forestry with particular reference to glyphosate usage. J. Eviron. Sci. Helth. 8 (2): 277-286

(11) Greenpeace

1998 - Glyphosate Fact Sheet, Web Page.
Herbicide Fact sheet: Glyphosate (Roundup). **Journal of Pesticide Reform**, Fall, 1998, vol.18, no.3, p.3.

(12) Goldsborough, L.G.and D.J. Brown
1993 - Dissipation of glyphosate and aminomethylphosphonic acid in water and sediments of boreal forest ponds. Environ. Toxicol. Chem. (12): 1139- 1147

(13) Helling, Charles S.
1997- Environmental fate of herbicides in Hawaii, Peru and Panama.; Weed Science Lab. Agr.Res. Service; U.S.D.A.; Beltsville, Maryland, USA.

(14) Hernández, D.
1969 - Calibración de equipos de aspersión aérea (Aerial Spraying Equipment Calibration). Unpublished Mimeograph Report. ICA, Bogota.

(15) Idrobo, J. M.
1992 - *Información sobre glifosato obtenida del Instituto Colombiano Agropecuario ICA: aspecto de salud y seguridad ambiental del herbicida ROUNDUP (Information on Glyphosate Obtained from the Colombian Farming and Livestock Institute ICA: Environmental Health and Safety Aspect of the Roundup Herbicide)* , p. 3.

(16) International Program on Chemical Safety
1994 - Environmental Health Criteria 159: Glyphosate, World Health Organization: Geneva, 1994, p.15.

(17) _______
1994 - Environmental Health Criteria 159: Glyphosate, World Health Organization: Geneva, pp.31, 59, 68

(18) International Standards Organization, ISO
1981 - Pesticides and other agrochemicals. Common names. Geneva.

(19) Iowa State University
1976 - Aerial Applications. Iowa Commercial Application Manual. Coop. Ext. Service. Aames, Iowa. 9 pp.

(20) Kearney, P.C. and D.D. Kaufman
1969 - Degradation of herbicides. Marcel Dekker, Inc. N. York. 394 pp.

(21) Lerch, M.
Without date Aerial Application of Herbicides at Reduced Spray Volumes. Ciba-Geigy Ltd. Switzerland. Agrochemical Pesticides Application.

(22) Londoño Uribe, Ruby
1983 - Metodología para el establecimiento de límites máximos de residuos de plaguicidas en productos agrícolas (Methodology for the Establishment of Maximum Limits of Pesticide Residues in Farming Products) . ICA/IICA. Miscellaneous Series of Publications No. 397 ISSN-0534-5391.

(23) Malik, J., G. Barry & G. Kishore.
1989 - Minireview: The Herbicide Glyphosate. **BioFactors** 2 (1): 17-25.

(24) Ministry of Justice and Law, National Anti-narcotics Agency.
2000 - Cultivos ilícitos, erradicación e impacto ambiental (Illicit Crops, Eradication and Environmental Impact), June 2000, p.15-30.

(25) Ministry of Justice and Law, National Anti-narcotics Agency, Special Administration Unit.
1998 - Plan de manejo ambiental para la aplicación del herbicida glifosato en la erradicación de cultivos ilícitos. Informe final. (Environmental Management Plan for the Application of the Herbicide Glyphosate in Illicit Crop Eradication. Final Report.); Bogota (Colombia); July 1998: 44-76

(26) Morrison, I.N. and M.D. Devine

1994 - Herbicide resistance in the Canadina prairie provinces: Five years after the fact. Phytoprotection 75 (Suppl.): 5-16.

(27) United Nations
1972 – Pesticide Production and Formula in Developing Countries. Vol. 1. N. York.

(28) Padgette, S.R. et al
1994 - New weed control opportunities: Development of soybeans with a Roundup Ready TM gene. *In* Herbicide resistant Crops. Agricultural, Economic, Environmental, Regulatory, and Technological Aspects. S.O. Duke, Ed. CRC Press.

(29) Illicit Crop Eradication Program (ICEP)
2001 - Comparación entre los datos de toxicidad de glifosato aceptados por diferentes agencias internacionales para evaluación de riesgos. Instructivo de Referencia. (Comparison among the Glyphosate Toxicity Data Accepted by Various International Agencies for the Evaluation of Risks. Reference Instructions.) Mimeograph. Anti-narcotics Police. Bogota. 5 pp.

(30) Piccolo, A. et al
1994 - Adsorption and desoption of glyphosate in some European soils. J. Environ. Sci. Health B 29, (6): 1105-1115.

(31) Revelo P., M
2001 - Plan de Manejo Ambiental. Erradicación de Cultivos Ilícitos . Anexo B. Régimen aplicable al manejo y uso de plaguicidas. (Environmental Management Plan. Illicit Crop Eradication. Annex B. Policy Applicable to Pesticide Handling and Use.) Unpublished Report. Edema Ltda.

(32) _______
1998 - Evaluación y calibración de los equipos de aspersión utilizados en los programas de control de cultivos ilícitos en Colombia. (Evaluation and Calibration of the Spraying Equipment Used in Illicit Crop Control Programs in Colombia.) Unpublished Technical Report, contracted by the firm Gemsi Ltda. 55 pp.

(33) ________
1965 - Matamalezas. Avances técnicos logrados en Colombia. Agricultura Tropical. (Weed Killers. Technical Advances Achieved in Colombia. Tropical Farming.) 21: 693-698

(33a) S.D.T.F.- (Spray Drift Task Force)
1997 - Aerial application studies. Spray Drift Task Force. Macon , Missouri

(34) Stern, V.
1966 - Significance of the economic threshold. In Integrated Pest Control. Proc. Symposium on Integrate Pest Control. FAO. Rome. No. 2: 41-56

(35) Stevens, James T. & Darrell D.
1991 - Summer. Herbicides. In **Handbook of Pesticide Toxicology**, Volume 3, Cases of Pesticides. Wayland J. Hayes & Edward R. Law, editors. New York: Academic Press, 1991.

(36) US Department of Health, Education and Welfare
1997 - Registry of Toxic effects of Chemical Substances. (Annual publication). Center for Disease control, Rockville, Maryland, 20852, USA

(37) U.S. EPA Communications, Education, and Public Affairs
1994 - Press advisory, Craven Laboratories, owner, and 14 employees sentenced for falsifying pesticide tests. Washington D.C. (March).

(38) U.S. EPA Office of Pesticides Program.
1976 - Aerial Application. Apply pesticides correctly. A Guide for Commercial Applicators. Washington, D.C. 20460

(39) _______ Office of Pesticide Programs. Special Review and Reregistration Division.
1993 - Reregistration eligibility decision; Glyphosate. Washington, D.C. (September).

(40) _______
1993 - Reregistration Eligibility Decision (R.E.D.) Facts, Glyphosate, 1993, p.2.

(41) _______
1992 - Pesticide Tolerance for Glyphosate. **Federal Register** 57 (49): 8739-40.

(42) __________
1991 - Press Advisory EPA lists crops associated with pesticides for which residue and environmental fate studies were allegedly manipulated. Washington D.C. (March).

(43) WHO United Nations Environment Programme, Internat. Labour Organization
1994 - Glyphosate Environmental Health Criteria # 159 Worthing C.R. Edit. Geneva, Switzerland.

(44) Williams, Gary M., et al.
2000 - Safety Evaluation and Risk Assessment of the Herbicide Roundup and its Active Ingredient, Glyphosate, for Humans. ***Regulatory Toxicology and Pharmacology*** 31: 160.

(45) _______
2000 - Safety Evaluation and Risk Assessment of the Herbicide Roundup and its Active Ingredient, Glyphosate, for Humans. ***Regulatory Toxicology and*** **Pharmacology** 31: 117-165.

(46) Womac, A.R.
1997 - De-fining droplet sizes . University of Tennessee. Agricultural and Biosystems Eng. Dep. Knoxville TN. Personal Communication.

SOCIEDAD LAS PALMAS LTDA.

Technical Department

Miguel Revelo Pepinosa, I.A., Ph.D.

Bogota, June 2004