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THE FERTILIZER INDUSTRY OF MEXICO[1/]

by

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Mexico

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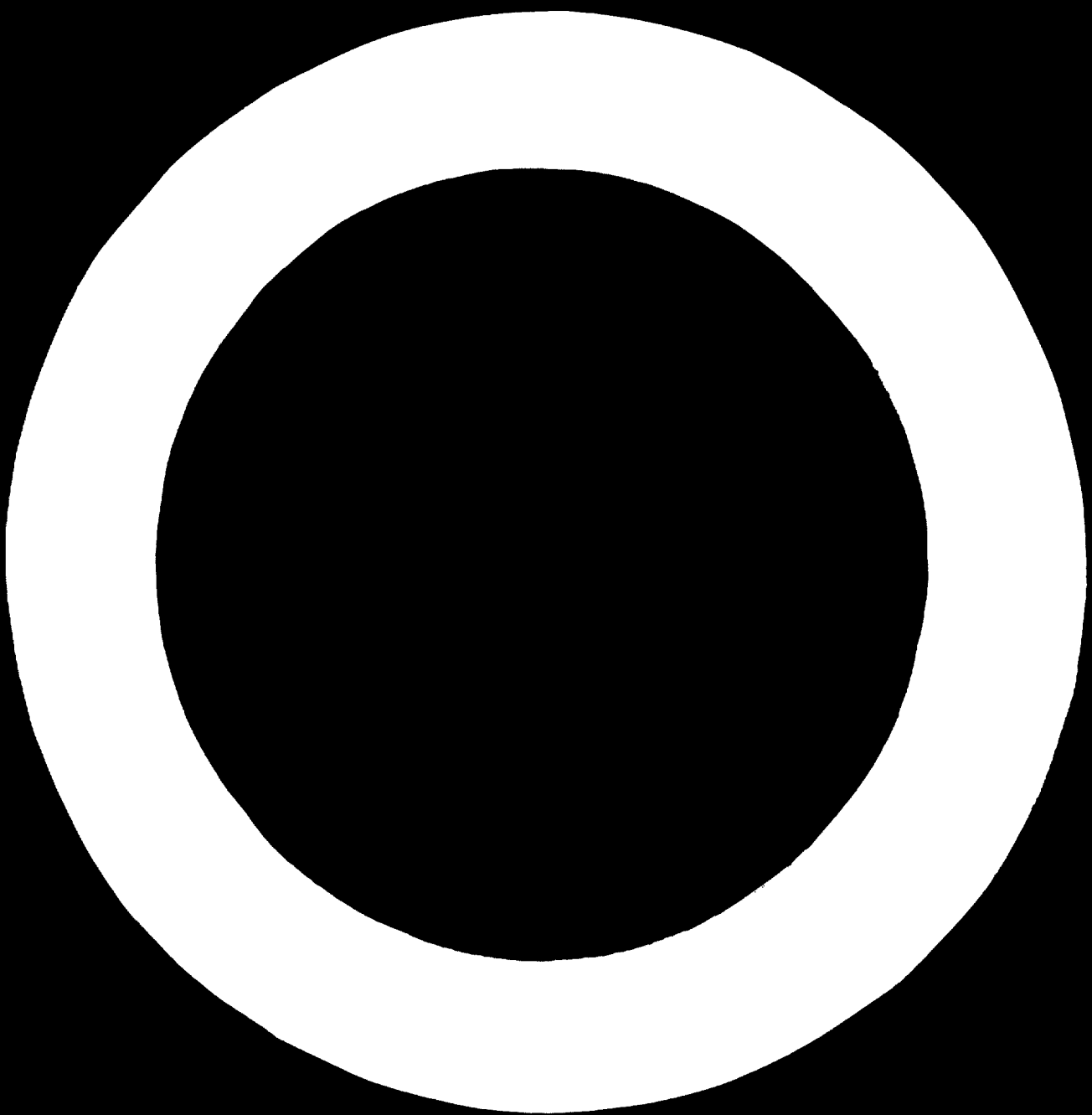

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I. HISTORICAL DEVELOPMENT OF INDUSTRY.

In the development of the Mexican Industry of Fertilizer we can distinguish 3 stages:

- The first (1943 to 1948) is characterized by the sole - - intervention of the State, in a period in which the acquisition of technology did not pose many problems.

- The second (1958 to 1965), in which the intervention of - the private initiative, together with capital and foreign technology is sought, being those the only means to acquire capital.

- The third stage (1965 to 1971) in which the process of - - integration of the industry, under the state's direction - is initiated.

Following we will analyze this process of development.

First Stage.- In the year 1943 the State participation - - Corporation Guanos y Fertilizantes de México, S. A. is created, considered from the beginning as an industrial public service. By 1948 this corporation started the production of chemical - - synthetic fertilizers in Mexico, installing a plant of simple - superphosphate with capacity of 55,000 MTY. Concurrently, the - import and distribution of other chemical fertilizers, particularly nitrogen based, was started.

In 1951, an industrial complex consisting of: a plant of -

22,000 MTY of anhydrous ammonia one of 70,000 MTY of sulphuric acid, and another of 75,000 MTY of ammonium sulphate was installed; in 1953 these facilities were expanded with the installation of a simple superphosphate plant with a capacity of 120,000 MTY, and in 1958, with the installation of an additional capacity of 55,000 MTY of ammonium sulphate.

In spite of these efforts, the national supply was insufficient, especially due to the introduction of new products in the market such as ammonium nitrate, urea and complex fertilizers.

Second Stage.- In 1958, according to the policy of substituting imports and to the criterium of achieving a competitive market, the creation of corporations with private capital, in particular foreign private capital, is allowed, in order to participate in supplying fertilizers considered as petrochemical by-products, leaving to the State, through its parastatal corporation, Petroleos Mexicanos, the manufacturing of basic petrochemical products.

In this stage, the creation of four corporations is particularly important: Fertilizantes de Monclova, S. A., Fertilizantes del Bajío, S. A., Fertilizantes del Istmo, S. A. and Industrias Químicas de México, S. A.

The criterium of availability of raw materials, regardless of their profitability determined the location of these plants. Thus, we have that, at the same time, two plants with reduced capacity of anhydrous ammonia from natural gas were installed, and one of

anhydrous ammonia from coking gas, with costs that reached more - than the double obtained by using natural gas. These plants - - implied the establishment of two urea plants, 2 of ammonium nitrate, two of complex formulas, and two of ammonium sulphate.

In general terms it can be said that both, ammonia plants and those of final products, were at the lowest possible level of - - their capacity. Similarly, the manufacturing of intermediate products such as nitric acid, sulphuric acid and phosphoric acid was branched into various plants with reduced capacity.

This policy implied an excessive and unnecessary effort in -- terms of investment, since the possibilities of obtaining scale - economies were lost, situation which resulted in high production costs and market prices.

The paradox of this situation is that, in spite of everything, the national needs for fertilizers were not met, since, during - this period imports kept on increasing.

It should be pointed out that some characteristics of the policy of fertilizing a developing country, such as technical incapacity, lack of knowledge about the market for its products and in-- sufficient working capital, make the State's intervention indispensable, in order to guide in the selection and financing, and in -- some cases, to apply products which require a minimum of technical training. In this period, the responsability of providing technical assistance was conferred to the private corporations, which --

resulted in disloyal commercial practices towards the farmers, who had the consume products which didn't fill their needs.

It has already been said that the location of these plants - was determined by the availability of raw materials, which are - far from the main markets. Thus, four factors which made impo-- ssible the efficient supply for the Mexican agriculture are added (high prices, high freight, defficient distribution and technical advise).

In spite of the high price paid by the national agriculture - due to the insufficient supply, the national industry was not - - able to consolidate a profitable operation, since capital costs - were exaggeratedly high when scale economies were lost. In addi- tion, since these were corporations with very little experience - on this field, they were not able to counter balance the high ca- pital costs with an efficient organization of labor and of the -- supply of raw materials. The disloyal competence among the same corporations further burdened their financial situation.

Third Stage.- The previous stage can be summarized, as basi- cally being a problem of lack of efficiency in the supply of fer- tilizers, which very specially affected agricultural exports and did not allow for the improvement of productivity of the tradi- - tional agricultural sector.

This situation forced a change in policy, directed towards -- the nationalization of production and of distribution of fertili- zers.

As first step, the merging of private corporations with the - State participation firm Guanos y Fertilizantes de México, S. A.- was posed, centralizing the production and distribution of fertilizers on the latter, with the exception of the production of - - ammonia which remained under the control of Petroleos Mexicanos, but whose distribution is handled by the first corporation.

This merging process (1965 to 1967) is conceived within a consequential process of integration. It was decided that this merging process would be entrusted to a state corporation, since at that - time the fact of taking advantage of the existing facilities to -- the extent possible and of eliminating those which were considered obsolete, resulted in less capital costs. Similarly, this merging allowed to eliminate duplicity in administrative costs.

Starting on 1967, the construction of a series of plants - - - oriented towards the integration of industry was initiated. These plants were.

Guadalajara, Jal.	
Sulphuric Acid	150,000 MTY.
Ammonium Sulphate	120,000 MTY.
Simple-superphosphate	120,000 MTY.
Mixed fertilizers.	20 MTH.
Camargo, Chih.	
Urea	75,000 MTY.
Minatitlán, Ver.	
Urea.	247,500 MTY.

Cuautitlán, Méx.	
Sulphuric Acid	198,000 MTY.
Cosoleacaque, Ver.	(Petróleos Mexicanos)
Ammonia	330,000 MTY.
Coatzacoalcos, Ver.	(Fertilizantes Fosfatados Mexicanos).
Sulphuric Acid	1.089,000 MTY.
Phosphoric Acid (54%)	550,000 MTY.
Triple-Superphosphate.	250,000 MTY.

Appendix I shows which corporations produce fertilizers in México, the products they manufacture, the year when they started their production as well as their capacity and technology.

These projects, of which a 90% are currently operating, can be analyzed in two secondary groups: those oriented towards the fulfillment of need of regional nature such as Guadalajara, Camargo and Cuautitlán; and those which, besides being oriented towards the whole of the national market, have been designed and located to carry out large scale export operations, such as Minatitlán and Coatzacoalcos.

Appendixes II, III, IV and V show one of the results of the integration policy, as production increased at an accumulative rate of 16% and imports were reduced to insignificant levels, as compared to national consumption, with the exception of anhydrous ammonia.

YEAR	PRODUCTION NPK (1)	Index	Ammonia (2)	Index
1960	295,106	100	19,423	100
1965	695,140	235	175,187	902
1970	1.235,454	419	497,801	2.563

YEAR	IMPORTS NPK (1)	Index	Ammonia (2)	Index
1960	116,422	100	68,452	100
1965	152,571	131	111,460	163
1970	25,805	22	74,245	108

YEAR	APPARENT CONSUMPTION N P K (3)	INDEX
1960	173,365	100
1965	347,282	200
1970	524,030	302

(1) Tons of gross product excluding ammonia

(2) Tons of gross product

(3) Tons of nutrient including ammonia for direct application.

This production increase is accompanied by considerable - - increase in the productivity of human resources and capital, which coordinated with new distribution systems, in which exaggerated - intermediate costs have been eliminated to the extent possible, - have allowed substantial reductions in prices as one can see in - the following comparative table (Paasche Indexes).

Comparative Table of Price Indexes.

YEAR	NPK Fertilizers Price index	Price index received by Mexican Agriculture	(Base 1960 equal to 100) Index ratio (1)/(2)	Price indexes of investments received by agriculture.
1960	100.0	100.0	1.00	100.0
1961	104.7	109.2	0.95	100.6
1962	111.6	114.2	0.99	101.3
1963	94.8	119.5	0.78	108.4
1964	103.0	124.8	0.83	104.9
1965	103.8	124.2	0.84	108.0
1966	104.0	123.8	0.83	107.5
1967	96.1	127.8	0.71	108.7
1968	93.4	129.3	0.66	108.2
1969	95.0	129.4 (1)	0.69	117.7 (1)
1970	85.8	139.6 (1)	0.62	119.2 (1)

(1) Preliminary.

A good part of this reduction in prices has been achieved due to the substantial improvements in the productiveness in fertilizers' production on one hand, and on the other, due to the increasing cooperation among a series of official institutions such as: State Fertilization Committees, financing institutions specifically dedicated to agricultural credit, Agricultural Research Centers and Institutions, and farmers unions and associations. This cooperation has allowed to cope with the three previously mentioned problems at market levels: effective technical assistance, financing

and distributing channels designed to prevent the raise in prices due to unjustified profits at the retail ends.

We consider that this task is still beginning, but, nevertheless, it is producing good results and it is one of the main concerns of the Federal Government.

II. CURRENT DEVELOPMENT PROBLEMS OF THE MEXICAN FERTILIZER INDUSTRY.

Considering consumption trends and taking as reference point the evaluation of the fertilizing possibilities with which it is economically feasible(apendix VI) we have set ourselves the following objetive: fertilize during the present decade, an equivalent to the whole of the surface cultivated under irrigation, and a fourth of the seasonal soil which, by 1980, can reach 8.4 million hectares.

Presently, the surface potentially susceptible to fertilization reaches 5 million hectares, of which, around 4 million hectares are fertilized at very reduced application levels (131 Kg. of nutrient per fertilized hectare), but which are equivalent to 34.9 Kg. of nutrient per hectare of the total cultivated surface in 1970.

At present levels of fertilization, this implies a demand for 1.100,000 TM of nutrients for 1980. If this same rate of growth in the consumption per hectare continues, the demand level mentioned for 1980, would appear towards 1977. In this way, besides the fact that we are being seriously pressed on to increase pre-

sent export levels, the Mexican industry would be forced to supply around 1.400,000 MTY of nutrients.

We know that in order to reach these objectives we have to face two serious problems: the first, being of internal nature, implies carrying out completly the integration of the industry in order to achieve an optimum utilization of the comparative advantages available to our country in terms of natural resources. The second problem, being of external nature, comes from the difficult conditions of an international market in which disloyal commercial practices are common, as well as of a market with highly monopolized technology by the developed countries.

The lack financial resources has prevented us from forming a research program regarding the development of new natural resources, as well as the development of adequate technologies for our supply of resources. Nevertheless, and in spite of the great limitation of resources, the corporation Guanos y Fertilizantes de México, S. A., together with the University of Guanajuato, have developed a process to benefit alunite ores ($K_2 SO_4 AL_2 (SO_4)_3 4 Al (OH)_3$) by means of a process by which, on one hand, a fertilizing mixture of potassium sulphate and ammonium sulphate - - - (15-0-17) is obtained together with aluminum sulphate on the other hand, for Mexico this process implies the development of a source of potassium of its own, mineral which currently is being imported. In addition, the above mentioned corporation has completed a process to produce urea with low contents of biuret, and that, just as the process of alunite, is being tried at a pilot plant.

It is evident that, at any level, be it internal or external, the main limiting factor for the development of the fertilizer industry is the lack of capital, and very particularly, in the form of technology, whose high cost in many cases prevents the production of fertilizers with direct procedures, or with new processes in which fertilizers are obteined as co-products in the manufacturing of artificial fibers and/or explosives, procedures in which a substantial economy could be expected in relation to capital -- costs per unit of product.

In México, as in many other developing countries, construction and erection costs for fertilizers' plants can be a 30% higher than in other developed countries, in addition to technology costs. -- All this aggravates the lack of capital situation, which we consider to be insurmountable for the current decade, since as it has been seen, our need of nutrients for agriculture is increasing at a very high rate.

III. CONCLUSIONS.

The determination of the ineffectiveness of the policy of substitution of imports is not new when it is judged in terms of its impact on the welfare of economy as a whole. The case of the fertilizer industry in México is one of the many examples which are so numerous in underdeveloped countries. Nevertheless, in spite of all, it has been the only way which, for the last 30 years, has been open to our countries.

In the long run, and considering the effects of this policy only on the fertilizer industry, the most transcendent effect has

been the inheritance of a series of plants, inefficient in scale, and which have represented a capital cost much higher that what - is consider necessary. The role of the State in the solution of these problems has been definit.ve, making us determine the need of an economical policy in accordance with the objectives that - the community has set. Planning is one of these elements of economical policy which are being used, and we except better results from its application.

Nevertheless, our efforts can be counteracted by the adverse commercial policies of the developed countries in relation to -- technology, capital, and market for final products.

MANUFACTURING PLANTS OF FERTILIZER IN MEXICO

APPENDIX I

Guanos y Fertilizantes de México, S.A.

Location	Product	Capacity MT/yr	Start up	Technology
Bajío	Ammonium sulphate	60,000	1969	" Chemico Construction Corp."
	Urea	Orig. 56,000 Act. 75,000	1963 Amp. 1969	" Lonza Lemmus"
Camargo	Urea	75,000	1968	" Toyo Koatsu "
Coatzacoalcos	Sulphuric acid	Orig. 50,000 Act. 65,000	1962 1968	" Monsanto "
	Phosphoric acid (P_2O_5)	17,00	1962	" Dorr Oliver"
	Ammonium sulphate	50,000 81,000	1966 1971	" Chemico Construction Corp."
	Diammonium phosphate	75,000	1971	" Dorr Oliver "
Cuautitlán	Anhydrous ammonia	22,000	1951	" Chemico Construction Corp."
	Sulphuric acid	130,000	Orig. 1951	" Chemico Construction Corp."
			Amp. 1958	" Monsanto "

	Ammonium sulphate	150,000	Orig. 1951 Amp. 1966	" Chemico Construction Corp."
	Simple super-phosphate	120,000	1953	Mexican technology
	Bulk blending	60,000	1961	Mexican
Ecatepec	Sulphuric acid	35,000	1957	" Lurgi "
			1964	" Monsanto "
	Simple super-phosphate	25,000	1965	Mexican
	Bulk blending	40,000	1965	Mexican
Guadalajara	Sulphuric acid	150,000	1968	" Monsanto "
	Ammonium sulphate	120,000	1968	" Struther Wells "
	Simple super-phosphate	120,000	1968	" Saint Gobian "
	Bulk blending		Former plant 1950 New plant 1968	Mexican
Minatitlán	Sulphuric acid	110,000	Orig. 1962 Amp. 1966	" Monsanto "
	Nitric acid	109,000	Orig. 1961 Amp. 1966	" Dupont "

	Phosphoric acid (P_2O_5)	41,000	Orig. 1962 Amp. 1966	" Dorr Oliver "
	Ammonium nitrate	110,000	Orig. 1961 Amp. 1966	" Prilling "
	Urea	55,000	1962	" Toyo Koatsu "
	Urea	247,500	1971	" Snam Progetti "
	Complex fertilizers	140,000	Orig. 1962 Amp. 1966	" PEC "
Monclova	Anhydrous ammonia(dismantled)	32,000	1961	Socicte Chemique de la Grande Paroise y Societé L'Air Liquide.
	Nitric acid	55,000	1959	Societe Belge de L'Azote
	Phosphoric acid (P_2O_5)	18,000	1965	" Pechiney-Saint Gobian "
	Ammonium nitrate	68,000	1959	" Saint-Gobian "
	Complex fertilizers	38,000	1963	" The A.J. Sackett "
San Luis Potosí	Simple superphosphate	55,000	1947	Mexican

	Bulk blending	5,000	1950	Mexican
Torreón	Ammonium sulphate	100,000	1966	" Chemico Construction Corp. "
Fertilizantes Fosfatados Mexicanos				
Coatzacoalcos	Sulphuric acid	1,089,000	1969	" Wellman Lord "
	Phosphoric acid (54% P_2O_5)	550,000	1969	" Prayon "
	Triple super-phosphate	250,000	1969	" Dorr Oliver "
Petróleos Mexicanos				
Camargo	Ammonia	132,000	1967	" Chemico "
Cosoleacaque	Ammonia	66,000	1962	" Lumus "
Cosoleacaque	Ammonia	330,000	1968	" Lemus "
Salamanca	Ammonia	90,750	1962	" Lemus "
Industrias Químicas de México, S.A.				
Guadalajara	Ammonium sulphate	30,000	1964	Process with own technology
	Ammonium sulphate	30,000	1958	Process with own technology

Compañía Mexicana de Coque			
	Ammonium sulphate	6,000	Obtained as by- product
Nueva Rosita			
	Ammonium sulphate	6,000	Obtained as by-product

NATIONAL PRODUCTION OF FERTILIZERS IN MEXICO

(Metric Tons of gross Product)

APPENDIX II

YEAR	AMMONIUM SULPHATE	UREA	AMMONIUM NITRATE	SIMPLESUPER-PHOSPHATE	TRIPLESUPER-PHOSPHATE	COMPLEX	AMMONIA	
1950	2,642			11,429				
1951	33,753			18,481			8,381	
1952	64,466			46,255			15,721	
1953	66,210			63,481			15,727	
1954	63,242			61,133			15,662	
1955	70,232			74,979			17,480	
1956	87,790			77,138			20,219	
1957	99,287			84,560			21,058	
1958	113,576			78,085			21,428	
1959	143,491		10,209	99,514			21,594	
1960	147,186		53,825	94,095			19,423	
1961	152,519		52,335	110,694			38,072	
1962	157,260	17	[illegible]3,076	117,044	15,168	[illegible],022	100,020	2
1963	159,031	38,938	122,733	124,355	45,309	60,424	150,527	1
1964	166,954	81,748	127,278	136,969	40.423	81,953	175,950	
1965	205,480	96,221	94,319	145,189	33,857	120,074	175,187	
1966	229,930	104,077	146,788	170,611	47,809	129,505	194,372	
1967	241,224	96,369	162,707	176,376	44,572	140,521	181,843	
1968	346,785	118,355	164,221	209,459	51,307	141,325	215,836	
1969	399,693	161,503	160,032	237,108	175,371	165,431	418,778	
1970	387,996	158,578	[illegible],655	174,877	198,588	165,760	497,801	

APPENDIX V.

APPARENT CONSUMPTION OF FERTILIZERS IN MEXICO.

(METRIC TONS OF NUTRIENT) .

YEAR	NITROGEN N	INCREMENT	PHOSPHORUS P_2O_5	INCREMENT	POTASSIUM K_2O	INCREMENT
1950	8,511	100	2,374	100		
1951	15,576	183	4,274	180		
1952	20,671	242	9,746	410		
1953	23,323	274	15,039	633		
1954	33,522	394	19,688	829	1,524	100
1955	54,746	643	21,234	894	3,563	233
1956	74,519	875	28,441	1,197	4,479	293
1957	78,213	919	28,746	1,210	5,056	331
1958	95,339	1,120	26,968	1,135	9,859	646
1959	128,444	1,509	31,496	1,326	8,127	533
1960	132,421	1,555	34,214	1,441	6,730	441
1961	129,992	1,527	44,871	1,890	9,053	594
1962	148,468	1,744	45,159	1,902	13,386	878
1963	203,779	2,394	68,455	2,883	13,702	899
1964	247,011	2,902	69,089	2,910	16,503	1,082
1965	250,111	2,938	75,615	3,185	21,556	1,414
1966	278,194	3,268	87,128	3,670	27,012	1,772
1967	295,397	3,471	102,936	4,335	25,437	1,668
1968	353,254	4,150	120,248	5,065	34,614	2,271
1969	397,551	4,671	151,732	6,391	22,415	1,470
1970	391,014	4,594	112,805	4,751	20,211	1,326

APPENDIX IV

EXPORTS OF FERTILIZERS BY MEXICO.

(METRIC TONS OF GROSS PRODUCT) .

YEAR	AMMONIUM SULPHATE	UREA	AMMONIUM NITRATE	TRIPLE SUPER-PHOSPHATE	COMPLEX	
1960						
1961						
1962		9,104				
1963		4,000				
1964		19,716	15,500		15,667	I & Y
1965		3,256				
1966		5,640	300		2,250	
1967		700	400	150	2,405	
1968	750	7,148			1,910	
1969	600	20,556		59,585	5,681	
1970		17,042		145,692	9,756	

IMPORTS OF FERTILIZERS IN MEXICO.

(METRIC TONS OF GROSS PRODUCT).

YEAR	AMMONIUM SULPHATE	UREA	AMMONIUM NITRATE	TRIPLE SUPER PHOSPHATE	COMPLEX	ANHYDROUS AMMONIUM
1950	15,185		7,465		1,142	663
1951	6,152	37	9,686		2,645	1,058
1952	3,850	526	7,832		1,158	893
1953	5,913	334	4,156		7,757	1,219
1954	14,435	691	10,904		18,010	1,788
1955	45,288	3,246	25,583		13,967	10,197
1956	46,067	21,298	34,323		36,002	19,182
1957	15,641	26,467	28,921		35,117	21,121
1958	21,913	33,487	38,007		36,976	29,322
1959	27,375	30,491	24,936		42,482	47,478
1960	7,415	42,626	13,321		53,060	68,452
1961	4,249	40,454	12,085		74,014	74,855
1962	10,103	45,437	1,759		45,627	48,338
1963	46,687	45,773	9,628		30,087	59,399
1964	72,579	35,925	30,346		38,421	85,455
1965	69,565	26,416	49,742		6,848	111,460
1966	63,482	25,796	27,327	3	-	152,817
1967	70,497	26,354	4,261	14,184	4	200,004
1968	111,403	34,089	10,000	19,639	14,968	212,068
1969	39,545	9,202	10,000	-	15,001	107,295
1970	-	7,813	5,000	-	12,992	74,245

CULTIVATION AREAS AND FERTILIZERS UTILIZATION.

REGION	CULTIVABLE SURFACE	IRRIGATION AREA	TEMPORAL AREA.	FERTILIZABLE AREA.	FERTILIZED AREA	THEORETICAL CAPACITY (TONS OF NUTRIENT).		
	HAS.	HAS.	HAS.	HAS.	HAS.	N	P_2O_5	K_2O
NORTHWEST	1,552,209	1,343,909	208,300	1,454,309	1,057,510	163,108	35,421	3,132
NORTH	1,265,455	890,116	375,339	1,023,456	412,100	100,098	47,504	8,290
WEST	1,851,389	182,776	1,688,613	1,167,738	824,191	155,724	64,501	6,110
CENTER	2,362,990	319,708	2,043,182	1,783,411	403,419	199,45[illegible]	112,189	49,100
BAJIO	4,082,892	585,547	3,497,345	1,572,460	652,992	204,168	123,184	48,025
SOUTH	3,414,675	100,389	3,314,286	2,330,609	250,017	236,289	166,911	92,163
TOTAL:	14,529,610	3,422,445	11,127,065	9,331,983	3,600,229	1,058,843	549,710	206,820

(1) In function of the cultivation areas and medium treatments by unit.

CULTIVATION AREAS AND FERTILIZERS UTILIZATION.

REGION	REAL CAPACITY (Tons. of nutrient)			SALES 1970 (Tons. of nutrient)			QUANTITY IN KG/HA.					
							N		P_2O_5		K_2O	
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	IRRIG.	TEMP.	IRRIG.	TEMP.	IRRIG.	TEMP.
NORTHWEST	140,323	30,910	2,635	157,479	14,397	971	131		8		1	
							(111)		(24)		(2)	
NORTH	72,969	33,158	5,153	58,523	18,395	1,201	92		35		1.6	
							(100)		(53)		(11)	
WEST	104,901	41,836	4,236	51,577	22,269	2,111	71	44	30	19	2.7	1.7
							(104)	(80)	(53)	(31)	(22)	(1)
CENTER	128,594	71,843	30,890	45,445	26,319	5,213	89		62		10	
							(103)	(81)	(60)	(46)	(26)	(20)
BAJIO	74,071	42,605	16,624	67,899	27,454	4,334	73	47	38	23	6	5
							(109)	(60)	(53)	(38)	(22)	(15)
SOUTH	133,095	92,095	53,065	24,388	12,551	8,805	79		39		31	
							(75)		(52)		(29)	
TOTAL:	653,953	311,907	112,603	405,311	121,385	22,635						

(2) Conditioned by the socioeconomic factors and present fisic and technical conditions.

(3) Quantities in parenthesis indicate recommended quantities and without it, real quantities in 1970.

The agricultural research in Mexico was the most important factor in the development of the fertilizer industry. In fact since the first results of the recommended fert lizer were known the use and production of fertilizer increased very rapidly, as important responses were obtained in crop yields, i.e. corn, wheat, cotton, sugar cane and others.

To illustrate it the data is presented as follows:

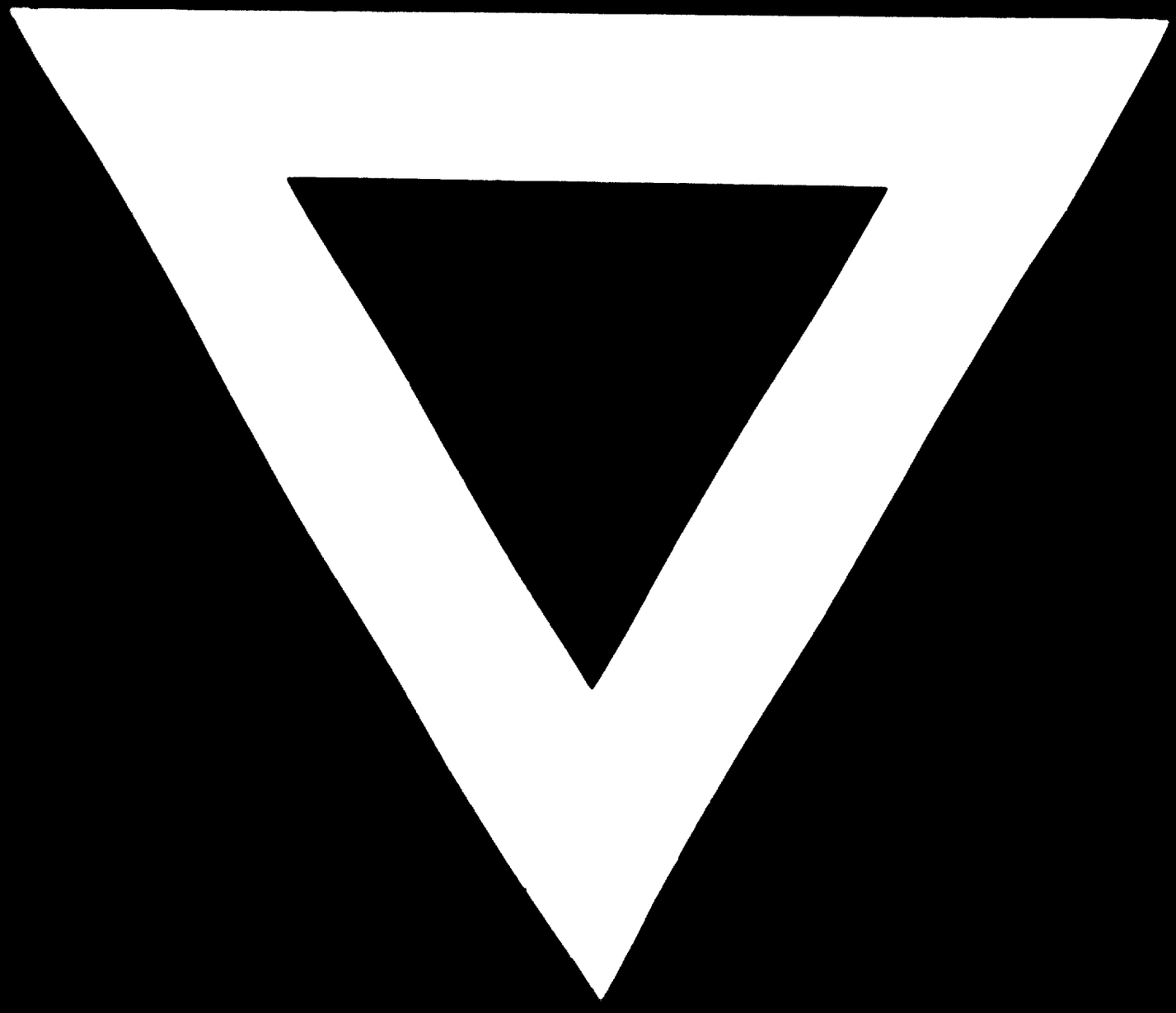
Year	N	%	P_2O_5	%	K_2O	%
1950	8,511	100	2,380	100	-	-
1960	132,421	1,555	34,214	1,441	6,730	400
1970	391,014	4,594	112,805	4,715	20,211	1,326

A presentation in graphs is made of the average responses of crops in Mexico, for the application of N, P_2O_5 and K_2O at three different levels. It is shown that 70 per cent of soils in which N is applied at more than 35 kg. per hectare show increases in yield, whereas yield increases were shown in only 50 per cent of the soils to which P_2O_5 was applied and only 4 per cent in the case of K_2O.

Actually about 50 per cent of the agricultural area under irrigation or in good moisture condition is fertilized at a lower rate than 35 kg. N per hectare.

It is expected that for 1980, in order to cover most of the areas with fertilizers a requirement of 1,058,843 metric tons of N; 559,710 tons of P_2O_5 and about 25,000 tons of K_2O will be needed.

One of the main problems in the use of fertilizers was due to the fact that the Agricultural Extension Service has been too small to cover adequately the large agricultural areas of the Mexican country. Therefore not all the farmers had knowledge of the benefits and profits of the fertilizer use, time and ways of application, etc. Fortunately, the recent reorganization of this service will cover in the future the deficiencies mentioned above.



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