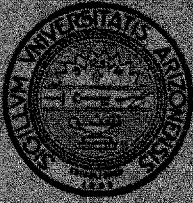


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University of Arizona

COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

THIRD ANNUAL REPORT OF THE ARIZONA FERTILIZER CONTROL OFFICE

YEAR ENDING DECEMBER 31, 1940

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THIRD ANNUAL REPORT OF THE ARIZONA FERTILIZER CONTROL OFFICE

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Responsibility for inspection and analysis of commercial fertilizers in Arizona is placed on the Agricultural Chemist, Agricultural Experiment Station, who is designated as State Chemist for the enforcement of the act. The law is designed to regulate the sale of commercial fertilizers and thus protect the consumer and manufacturer from fraud and unfair competition. All grades or brands of fertilizer sold in the state must be registered with the State Chemist for which a fee of \$5 is charged. There is also a tonnage fee of 20 cents per ton.

CAUTION

Consumers should be guided by the analysis of the fertilizer which must appear on the label or bag, since poor quality fertilizer may be sold legally if properly tagged. The consumer is especially advised to differentiate between available phosphate and total phosphate. Any fertilizer that is not properly tagged should be refused.

FERTILIZERS FOR ARIZONA SOILS

Arizona soils, like those of all semiarid districts, are deficient in nitrogen. Nitrogenous materials therefore comprise a large percentage of the fertilizers consumed in the state. While the law does not require a statement of ingredients, it shows a good intent on the part of the fertilizer manufacturer when such a statement appears on the tags. It is of value to the consumer to know whether he is buying quick-acting nitrogen, as nitrate; slow-acting nitrogen, as organic; ammonia nitrogen, which is intermediate; or even a mixture of two or more forms of nitrogen.

Arizona soils are very deficient in available phosphate. As there is a wide variation in the amount of available phosphate in the various phosphate fertilizer materials, a statement of availability must appear on the tag. Since Arizona soils already contain a good supply of total phosphate, which is of poor availability, obviously it would be poor economy to add more insoluble phosphate to the soils. Water-soluble phosphates such as treble superphosphate and ammonium phosphates are the best forms to use on Arizona soils. Single superphosphate is also very effective.

Potash is nothing more nor less than an alkali salt, and all the soils of semiarid districts are well supplied with available potash. Therefore the use of potash on Arizona soils is not recommended, and few fertilizers sold in the state contain any potash.

PROPERTIES OF FERTILIZER MATERIALS

Nitrogen (N).—This is beyond doubt the most important plant food used in fertilizers. While nitrogen fertilizers stimulate root growth to a certain extent, their effects are most often manifested in the leaves. If nitrogen is deficient, the leaves will usually have a pale or yellowish green color. There is also some danger of using too much nitrogen, which will cause excessive vegetative growth by producing more succulent plant material, thus making the plant an easier prey to plant diseases and insects.

While at one time most of the nitrogenous materials used in fertilizers were of organic origin and contained practically no water-soluble nitrogen, at the present time most of the nitrogen in fertilizers comes from water-soluble salts. Prominent among these are ammonium sulphate, calcium nitrate, sodium nitrate, urea, cyanamid, and ammonium phosphate.

Phosphoric acid (P_2O_5).—The function of phosphate in plant nutrition is largely in the production of growth and seed. Plants deficient in phosphate will usually be greatly stunted in growth. It is also considered one of the most important root stimulants. As already stated, all Arizona soils contain a good supply of poorly available phosphate of chemical composition similar to bone and phosphate rock. It is not advisable to use such materials as

TABLE 1.—AVERAGE COMPOSITION OF SOME COMMON FERTILIZER MATERIALS USED IN ARIZONA.

Fertilizer	Total nitrogen	Water-soluble nitrogen	Phosphoric acid (P_2O_5)		
			Total	Insoluble	Available
Sodium nitrate.....	16.0	16.0	.....	.....	.....
Calcium nitrate.....	15.5	15.5	.....	.....	.....
Ammonium sulphate..	20.5	20.5	.....	.....	.....
Cyanamid.....	22.0	20.6	.....	.....	.....
Urea.....	46.0	46.0	.....	.....	.....
Ureor.....	40.0	40.0	.....	.....	.....
Uramon.....	42.0	42.0	.....	.....	.....
Anhydrous ammonia	81.0	81.0	.....	.....	.....
Garbage tankage.....	3.0	0.6	4.5	2.5	2.0
Cattle manure.....	2.5	0.5	1.6	.....	.....
Sheep manure.....	2.5	0.5	1.8	.....	.....
Poultry manure.....	4.3	1.5	3.1	.....	.....
Activated sewage.....	3.0-5.0	0.8	2.2	.....	.....
Raw bone.....	3.6	0.8	23.4	9.2	14.2
Steamed bone.....	2.2	0.4	27.5	10.4	17.1
Animal tankage.....	6.0	1.5	12.0	4.0	8.0
Raw rock phosphate..	.....	.....	33.4	31.1	2.3
Superphosphate					
16 per cent.....	.....	.....	17.0	1.0	16.0
48 per cent.....	.....	.....	48.0	3.0	45.0
Calcium metaphos....	.....	.....	65.0	.....	.....
Ammonium phos.					
16-20.....	16.0	16.0	20.0	.....	20.0
11-48.....	11.0	11.0	48.0	.....	48.0
Liquid phosphoric acid.....	.....	.....	53.0	.....	53.0

phosphate fertilizer, since tests have shown them to be of little value. The best forms of phosphate to use on Arizona soils are treble superphosphate and ammonium phosphates. Single superphosphate which is high in available but not in water-soluble phosphate is a good source but not equal to the water-soluble phosphates.

Potash (K_2O).—Potash is largely used by the plant in the new actively growing tissues; it seems to be associated in some way with the production of sugar in the plant, and therefore many claims are made for potash fertilizers as a means of improving the quality of plant products. The law requires that all potash used in fertilizers must be soluble in water. With such restrictions potash materials are mostly the sulphate and chloride, although potash nitrate is used to a limited extent to supply both nitrogen and potash in one salt.

FERTILIZER USE

During the past year several new fertilizer materials have entered the Arizona market for the first time, and the consumption of some others has shown an increase. Because of the quantities of nitrogen required for the manufacture of explosives a scarcity of some forms has arisen in spite of the fact that the world supply of nitrogen is inexhaustible.

Inability to obtain calcium nitrate from Norway and Germany has created a scarcity of this material. It has been largely replaced by nitrate of soda where the nitrate form of nitrogen is needed.

The fixation of atmospheric nitrogen as ammonia has surpassed all other commercial processes for the manufacture of nitrogenous salts in the United States. It may be prepared in the liquid form as anhydrous ammonia, 82 per cent nitrogen; as ammonium nitrate, 35 per cent nitrogen; as ammonium sulphate, 20.5 per cent nitrogen. In view of the fact that nitrogen can be fixed more economically as ammonia than by the arc process as nitrate, sodium nitrate, 16 per cent nitrogen, is also being manufactured from the nitrogen fixed as ammonia. Since the ammonia process of nitrogen fixation is the major source of nitrogen for all purposes in the United States, a slight shortage has arisen because consumption is exceeding production capacity.

There has been an increase in the amount of nitrogen used as urea in Arizona. This applies especially to sources of nitrogen in mixed fertilizers, and it is a very suitable form of nitrogen for Arizona soils. Urea is a highly concentrated form of nitrogen (46 per cent), but because it is very hygroscopic—that is, having a great affinity for water—this property has limited its practical value. Methods have now been developed by which this undesirable property can be overcome. Two such forms of urea known as “uramon” (42 per cent nitrogen) and “ureor” (40 per cent nitrogen) were registered in Arizona the past year. The former is urea with which small amounts of cocoa dust and phosphate rock dust are mixed to make it free running. The “ureor” contains a

small amount of diatomaceous earth added for the same purpose. If a further scarcity of ammonium sulphate should arise its place can be taken by urea nitrogen as this form is readily hydrolyzed to ammonia in the soil.

Cyanamid (22 per cent nitrogen) is one of the oldest forms of fixed atmospheric nitrogen. Its use has been largely confined to eastern soils where its basic properties are of value and for building up the nitrogen reserve in the soil by cultivating it in with green manure crops. It has not been used extensively for application to growing truck or field crops. In a recent experiment in which cyanamid was added to the soil just 2 weeks prior to the planting of lettuce some favorable results were obtained. This indicates that its decomposition may be sufficiently rapid in Arizona soils to warrant more extended use in the state.

While Arizona farmers may not be able to obtain the same form of nitrogen they have been using in recent years, there should be no shortage of suitable substitutes—nitrate of soda where quick-acting nitrate nitrogen is needed, urea if ammoniates become scarce, and cyanamid for building a nitrogen reserve in the soil.

Liquid phosphoric acid is a new form of phosphate which was registered for the first time in Arizona. It is a heavy syrupy liquid containing 53 per cent P_2O_5 and is being used to a limited extent in irrigation water and for mixing with highly absorptive substances like manure. With the high temperatures now available in electric furnaces it is possible to manufacture the liquid phosphoric acid from phosphate rock at low cost. This form of phosphate will probably find extensive application in Arizona.

USE OF SOIL CONDITIONERS

There are a number of materials used in plant nutrition and soil treatment which are not classified as commercial fertilizers and are therefore not controlled by the fertilizer law. Many states have agricultural mineral laws for the control of such materials of which gypsum and sulphur are of major importance in Arizona. Sulphur and calcium, the principal elements in these materials, are both of plant food value. However, there is no scarcity of either in Arizona soils, as plant food, and therefore these materials have no use as fertilizer. Their use on Arizona soils is entirely one of improving the structure of the soil and making it a better environment for the development and feeding activities of roots. With such an improvement in the soil structure, which is accompanied by a better movement of air and water within the soil mass, fertilizers can be more efficiently used and more thoroughly absorbed by the crop.

A large percentage of the soils of the alluvial valleys of the state will be improved by light annual applications of sulphur or gypsum, and alkali soils can be reclaimed by heavy applications. It should be kept in mind that 400 pounds of sulphur will do the same amount of work as 1 ton of gypsum, and applications should be made accordingly. Since both these materials are available in

various degrees of purity, one should insist on some evidence of purity when making purchases, and in spite of the fact that they are not included in the fertilizer law, the Fertilizer Control Office will gladly make analyses of these materials for farmers without charge.

SEASONAL SALE AND CONSUMPTION OF FERTILIZERS

For the information of farmers and fertilizer manufacturers in Arizona the amount of fertilizer sold in the state and the seasonal consumption for 1940 are shown graphically in Figures 1, 2, and 3.

The total sale amounted to 6,900 tons. The largest volume of sales came in the fall and early winter, August to November inclusive, and in late winter, January to March inclusive. The volume of sales is very small during the summer. The sales are in larger part simples such as nitrates, phosphates, and ammoniates.

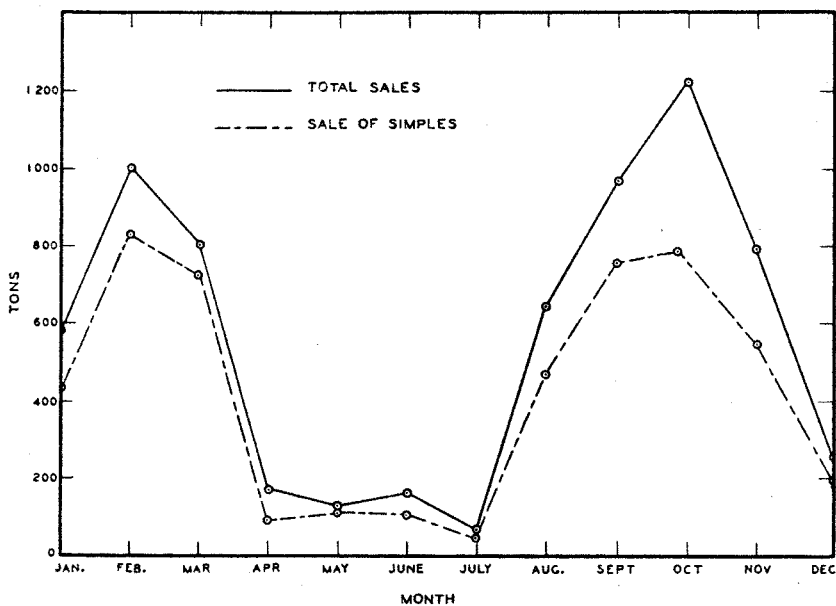


Figure 1.—Monthly volume of fertilizer sales as total of mixed fertilizers and simples and as simples alone.

The volume of fertilizer consumption is shown in more illuminating form in Figures 2 and 3. Figure 2 shows the seasonal use of phosphate and proves it to be a late fall-early winter fertilizer. Tonnage sales of single superphosphate are shown approximately equal to treble superphosphate. However, the treble superphosphate contains about two and one half times as much P_2O_5 , which makes the consumption of actual P_2O_5 in this form about two and one half times that of single superphosphate.

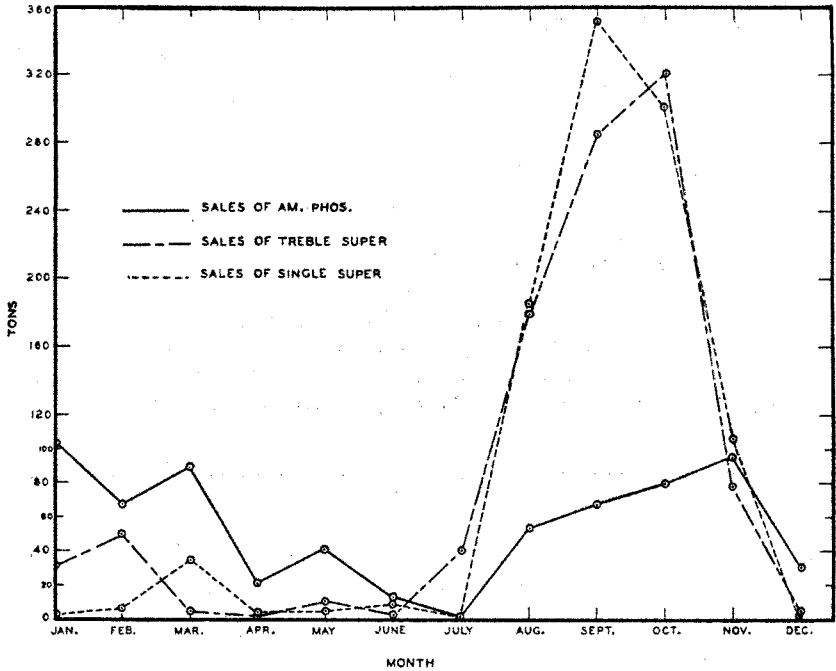


Figure 2.—Monthly volume of phosphate sales as ammonium phosphate, treble superphosphate, and single superphosphate.

Figure 3 shows that nitrogen is a late winter-early spring fertilizer, the peak of sales being from January to March inclusive. Nitrates and ammoniates enjoy approximately equal popularity except during August, September, and October, when sales of ammoniates are slightly higher.

REGISTRATION AND SALE

This report covers the period from January 1, 1940, to December 31, 1940.

In the operation of this law all registrations must be made by the manufacturer, and the registration fee paid by him. The inspection fee of 20 cents per ton must be paid by the dealer or agent who makes the sale to the consumer. In most cases, since sales are usually made by the manufacturer to the consumer, the manufacturer is responsible for both the registration and tonnage fees.

In all cases where doubt exists as to whether or not a fertilizer is registered, kindly consult the

State Chemist
 Arizona Fertilizer Control Office
 Agricultural Experiment Station
 Tucson, Arizona

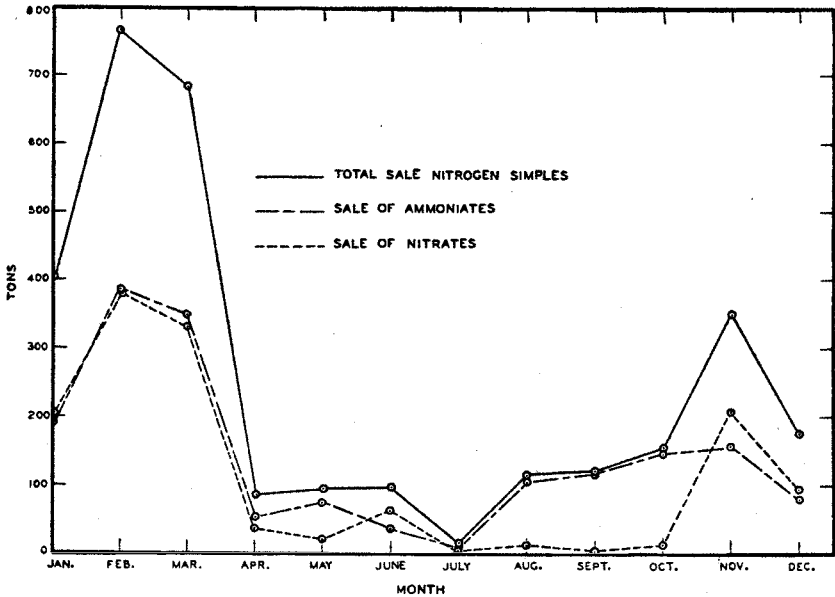


Figure 3.—Monthly volume of nitrogenous materials as total, as ammoniates, and as nitrates.

or the
 Deputy Administrator
 Arizona Fertilizer Control Office
 1201 W. Madison Street
 Phoenix, Arizona

Contracts and orders for delivery of fertilizers in Arizona should carry this statement: "Fertilizers delivered on this contract (or order) must comply with the requirements of the Arizona Commercial Fertilizer Law."

The Arizona Commercial Fertilizer Law requires that inspection fee stamps or tags shall be attached to every bag, barrel, or other container when so shipped; shall be attached to certificate when shipped in bulk by rail; or to the invoice when shipped in bulk by truck. Stamps or tags are to be attached to material before it is offered for sale, except when shipment is made directly to a consumer, then they may be attached before material is unloaded.

The law further requires that every person making shipment of commercial fertilizer or fertilizer material into or within Arizona send to the State Chemist a notice of the kinds, amounts of each kind, dates, destination, and consignees of all such shipments.

REGISTRATION AND ANALYSES

The following tables list the fertilizers registered in Arizona during 1940, their guaranteed analyses, and the analyses of all samples analyzed in the State Chemist's laboratory.

TABLE 2.—REGISTRATION. ANALYSES OF SAMPLES TAKEN (PER CENT).

Manufacturer or agent and product	Lab. no.	Nitrogen (N)	Available phos. (P ₂ O ₅)	Potash (K ₂ O)	Moisture
Agro-Chem Co., Los Angeles, Calif.					
Liquid Phosphoric Acid....	..... 199	G.* F.	53.00 54.40	..........	..........
American Cyanamid & Chemical Corp., Azusa, California					
Aero Cyanamid.....	..... 153	G. 21.00 F. 21.18	..... .....	..... .....	..... 0.55
Ammo-Phos.....	..... 139	G. 16.00 F. 16.36	20.00 21.00	..... .....	..... 0.31
American Potash & Chemical Corp., Los Angeles, Calif.					
"Trona Brand Potash Salts," Sulphate of Potash.....	.....	G. ....	.....	51.50	.....
Anaconda Copper Mining Co., Anaconda, Mont.					
Anaconda Treble Super- phosphate (0-43-0)....	..... 154	G. F.	43.00 47.40	..... .....	..... 1.73
Anaconda Treble Super- phosphate (0-44-0)....	..... 162 163	G. F.	44.00 44.85 45.00	..... ..... .....	..... 3.24 2.31
Arizona Fertilizers, Inc., Phoenix, Arizona					
Nature's Gift 6-6-0.....	..... 171	G. 6.00 F. 6.64	6.00 6.62	..... .....	..... 3.38
Nature's Gift 6-9-0.....	..... 191	G. 6.00 F. 6.32	9.00 12.81	..... .....	..... 4.55
Nature's Gift 6-12-0.....	..... 168	G. 6.00 F. 6.46	12.00 12.43	..... .....	..... 2.63
Nature's Gift 6-18-0.....	..... 169	G. 6.00 F. 6.38	18.00 17.67	..... .....	..... 3.04
Nature's Gift 8-12-0.....	.....	G. 8.00	12.00	.....	.....
Nature's Gift 8-32-0.....	..... 189	G. 8.00 F. 8.19	32.00 36.51	..... .....	..... 3.18
Nature's Gift 10-5-0.....	..... 172	G. 10.00 F. 11.12	5.00 5.54	..... .....	..... 2.45
Nature's Gift 11-22-0.....	..... 170	G. 11.00 F. 10.65	22.00 22.67	..... .....	..... 2.61
Nature's Gift 25-0-0.....	..... 174	G. 25.00 F. 26.44	..... .....	..... .....	..... 2.37
Nature's Gift Hiacid.....	..... 173	G. F.	45.00 41.95	..... .....	..... 4.17

*G, guarantee as shown in registration; F, found by analysis; boldface figures indicate deficiency.

TABLE 2.—REGISTRATION. ANALYSES OF SAMPLES TAKEN (PER CENT)—Continued.

Manufacturer or agent and product	Lab. no.	Nitrogen (N)	Available phos. (P ₂ O ₅)	Potash (K ₂ O)	Moisture
Balfour, Guthrie & Co., Ltd., Los Angeles, Cal.					
Elephant Brand 11-48 Ammonium Phosphate ("Conaphos")..	155	G. 11.00 F. 11.70	48.00 50.65	.....	0.89
Elephant Brand Ammonium Phosphate 16-20 ("Conaphos")..	133	G. 16.00 F. 16.88	20.00 20.65	.....	0.50
Elephant Brand Sulfate of Ammonia.....	135	G. 21.00 F. 21.30	.....	.....	0.06
Bandini Fertilizer Co., Ltd., Los Angeles, Cal.					
Bandini Azalea, Camelia & Rhododendron Food.....	178	G. 3.00 F. 3.25	10.00 12.50	5.00 5.74	..... 4.42
Bandini Blood Meal.....	175	G. 12.00 F. 13.26	.....	.....	7.22
Bandini Bone Meal.....	142	G. 0.75 F. 1.20	14.00 13.34	.....	2.66
Bandini Bulb Plant Food..	176	G. 4.00 F. 4.69	8.00 9.45	10.00 9.52	..... 2.24
Bandini Citrus Food.....	177	G. 6.00 F. 6.42	5.00 10.17	4.00 4.50	..... 3.52
Bandini Fish Meal.....	192	G. 10.00 F. 10.02	3.00 7.72	.....	4.97
Bandini Gro-Rite.....	143	G. 5.00 F. 5.28	9.00 9.45	2.00 2.62	..... 2.86
Bandini Rose Plant Food..	144	G. 4.00 F. 4.40	8.00 12.20	4.00 4.54	..... 2.76
Bandini Sweet Pea Food..	145	G. 5.00 F. 5.62	7.00 9.30	5.00 5.64	..... 3.21
Bandini Vita-Rite.....	193	G. 3.00 F. 4.55	3.00 2.38	1.00 1.55	.....
The Barrett Company, New York, New York					
Arcadian, the American Nitrate of Soda.....	198	G. 16.00 F. 16.02	.....	.....	0.02
Barrett Sulphate of Ammonia.....	.....	G. 20.56	.....	.....	.....
Capital Fuel, Feed & Seed Co., Phoenix, Ariz.					
Acidphos.....	180	G. F.	18.00 20.52	.....	..... 12.15
Acidphos with Sulphur....	.....	G.	16.00	.....	.....
Vita-Crop 4-8-0.....	181	G. 4.00 F. 6.48	8.00 9.34	.....	..... 4.85
Vita-Crop 4-12-0.....	157	G. 4.00 F. 4.43	12.00 14.55	.....	..... 4.04
Vita-Crop 4-16-0.....	183	G. 4.00 F. 5.09	16.00 15.33	.....	..... 4.83
Vita-Crop 5-20-0.....	.....	G. 5.00	20.00	.....	.....
Vita-Crop 6-10-0.....	182	G. 6.00 F. 6.18	10.00 10.12	.....	..... 4.37

TABLE 2.—REGISTRATION ANALYSES OF SAMPLES TAKEN (PER CENT)—*Continued.*

Manufacturer or agent and product	Lab. no.	Nitrogen (N)	Available phos. (P ₂ O ₅)	Potash (K ₂ O)	Mois- ture
Vita-Crop 8-11-0.....	.....	G. 8.00	11.00	.....	.....
	158	F. 9.13	11.03	.....	2.32
Vita-Crop 11-22-0.....	.....	G. 11.00	22.00	.....	.....
	196	F. 11.00	25.44	.....	3.61
Vita-Crop 16-20-0.....	.....	G. 16.00	20.00	.....	.....
	195	F. 16.40	20.24	.....	0.99
Central Fertilizer Co., Los Angeles, Calif.					
Suihiso No. 3.....	.....	G. 8.00	36.00	12.00	.....
Chilean Nitrate Sales Corp., New York, N.Y.					
Champion Brand Chilean Nitrate of Soda.....	190	G. 16.00 F. 16.04	.....	.....	0.05
Chilean Potash Nitrate....	.....	G. 15.00	.....	14.00	.....
Colorado Fuel & Iron Corp., Denver, Colo.					
Silver Tip Ammonium Sulphate.....	.....	G. 20.00	.....	.....	.....
(cancelled 11-19-40)..	156	F. 20.70	.....	.....	0.15
Silver Tip Ammonium Sulphate.....	.....	G. 20.50	.....	.....	.....
E. I. du Pont de Nemours & Co., Incorporated, Wilmington, Del.					
Uramon.....	.....	G. 42.00	.....	.....	.....
	184	F. 43.68	.....	.....	0.20
Ford Motor Company, Dearborn, Michigan					
Ford Ammonium Sulphate.....	150	G. 20.80 F. 21.00	.....	.....	0.02
Garden Fertilizer, Phoenix, Arizona					
Crop-Gro 6-12-0.....	.....	G. 6.00	12.00	.....	.....
Hydroponic Chemical Co., New York, N. Y.					
Hyponex.....	.....	G. 7.00	6.00	19.00	.....
Liefgreen Seed Company, Phoenix, Arizona					
Liefgreen's 8-9-6.....	.....	G. 8.00	9.00	6.00	.....
	194	F. 8.40	11.36	6.44	2.65
Mechling Bros. Chem- icals, Los Angeles, California					
Veget-Aid Complete Plant Food.....	138	G. 5.00 F. 5.84	10.00 11.40	4.00 5.06	2.63
Pacific Guano Company, Los Angeles, Calif.					
Gaviota Cotton Special....	.....	G. 10.00	38.00	.....	.....
Gaviota Garden & Lawn	.....	G. 6.00	9.00	6.00	.....

TABLE 2.—REGISTRATION. ANALYSES OF SAMPLES TAKEN (PER CENT)—Continued.

Manufacturer or agent and product	Lab. no.	Nitrogen (N)	Available phos. (P ₂ O ₅)	Potash (K ₂ O)	Mois- ture
Shell Chemical Company, San Francisco, Calif.					
Shell Agricultural Ammonia.....	200	G. 81.00 F. 82.00	.....	.....	.....
Shell Sulphate of Ammonia.....	161	G. 20.60 F. 21.50	.....	.....	0.12
Southwestern Supply Co., South Gate, Calif.					
Fertilgro.....	.....	G. 11.00	22.00	.....	.....
Southwest Flour & Feed Co., Phoenix-Glendale-Tempe, Arizona					
Southwest Special Grain No. 1.....	.....	G. 2.00	12.00	.....	.....
Southwest Special Grain No. 2.....	.....	G. 2.00	20.00	.....	.....
Stauffer Chemical Co., Los Angeles, Calif.					
Anchor Brand Superphosphate 18%.....	164	G. F.	18.00 19.78	.....	1.90
Swift & Company Fertilizer Works, Los Angeles, Calif.					
Swift's Bone Meal.....	.....	G. 3.00	8.00	.....	.....
Swift's Red Steer Brand 4-8-0.....	.....	G. 4.00	8.00	.....	.....
Swift's Red Steer Brand 4-12-0.....	.....	G. 4.00	12.00	.....	.....
Swift's Red Steer Brand 6-9-0.....	.....	G. 6.00	9.00	.....	.....
Swift's Red Steer Brand 6-12-0.....	.....	G. 6.00	12.00	.....	.....
Swift's Red Steer Brand 6-15-0.....	.....	G. 6.00	15.00	.....	.....
Swift's Red Steer Brand 11-22-0.....	131	G. 11.00 F. 11.00	22.00 22.70	.....	3.56
Swift's Red Steer Brand Superphosphate 18%.....	165	G. F.	18.00 19.58	.....	2.52
Swift's Red Steer Brand Treble Superphosphate.....	132	G. F.	44.00 45.90	.....	2.83
Swift's Red Steer Brand 8-8-4.....	.....	G. 8.00	8.00	4.00	.....
Swift's Red Steer Brand 10-30-0.....	.....	G. 10.00	30.00	0.00	.....
Swift's Red Steer Brand 2-14-10.....	.....	G. 2.00	14.00	10.00	.....
Vigoro 4-12-4.....	197	G. 4.00 F. 4.33	12.00 13.19	4.00 4.04	.....
Vigoro Commercial Growers 6-10-4.....	166	G. 6.00 F. 6.45	10.00 10.39	4.00 4.08	1.06 1.22

TABLE 2.—REGISTRATION. ANALYSES OF SAMPLES TAKEN (PER CENT)—Continued.

Manufacturer or agent and product	Lab. no.	Nitrogen (N)	Available phosph. (P ₂ O ₅)	Potash (K ₂ O)	Moisture
Synthetic Nitrogen Products Corporation, New York, New York					
Cal-Nitro.....	.....	G. 20.50	.....	.....	.....
Calcium Nitrate (nitrate of lime).....	134	G. 15.50 F. 15.72	.....	.....	2.00
Ureor.....	.....	G. 40.00	.....	.....	.....
Taylor Milling Corp., Los Angeles, Calif.					
Taylor's Wonder Peat Mixture 4-7-2.....	179	G. 4.00 F. 5.61	7.00 8.69	2.00 2.77	..... 5.37
Tovrea Packing Co., Phoenix, Arizona					
Crop-Gain 11-22-0.....	.....	G. 11.00	22.00	.....	.....
	187	F. 11.75	21.72	.....	1.67
	188	F. 10.17	21.68	.....	2.28
Crop-Gain 6-12.....	.....	G. 6.00	12.00	.....	.....
	185	F. 6.02	12.73	.....	4.21
Tovrea's Blood Meal.....	.....	G. 12.00	.....	.....	.....
	186	F. 14.18	.....	.....	6.20

SUMMARY

	1939	1940
Total fertilizers registered (Jan. 1 to Dec. 31).....	93	82
Arizona.....	30	27
Out of state.....	63	55
Number of fertilizer manufacturers registered.....	25	27
Arizona.....	6	6
Out of state.....	19	21
Number of samples taken and analyzed (chemical analysis).....	69	57
Number of samples off guarantee.....	13	9

REASONS FOR UNSATISFACTORY REPORTS

Fertilizers deficient in nitrogen.....	6	2
Fertilizers deficient in available phosphate.....	9	7
Fertilizers deficient in potash.....	2	1