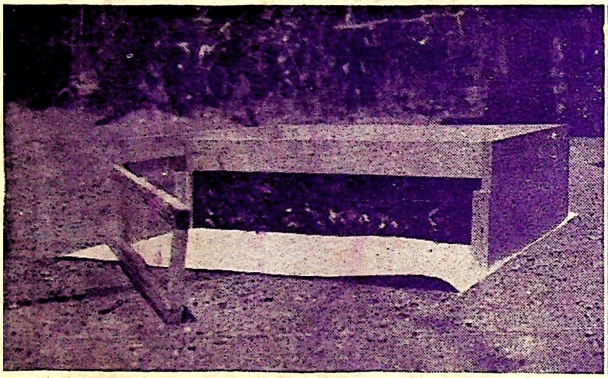
FARMING
AND COOPERATIVES

OFFICIAL ORGAN OF THE PHILIPPINE FARMERS

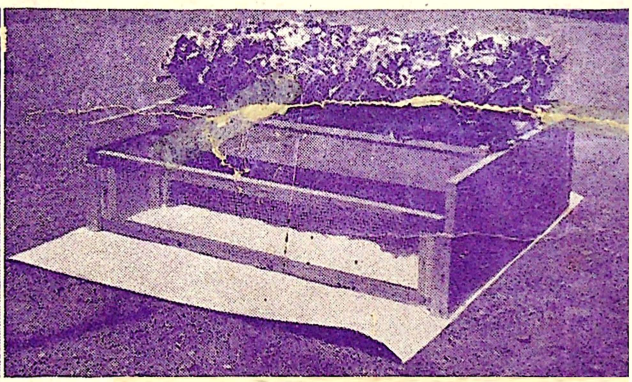
Vol. II No. 4
April, 1947

READ ABOUT THE FEATHER BROODER—PAGE 2

LATEST INOVATION IN POULTRY SCIENCE



Natural position of the feather brooder—the most practical in use now in the Philippines.

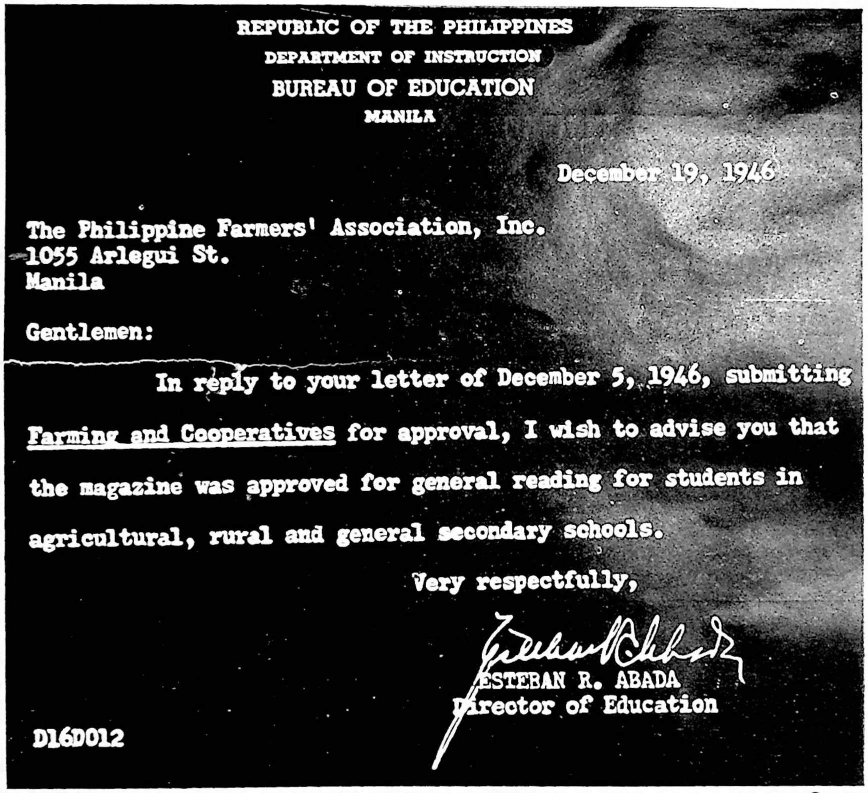


The same as the one on the left with the feather board inverted to show the feather attachment.

THE MONTHLY AGRICULTURAL
JOURNAL THAT REACHES
EVERY HOME
WITH
A MISSION OF SERVICE

"—That research at the College of Agriculture at Los Baños be greatly strengthened in the interest of developing an outstanding institution."
—American Agricultural Mission to P.I.
December, 1946

THREE STARS OF DISTINCTION



REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF INSTRUCTION
BUREAU OF EDUCATION
MANILA

December 19, 1946

The Philippine Farmers' Association, Inc.
1055 Arlegui St.
Manila

Gentlemen:

In reply to your letter of December 5, 1946, submitting Farming and Cooperatives for approval, I wish to advise you that the magazine was approved for general reading for students in agricultural, rural and general secondary schools.

Very respectfully,

ESTEBAN R. ABADA
Director of Education

D16D012

READING FOR INFORMATION
READING FOR INSTRUCTION
READING FOR ENTERTAINMENT

FARMING AND COOPERATIVES

Vol. II—No. 4 April, 1947

WEATHER REPORT

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WEATHER REPORT

AVERAGE MONTHLY RAINFALL AND RAINY DAYS
FOR THE MONTH OF APRIL IN DIFFERENT TYPES
First Type:—Two pronounced seasons; Dry in Winter and Spring, Wet in Summer and Autumn.

STATION	*Length of Record.*	*Monthly Average Rainfall*	*Average Monthly Rainy Days*
	Years	mm.	
Iloilo City	36	41.9	6
Lapuslapus, Iloilo City	20	37.9	5
Cuyo, Palawan	36	20.5	3
Batangas, Batangas	30	27.2	3
Calatagan, Batangas	18	10.3	1
Lian, Batangas	18	30.3	2
Ambulong, Tanauan, Batangas	25	43.9	5
Canlubang, Laguna	22	36.9	5
Santa Cruz, Laguna	28	39.5	7
Fort Mills, Corregidor	28	19.2	1
Cavite Naval Station, Cavite	21	14.2	2
Lamao, Horticultural Station, Bataan	20	17.6	2
Manila City	73	31.3	4
Antipolo, Rizal	26	37.4	4
Bosoboso, Rizal	18	29.8	3
La Mesa, Rizal	13	58.9	7
Montalban, Rizal	·20	50.3	6
Olongapo, Zambales	20	26.8	2
Iba, Zambales	29	41.3	4
Dagupan, Pangasinan	36	74.1	6
Itogon Mining Company, Mountain Province	16	100.4	7
Baguio City	36	109.1	10
San Fernando, La Union	36	21.2	2
Sagada, Mountain Province	20	147.7	12
Bontoc, Mountain Province	20	124.5	10
Vigan, Ilocos Sur	36	18.9	2
Laoag, Ilocos Norte	30	11.1	2

AVERAGE MONTHLY RAINFALL AND RAINY DAYS
FOR THE MONTH OF APRIL IN DIFFERENT TYPES
Second Type:—No dry season with a very pronounced maximum rainfall in Winter.

STATION	*Length of Record*	*Average Monthly Rainfall*	*Average Monthly Rainy Days*
	Years	mm.	
Compostela, Davao	18	160.4	8
Hinatuan, Surigao	11	314.3	21
Butuan, Agusan	35	149.5	17
Surigao, Surigao	36	254.3	17
Guiuan, Samar	26	200.2	19
Tacloban, Leyte	35	136.7	15
Borongan, Samar	36	262.0	19
Catbalogan, Samar	23	137.9	14
Legaspi, Albay	36	150.1	14
Virac, Catanduanes	30	115.2	13
Atimonan, Quezon (Tayabas)	36	76.8	7
Pandan, Albay	7	72.3	6
Lucban, Quezon (Tayabas)	11	210.7	16
Daet, Camarines Norte	18	135.5	13
Infanta, Quezon (Tayabas)	12	196.1	16

(*Continued on page 5*)

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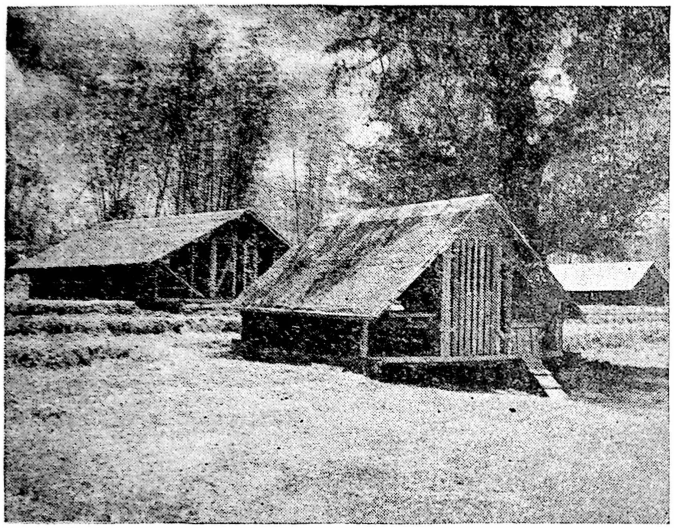
THE FEATHER BROODER—Most Practical of Modern Brooder

By SANTIAGO R. CRUZ, Ph.D.



Artificial brooding is one of the most delicate stages, if not the most, in the operation of a poultry farm. In the temperate zone many kinds of artificial brooders are in use, heated by wood, coal, oil, distillates, natural gas, and electricity. No matter what source of heat is used, frequent attendance by the poultry raiser is necessary to prevent underheating or overheating, especially during the first few days after the baby chicks are hatched. Failure of the source of heat, even as short an interval as 30 minutes, causes chilling of the baby chicks which leads to outright death, or more commonly, to serious sickness which also leads to death. Overheating if not excessive, causes poor growth of the birds and, subsequently, to poor egg or meat production when they mature. Heated brooders cause also, not infrequently, total loss of both baby chicks and brooder houses by fire. Thus most poultry raisers are kept on edge until the time when artificial heat is no longer needed by the chicks.

Fortunately, in the tropics, the need for artificial heat is not as pressing as it is in the temperate countries. As a matter of fact, chicks have often been brooded successfully in the so called fireless brooders in the Philippines. However, there are many poultrymen who couldn't or wouldn't dispense with artificial heat. And those who use fireless brooders have only makeshift affairs the effectiveness of which are open to doubt during the cold months of November, December, Jnuary, and February.

In the poultry farm being operated by the Paulino Cruz, Inc. in the bario of Batia, Bocaue, Bulacan, the feather brooder (see cover) is standard equipment. The writer, who is managing this farm, had studied, observed, and handled many types of brooders, except the feather brooder, when he was in the United States. However, this experience was concerned mostly with brooding in the temperate climate, so that when he planned and organized the poultry farm for the Paulino Cruz, Inc., he was at a loss as to what type of brooder to use. His confusion became alarming when he observed the kind of brooders being used in this country—almost all of them makeshift affairs. Their performance vary during different times of the year and with the skill and intelligence of the person handling them during any particular time.

The feather brooders being actually used now in the poultry farm of the Paulino Cruz, Inc., is almost foolproof in their performance. They were adapted after a careful study of their characteristics in relation to (1) the climate; (2) the skill and intelligence of the person to handle them; (3) first cost; (4 maintenance; and (5) dependability.

A brooder should provide adequate ventilation and optimum temperature anytime the chicks need warmth. The heat regulating mechanism should be simple and dependable and the source of heat must be easy to handle in order to lessen the burden of attention on the part of the operator and also to prevent danger from fire. The brooder must not be bulky so that it could be easily disinfected and cleaned, and have enough space for adequate ventilation. The materials of which the brooder is made must be abundant and easily procurable in order to lessen the first cost. These are the reasons why in the temperate climate the electric brooder is coming more and more into use whenever a sufficient and reliable source of electric energy is available. Feather brooders are also sometimes used in temperate countries in conjunction with some method of supplying heat in the brooder room.

In the tropics, particularly in the Philippine Islands, the temperature seldom falls below 70°F, and even when it falls below this point, it does so only for a few hours. Now, the feather brooder conserves the body heat of the chicks efficiently when the room temperature is at, or above, 70°F and even when the temperature fals below 70°F during the early hours before sunrise, the fall of temperature inside the feather brooder is so gradual as not even to disturb the chicks as actually observed in the above-mentioned farm. The chicks begin to come out from under the feathers one hour or so after sunrise.

The feather brooder almost entirely eliminates the attention necessary with heated brooders. There can be no overheating as the maximum temperature inside it cannot exceed the body temperature of the chicks. Danger from fire cannot originate in a feather brooder.

The materials used are a few pieces of lumber, feather tufts, about a square foot of wire netting and some nails. For a capacity of from 65 to 150 day-old chicks, the brooder can be made or bought for between P25.00 and P30.00.

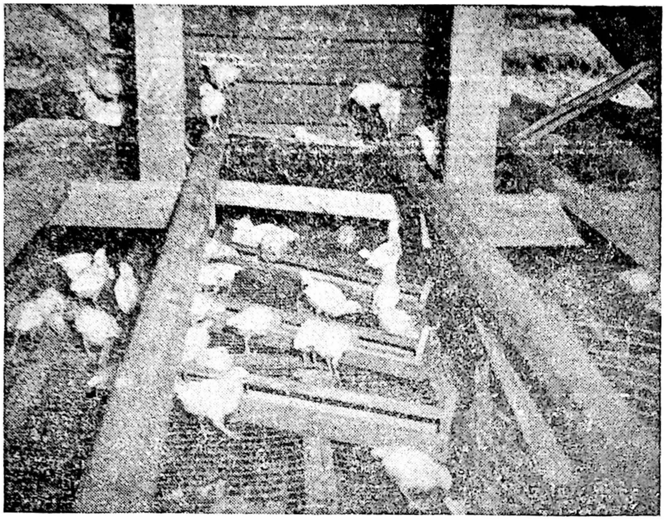
Since there are no burners or heating elements, there is no fuel expense and the air capacity for ventilation is much more than that of a heated brooder of the same capacity.

The only attention necessary is the raising of the feather board from the original position one inch every ten days, which operation requires only a few seconds of the lightest effort, and the cleaning and disinfection of the brooder for storage when the chicks are weaned.

There is now no question in the writer's mind but that for Philippine use the fireless brooder is the type and of this type the feather brooder is the most efficient and reliable. Even a young child can operate it and be successful.

The writer is also the technical manager of the Marikina Valley Farm Products Corporation. This corporation is going to operate a 5000-layer poultry farm as one of its enterprises. This year 1500 layers are being raised and the baby chicks, which are to be supplied by the Poehlman Hatchery of Petaluma, California, during the first week of May, this year, will be brooded under feather brooders. Twenty of these brooders were already made and ready for use.

Apropos to feather brooders it is pertinent to mention that this brooder is being manufactured under a patent granted to John J. Poorman of Tinley Park, Illinois, by the U.S. Patent Office. The writer has the good fortune of securing a license from Mr. Poorman to manufacture these brooders in this country provided the feather tufts are to be supplied by him. Personally, the writer is of the opinion that this is a great boon to local poultry raisers, because with the use of feather brooders, almost anybody can brood large number of chicks cheaply and successfully with a minimum of effort.



Progressive Farming . . .

(Continued from page 9)

DIPPING CHART

Add 22 gallons of water to each pound of RA-PID-GRO. Use tub or pail and place roots in the solution.

TREES—Four minutes.

SHRUBS—Three minutes.

EVERGREENS WITH BALL—Five minutes (leave burlap on.)

VEGETABLES and PLANTS—Dip and out.

BERRIES (all kinds)—One minute.

STRAWBERRIES—Dip and out.

Use remaining solution for watering after planting.

Feed with RA-PID-GRO every four weeks after planting. For Vegetable Seeds use sprinkling can.

Sprinkle seeds with RA-PID-GRO before covering. For Grass Seed sprinkle seeds with RA-PID-GRO as sown, then apply RA-PID-GRO once every four weeks.

RA-PID-GRO
During the Growing Season
Nursery Stock

TREES—Apple, Cherry, Pear, Peach, Plum, Apricot, Quince, Nut Trees, Mulberry.

See Dipping Chart. One teaspoonful of RA-PID-GRO to every quart of water. ALWAYS ADD WATER. TWENTY-TWO GALLONS OF WATER TO EACH POUND OF RA-PID-GRO. Feed every two weeks, the first year, then once each month there-after.

4 to 5 ft. threes—one gallon ilquid RA-PID-GRO

6 to 7 ft. trees—two gallons liquid RA-PID-GRO

Larger trees—add one-half gallon to every two feet. To feed the foliage, add double the amount of water. This can be sprayed on the tops.

SMALL FRUITS—Berries, Gooseberries, Currants, Figs, Grapes

See Dipping Chart. After planting, feed every two weeks the first season, then every month. Use one quart of liquid RA-PID-GRO to a plant. Feed at the base of the plant. On larger plants, use one gallon of liquid RA-PID-GRO to a feeding. When feeding the foliage, use twice the amount of water.

EVERGREENS

Feed around the base, after loosening the earth with a fork. Feed once every ten days during the first season. Thereafter feed once every month, during the growing season.

18 to 24 inch trees—one gallon liquid RA-PID-GRO

Larger trees—add one-half gallon liquid RA-PID-GRO to every foot.

ORNAMENTALS

Use the liquid RA-PID-GRO in planting all trees. Puddle them in. Feed them every ten days during the first year.

2 to 3 ft. trees—one gallon liquid RA-PID-GRO. Add one-half gallon liquid RA-PID-GRO to every foot above this. On larger trees, 4 inches or better in diameter, make holes around the base of the tree, from ft. to 2 ft. in depth, as far out as the spread of the branches. Fil lthese holes with liquid RA-PID-GRO. Do this each month during the growing season.

LAWNS

As soon as seed is sown, take a sprinkle can, use one teaspoonful to each quart of water. Sprinkle well until top earth is well dampened. Feed every ten days for two months, once a month

(*Continued on page* 14)

SOILLESS GARDENING—Farming of Tomorrow

Bb: It's Originator & Inventor—DR. WILLIAM F. GERICKE

INTRODUCTION

Hydroponics is the art and science of growing crops without soil, and its application. The word is derived from the Greek and means literally "water working." It is thus distinguished from agriculture, "care of the field." Hydroponics is based on the theory that all the factors of plant growth naturally supplied by the soil can be coordinated artificially by the use of water and chemicals into a crop-production method capable of competing with agriculture.

With few exceptions, such as the Eskimos, man in the past has been completely dependent upon the soil for his food supply. The course of human civilization has been determined largely by this dipendence. Racial migrations and the opening of new frontiers have dramatized man's historical need for fresh and fertile soil. In recent years chemists have tried to create ersatz food by converting indigestible plant material, such as wood cellulose, into edible products. So far they have had only slight success. Efforts have also been made to reproduce photosynthesis—the natural process by which plants use sunlight to manufacture food materials out of carbon dioxide and water. But hydroponics is agriculture's first real competitor.

Soiless crop production has captured world-wide attention. Thousands of inquiries have been received concerning. it. My overflowing mailbox has not, however, been filled entirely letters lauding the discovery of the world's newest crop-production method. When I first anounced that crops could be grown commercially without soil, the idea was received with skepticism by some and with outright decision by others. The work was done largely on my own time and with little aid from any scientific organization, notwithstanding requests therefore. Not until private businessmen offered their cooperation was hydroponics given a fair trial. Today proof of its worth is being provided by growers in California, New York, Illinois, Florida, distant Wake Island—a mid-Pacific fueling station of Pan American Airways—and other places.

It seems strange that soilless crop-production was not developed long ago. The immediate scientific basis for other great technological developments has been laid by a few talented men, in some cases by only one individual, but the theoretical basis for hydroponics has been known to many. More research has been carried on in the fields of soil science and plant nutrition than in any other branch of agricultural scientific endeavor. Soon after 1868 the conditions were as auspicious for the birth of hydroponics as they were in 1929.

Scientists failed to realize the true value of a principle they themselves applied in laboratory experiments. The development of water culture as a means of studying the life processes of plants is covered briefly later in the chapter. It is enough to point out that plants have grown in nutrient solutions under experimental conditions for nearly a century. Modern scientific agriculture has been greatly aided by information obtained through these studies. By no means do I wish to disparage their value.

The fact remains, however, that laboratory water culture has been aimed at but one objective, that of making better use of the soil. Not until 1929, when the theory of hydroponics was presented, was it pointed out that crop production need no longer be chained to the soil, that some commercial crops could be grown in larger quantities without soil in basins containing solutions of plant food. Indeed, it is obvious that since hydroponics requires a larger expense per unit of area than does agriculture, either yields must be larger, or there must be other compensations, if the method is to succeed commercially. And experience has already shown that it can succeed.

Some scientists who failed to realize the import of natural and field conditions have compared yields from small hydroponic basins with those from basins of fertile soil, and also with those of sand treated with nutrient solutions, using the same number of plants each. In using the same number of plants in the hydroponic basin as in the soil, these experimenters have made the mistake of limiting the productive capacity of hydroponics to that of soil. Comparison can be only by growing as great a number of plants in each case as the fertility of the culture medium can support. A greater mistake was to consider the yield from a few square feet of soil in a basin as representative of that of an equal sector of the field. How large a hydroponic basin must be to represent the conditions which will be encountered in large-scale production is not known at present. The established yields of agriculture are known, and comparison between the two systems can be made only under conditions representative of practical production and not by small experiments in a laboratory. It was the laboratory point of view and method in studying crop production that circumscribed the potentialities of water culture in the minds of plant physiologists familiar with nutrient solutions. The basin is capable of nourishing a much larger number of plants than is an equal area of soil because it can provide more water and nutrients. To utilize these fully it is necessary to provide as many plants as light conditions will permit, regardless of species, as will be shown later on in the chapter on multiple cropping.

Hydroponics is not an exact science at present. It is still in the experimental stage. The most universal of all arts—that of growing plants—cannot be changed overnight simply by following the directions on a package of chemicals. Do not believe all the exaggerated statements you may hear. Results have been extraordinary but, unfortunately, they seem to have convinced many people that tremendous yields of vegetables and flowers can be produced with little trouble and without any real knowledge of the problems involved. The idea is widely held that the nutrient solution will take care of everything and that, like Topsy, the crops will just grow. Unthinking enthusiasts by the hundreds have been misled by promoters selling tank equipment and "magical" formulas at exorbitant prices. The vendors of this equipment had not valuable information to offer, nor could their customers obtain the necessary knowledge from any publications. Because the buyers were not warned concerning the limitations of hydroponics, most of their expensive projects have failed.

The problems involved in growing plants without soil are many. Supplying the proper food elements through a well-balanced solution is only one. Once the plants have started to grow, other difficulties come up. The questions of light and heat, as well as of protecting the crop from pests and diseases, must be met and solved. For example some plants will not grow in dimly lighted basements, nor even in well-lighted houses, though certain publications have stated that they will. You must realize that the theory from which hydroponics has grown is based more on field observations, which cannot be expressed in neat tables of figures, than on laboratory measurements, which lend themselves to such statistical treatment. The successful farmer's instinctive ability to coordinate all the growth factors of plants is indispensable. Thus, your success or failure in hydroponics will depend more upon skill in working out a proper technique indescribable in textbook language than upon possession of a simple chemical formula. You must combine to some extent the knowledge of the chemist, the botanist and the farmer, arming yourself with an understanding of the fundamental requirements of plant life and developing through your own alertness and insight a sure sense of the technique required.

The productive powers of hydroponics dwarf those of agriculture. Yields far outstripping those obtained from some of the richest farming sections of the nation have been produced on experimental plots. Yet these fields, large as they have been, by no means exhaust the possibilities. A later chapter will show how several different crops can be grown simultaneously from the same basin, each of them providing larger harvests than can be taken from the soil. This has already been done in large-scale experiments. It promises to overcome one of the major objections to hydroponics: the high cost of equipment for somt crops. Nevertheless, caution should be employed in selecting the crops to be grown; some will always be grown more economically in soil.

SOCIAL IMPLICATIONS

Soilless crop production presents a challenge to the amateur. The main purpose of this book is to aid him in mastering it. As the rules of operation become standardized, the wage earner with a small plot of ground at his back door may regain a measure of economic independence. His food supply will be more under his own control so that his livelihood will no longer depend solely upon national philanthropy or the weekly pay check. As a means of providing subsistence to those thrown out of employment by recurring economic depressions, hydroponics deserves the utmost consideration from government.

In the commercial field soilless crop production is now being employed successfully. Experiments indicate that it will soon invade new regions and new fields of agricultural production. Hydroponics can be used wherever good climate prevails. Thus, states like New Mexico and Arizona, lacking in soil resources but blessed with mild temperatures and plentiful sunshine, will find it ideal.

Hydroponics offers much to those who are interested solely in growing flow-

(*Continued on page 7*)

WEATHER REPORT

(*Continued from page 1*)

AVERATE MONTHLY RAINFALL AND RAINY DAYS
FOR THE MONTH OF APRIL IN DIFFERENT TYPES

Third Type:—No very pronounced maximum rain period with a short dry season lasting only from one to three months.

STATION	*Record of Length*	*Average Monthly Rainfall*	*Average Monthly Rainy Days*
	Years	mm.	
Zamboanga City	38	50.8	7
San Ramon Penal Colony (Heights), Zamboanga City	12	102.6	7
Sibuko Farm School, Zamboanga	13	31.6	4
Central Camp, Davao	6	256.7	15
Dansalan, Lanao	4	166.3	17
Cagayan, Oriental Misamis	29	32.7	4
Dumaguete, Oriental Negros	27	44.9	6
Hacienda San Jose, Oriental Negros	19	51.1	4
Iwahig Penal Colony, Palawan	24	52.7	7
Hacienda Asia, Occidental Negros	10	67.9	7
Central Bearin, Occidental Negros	16	28.8	3
Binalbagan Estate, Occidental Negros	18	54.1	5
Isabela Sugar Company, Occidental Negros	16	96.5	6
Cebu Sugar Company, Talisay, Cebu	10	41.7	9
Cebu City	36	43.8	7
Hacienda Valehermoso, Oriental Negros	19	44.0	5
Pontevedra, Occidental Negros	16	78.9	7
Lucena, Iloilo	20	48.8	4
Hacienda Lanjagan, Iloilo	10	57.3	5
Capiz, Capiz	36	50.9	8
Masbate, Masbate	34	36.9	5
Odiongan, Romblon	13	43.2	6
Romblon, Romblon	35	66.4	8
Boac, Marinduque	14	65.9	8
San Pablo, Laguna	13	48.7	7

AVERAGE MONTHLY RAINFALL AND RAINY DAYS
FOR THE MONTH OF APRIL IN DIFFERENT TYPES

Fourth Type:—No very pronounced maximum rain period and no dry season.

STATION	*Length of Record*	*Average Monthly Rainfall*	*Average Monthly Rainy Days*
	Years	mm.	
Lapac Agricultural School, Sulu	18	94.0	7
Glan, Cotabato	18	84.6	8
Jolo, Sulu	41	137.1	11
Paranglalap, Zamboanga	19	124.0	8
Latuan, Zamboanga	19	81.1	6
Upi, Cotabato	10	159.0	11
Davao City	36	146.4	9
Kidapauan, Cotabato	18	131.3	9
Maridagao Rubber Experimental Station, Co-	9	145.7	11
tabato	6	261.1	16
Camp Mactan, Davao	11	165.1	15
Impalutan, Bukidnon	9	57.9	5
Siari Valley Estates, Zamboanga	11	87.7	7
Pamplona Plantation Company, Oriental Neg.	19	60.8	5
Hacienda Palanas, Oriental Negros	36	125.3	8
Tagbilaran, Bohol	36	74.5	6
Maasin, Leyte	18	94.9	10
Hawaiian Philippine Company, Occ. Negros.	15	85.6	11
North Negros Sugar Company, Occ. Negros.	18	87.0	9
Janiuay, Iloilo	36	80.0	11
Ormoc, Leyte	20	64.5	6
Dueñas, Iloilo	20	54.9	5
Bitaogan, Iloilo	20	65.2	4
Dumarao, Capiz	20	70.3	6
Dao, Capiz	35	132.2	15
Calbayog, Samar	9	129.2	9
Halcon Rubber Experimental Station, Mindoro	35	82.8	7
Naga, Camarines Sur			

MECHANIZATION—Today And Tomorrow

A COMPREHENSIVE SUMMARY

Mechanization Today And Tomorrow
News of Farm Machinery and Farming Methods

New Implements and Developments

(Reprint from AMERICAN EXPORTER, January, 1947 issue)

PRODUCTION INCREASES

Despite the loss by the farm implement industry as a whole of at least three months output this year due to strikes and materials shortages, the industry will reach a total production valued at approximately $700,000,000 in 1946, or slightly more than in 1945. The fact that the industry, despite innumerable handicaps, will set a peacetime production record in 1946 is the basis for predictions that with all producing units operating normally 1947 volume may easily exceed $1,000,000,000 to set an all-time high mark.

This estimate for 1947 is predicated upon the cessation of the labor strife that has plagued the farm implement makers, and upon easing of the materials shortages. W. A. Roberts, vice-president of Allis-Chalmers and president of the Farm Equipment Institute, says that output in 1947 could conceivably reach $1,250,000,000.

The labor difficulties of the industry since the war ended have affected every large producer except Massey-Harris and Minneapolis-Moline.

Nevertheless, International Harvester's output has climbed to a point where it is equal to the 1941 level—the best peacetime production rate ever attained by that company. Despite this, some of the company officials sound a pessimistic note regarding materials, anticipating further difficulty in obtaining gray iron castings, sheet metal, copper, lead and paint.

The Oliver Corp. has had a good year considering the labor situation, but that company's total production this year is now estimated at about 30 per cent less than originally projected.

The folowing is the dollar production totals of farm machinery output for the first nine months of 1946 as compiled by the Civilian Production Administration on the basis of reports from the manufacturers.

Type of Machinery	Total Value
Planting, seeding & fertilizing equipment	$ 12,164,564
Harrows, rollers, pulverizers & stalk cutters	9,806,598
Plows & listers	13,476,247
Sprayers, dusters & orchard heaters	16,400,666
Harvesting machinery	38,377,055
Haying machinery	18,450,355
Machines for preparing crops for market or use	10,423,540
Farm elevators & blowers	4,013,350
Wheel-type tractors	119,622,070
Industrial tractors	5,376,000
Garden tractors	5,207,125
Farm wagons, gears, trucks	4,952,297
Domestic water systems	24,727,411
Farm pumps & windmills	3,418,501
Irrigation equipment	10,169,335
Dairy farm machinery & equipment	16,406,795
Barn & Barnyard equipment	5,118,816
Farm poultry equipment	8,949,236
Miscellaneous agricultural equipment	7,106,455
Attachments	36,947,411
Repairs	127,182,261
	$512,314,469

MACHINERY EXPORTS

For the year ending June 30, 1946, exports of farm machinery amounted to $62,674,575, substantially lower than 1945 exports which amounted to $80,934,154, according to a C. P. A. tabulation based on reports from 300 manufacturers representing about 90 per cent of industry production.

Export of Machinery	1946 Percentage in	1945 Percentage in
Farm type wheel tractors	20.2	27.0
Planting & Cultivating equipment	8.4	8.0
Harvesting and haying quipment	5.6	7.7
Sprayers, dusters, etc.	7.2	6.8
Water equipment	4.3	4.6
Dairy, barn & poultry equipment	3.2	3.4
All other types of equipment including repairs	7.8	8.3

DEMAND A FACTOR

While the actual value of the backlog of orders of the industry cannot be expressed precisely, the manufacturers state that it is huge. They base their calculation in the following significant indications.

American farmers generally spend from 3 to 5 per cent of their income for machinery. With buying held down during the war, the total is expected to run as high as 5 or 6 per cent of total farm income for the next several years.

One out of every four machines now in use on American farms should be replaced. As this demand is filled, other machines will wear out progressively and in the course of the next few years, almost a complete renewal of equipment is expected.

New machines being introduced will create additional markets. The new tractor attachments that have been perfected, such as loaders and stackers, should sell widely, as may new devices such as sugarbeet and forage harvesters.

These machines are designed to increase production for the farmer by lowering labor requirements and mechanizing hitherto handraised crops. A notable example is the mechanical cotton picker. This units is slated to do the work of 30 to 60 hand pickers.

The "baby tractor" now prominent in farm catalogs will also further farm mechanization. Of the 6,000,000 farms in the U. S., only 2,000,000 are equipped with tractors. Formerly, it was estimated that another 1,000,000 farms might be mechanized but the advent of the new small tractor has doubled that estimate.

RECENT DEVELOPMENTS

Examples of close-coupled, load-distributed power units already in the implement field include the selfpropelled combine and the green-crop harvester.

Use of the combine in harvesting nearly all kinds of seeds is increasing, and this trend can be expected to continue in the years ahead. This has decreased labor requirements and eliminated peak labor loads at harvest time.

The self-propelled combine can be operated by one man and can be used to cut any part of a field, leave unripened patches for later harvest, and operate without running over uncut grain. It is capable of operating wherever the ordinary combine does and with equal efficiency.

Another comparatively new tractor-drawn and operated machine coming into use in considerable numbers, particularly for specialized crops, is a tillage unit that prepares seedbed in one operation. It is conceivable that after it has been thoroughly tested and proved in use on farms, this machine might materially change farming methods and practices.

Tractor-operated loaders have shifted one of the tedious jobs in livestock farming from the back of the worker to the machine. With this new equipment, the job of housekeeping in the barn has been greatly simplified and the time required to do it cut from weeks to a few days.

New methods and haying machines are also under development. One example is the field chopper with pick-up attachment which chops the field-cured hay into short pieces which may be put into the shed or barn through a blower. Another machine crushes the freshly cut hay to speed up field curing. And, of course, there are the new one-man balers, some of which produce round bales, and still others that automatically slice the hay being baled into sections that can be easily fed to livestock.

THE YEAR'S ADVANCES

Research now being conducted by the U. S. Department of Agriculture and leading manufacturers includes experimentation with electric lamps and traps to control insect pests; with infra-red heaters to dry seeds and other valuable farm crops so as to improve them for storage, and also for thermal therapy in treating farm animals; and with the use of bactericidal lamps in animal shelters and storage cellars. The Sylvania Electric Products Co. has already developed a germicidal lamp.

Contour farming which is growing in importance necessitates a plow with longer shares and bases such as those introduced on the unit by the Oliver Corp, and known as the TNT plow.

Considerable savings in time and money by combining all potato harvesting operations in a single machine are afforded by the unit made by the New Holland Machine Co.

Of great value to the small-acreage farmer is the Rototiller made by the Graham-Paige Motors Corp. for planting and cultivating crops and for many other varied purposes.

Perhaps the most spectacular of the herbicides introduced in 1946 is 2 4-D or 2, 4-Dicholophenoxy-acetic acid. a hormone-like chemical of the plant growth-regulant type made by Du Pont.

Soilless Gardening . . .

(*Continued from page* 5)

ers for their own enjoyment and the beautification of their homes. Daisies, snapdragons, begonias, and dahlias are but a few of the garden flowers which can be grown to their natural size and beauty in neatly concealed tanks.

Nations such as Italy and Japan. which are worried by crowded populations and inadequate agricultural land, could easily use it to multiply their production of foodstuffs manifold. Once their hunger is satisfied from within their own boundaries, the reasons for seizing the rolling wheat fields of their neighbors might be swept away.

THE CYCLE OF CONSERVATION

Finally, hydroponics will help us to conserve our natural fertilizers and to solve our future fuel problems. Of the fertilizers commonly applied to the soil only nitrogen can be recovered completely. But in hydroponics the plant food provided need never be wasted. The dry plants can be burned and the ashes used for nutrient solution. In this way the so-called "cycle of conservation" has been completed for the first time.

The carbohydrates produced by the plants will form a vast reservoir of cheap, available power. Chemists have shown their ability to rearrange the molicules of carbon compounds and convert them into fuel. The greatest natural production of carbohydrates now takes place in certain sections of the Hawaiian Islands. In these regions 24,000 pounds of this material in the form of cane sugar can be grown per acre. By hydroponics, however, 180,000 pounds of potatoes can be produced in many areas from an acre of tank space. They will contain about thirteen tons of natural carbohydrate in the form of starch. In some cases ten to fifteen tons of corn, corn stalks, and leaves containing additional chemical energy can be grown from the same tanks at the same time. And, while cane sugar has been produced in the quantities named only in certain parts of Hawaii, corn and potatoes can be grown by hydroponics over vast areas of the earth's surface. The fuel of the future, after our stocks of coal and oil have been expended, may well be made from carbohydrates produced by the hydroponic method.

Before soilless crop production can realize its full potentialities, however. the widest and most intelligent use must be made of it. Misconceptions must be swept from the public mind. The technique must be placed on a thoroughly scientific and practical basis. It is with this end in view that I have written this book. It would have been preferable to clarify the scientific basis of the method in another book before releasing this more popular one. However, the great demand for information prevented adoption of this procedure. Within these pages you will find the science of soilless crop production reduced to terms which I trust will be understandable to all.

WATER CULTURE

The task of finding out how plants feed and what they use for food has occupied the attention of men of thousands of years, beginning before the days of Aristotle. But the true science of plant nutrition is of more recent vintage. It was not until the dawning of the nineteenth century that the facts obtained through years of earnest if somewhat ineffective research began to dovetail into a complete story. Once the basis ha dbeen laid, however, discoveries followed at a rapid pace.

The story of these discoveries cannot be separated from that of water culture. To arrive at the beginning of this development we must go back to the days before chemistry revolutionized scientific research. Handicapped as they were by lack of equipment, the scientists of that era had already found that certain sprigs would grow if partly immersed in water. Some produced only roots; others roots and leaves. After a short time these sprigs stopped growing and the early observers rightly inferred that this was due to lack of food. Still they had no idea that nutrients could exist in water, nor did they know in what forms this food existed.

Real water culture dates from 1860 when Knop, a German agricultural chemist, and Sachs, a botanist, first added chemicals to water and obtained nutrient solutions. Knop may rightfully be called the father of water culture. His experiments laid the groundwork for those which later led to hydroponics. He was concerned with using this method to study the basic relationship of soil to crop production. Sachs was more interested in studying plant processes and thus adding to botanic knowledge. In the end Sachs' point of view prevailed. It is for this reason that scientific literature from 1860 to 1929 is utterly devoid of any suggestion that water culture principles might be applied to crop production without soil. Nowhere in the history of technological development do we find another instance in which principles widely used in laboratory work have not provided sooner a scientific approach to the problems of practical production. The formulas for the nutrient solutions might well have been used for a venture into the field we call hydroponics. Instead they were diverted to a relatively lesser endeavor.

In his first experiments in 1859 Knop grew plants in natural water without mineral nutrients. Seeds were sprouted in sand or fiber netting. The seedlings were then inserted in holes made in a rigid support. usually cork sttoppers, held tightly by a cotton wadding, and suspended in glass or earthenware containers filled with liquid. Thus, Knop

(*Continued on page* 12)

GROWING LOVE BIRDS Pigeon Raising

(Con't. from Last Issue)

SQUAB MARKET

The income from a squab plant is not limited to the production of squabs at ₱0.50 each. There is a certain demand, which might be increased, for good matured (six months old) squab-producing breeds at ₱2 to ₱10, or even more, per mated pair for foundation breeding stock. The possible local market forsquabs would be (a) house keeping families, (b) clubs, (c) first-class hotels, and (d) the many panciterias, which could use all the squabs that can be raised near Manila and the larger centers of population in the Islands for some time to come.

Panciterias in Manila pay ₱0.20 to ₱0.30 each for the common variety of squabs. For prime squabs of special quality they would, no doubt, readily pay more, while clubs and hotels readily take all good first-class quality squabs offered at ₱0.50 to ₱1 each.

With efficient organization to assure mass production of marketable quality squabs, the trans-oceanic steamship companies having passenger-carrying vessels calling at Island ports would also be a potential market. It is believed that the possibilities are here for a profitable squab industry. but they need systematic exploiting.

PRODUCTIVITY OF PIGEONS

It has been said that pigeons will breed every month in the year which, collectively, is true but not individually. Occasionally a pair of pigeons may raise 10 or 11 pairs of squabs in one year, but such cases are exceedingly rare in any country. If a pair of pigeons raise seven pairs of squabs in one year, on an acerage, they are doing very well, which would be from two to three pairs more than the average common pigeons would raise under the same conditions.

DIFFERENTIATING SEX

Ordinarily pigeons are hatched in pairs—one of either sex but sometimes, although rarely, they are of the same sex. Usually the first bird hatched is the male and by immediately banding it, for instance, on the right leg and the other one when hatched on the left leg as the female, there will not be many mistakes in determining sex later on when they are in full feather. The bands may be specially made bands of different materials or a colored string tied around the leg in such a way that it will not come off nor interfere with the circulation of blood in the leg.

By DAVID C. KRETZEL
Revised by
Carlos X. Burgos

There is no known way of differentiating the sex of all breeds physically. In some of the very refined farcy breeds like the little shimmering snakey head Fantails, as well as a number of others, both sexes may look exactly the same. The sexes of Pouters are more readily determined when the pair are seen together as the male is considerably larger than the female, another distinctive feature of the Pouter breed that differs in this respect, from all other breeds. In other breeds like the Runts and Mallorquinas the males are usually a little larger and coarser in the head and neck than the females of the species, but not always. After pigeons are old enough to mate the male is more aggressive and is the one that always does the driving of its mate to the nest, if they are preparing one. He is usually the one that does the treading but, not always. In cooing he frequently turns round and round, half strutting, with head up and down and is the most active one of the pair. The end of the tail feathers in the male may be more or less worn off and disheveled from strutting. The female when cooing will seldom turn more than half way round and then in a semi-crouching or squatting position with the head low and feathers fluffed out. About laying time the bones at the vent of the female are wider apart than the male, but the difference is not always easy to determine. Rice says that if the beak of the pigeon is held on one hand and the feet in the other, stretching them out, the male bird usually will hug his tail close to his body, while the female will throw up her tail.

MATING

Pigeons are monogamous by nature and usually mate for life. Occasionally, however, a pair will separate for some unknown reason and find new mates, or one of the birds may die. In such an event the other bird will seek a new mate and. therefore, may be a serious disturbing element in Doveland. Every pigeon that is kept in a commercial squab plant, loft, or dovecote should be mated, no difference whether it be a male or female as it may cause trouble if it is not mated. By keeping every pigeon mated and promptly removing the unmated ones to a mating coop for subsequent mating, or for confinement, different breeds of pigeons can be raised in the same habitation with little or no danger of them interbreeding which, if permitted to occur, would be very detrimental in results, as it would result in mixing the breeds in many other classes of animals. Several ways have been employed for mating pigeons. One way, when receiving a new lot of pigeons is to put all of them together in a fly, pen or loft, that has no other pigeons in it and then await developments. They will sooner or later find their own mates by affinity and pair off. Odd birds or those that do not pair off in the course of a reasonable length of time should be removed from the pen and disposed of for table use or confined in a mating coop for possible subsequent mating.

An empty potato or onion crate may be used as a provisional mating coop by putting a wire mesh, or a lattice-like partition in the center. Then place the birds that are to be mated, presuming that one of them is a male and the other one a female, one in each end of the box and set the box in a drakened place, or partly cover it with a cloth and give the birds all the fresh water they want to drink, with but a small amount of food, for one to two weeks. Then put both birds in the same compartment just before night. Early the next morning watch results. If they fight they are probably of the same sex, or at least they are not in the mating mood. If reasonably sure that they are of the opposite sexes separte them again and try the same method over, as they may change their minds about mating this time. If they will not then mate try different mates, if they are available, or dispose of them altogther if they are not too valuable but in the meantime keep them confined to prevent them from causing trouble in the house, loft or cote. This is the method generally used when mating birds by selecting in breeding. Specially made mating coops may be constructed with a wooden frame and wire mesh netting, having slide or hinged doors, which are much more convenient and appropriate for the purpose.

If birds that are raised are kept banded as to sex and preferably with day and month and year hatched recorded, it would facilitate matters greatly in mating birds by selection.

PROGRESSIVE FARMING—
Rapidgro The Miracle Plant Food

Rapid-gro comes in 2
And 8 oz. 1, 2, 5, 10 and 25 lbs. packages.

How to raise
Vegetables
the
Rapid-gro way

Look at the picture at the left—that's the vegetables you should get on your garden.

RAPIDGRO "THE MIRACLE PLANT FOOD" LIQUID FERTILIZER

All living things require regular feeding . . . plants, animals and humans alike. In the case of your plants. nature provides them with food through the soil. However, before they can use any of that food, it must be dissolved by rain or watering, for plants live in a liquid diet. Then, too, most soils are deficient in one or more of the elements the plant needs for healthy growth. That is the reason why you should feed them regularly with RA-PID-GRO. That is why they thrive and bear so miraculously on a regular summer long diet of RA-PID-GRO.

RA-PID-GRO contains 11 vital food elements plus VITAMINS

RA-PID-GRO is a miracle-working concentrated food that helps nature bring out the best in your flowers, fruits, vegetables, and ornamental trees. It contains all the elements nature intended plants to have . . . vitamins B1 and B2, the hormones that control growth, and the essential chemicals . . . eleven vital food elements in addition to the vitamins.

RA-PID-GRO contains no inert materials . . . no sand, brick, dust or coconut husks. It is all 100% usable plant food. Dissolved in water, as all natural plant foods must be before they can be assimilated by the plant, it is immediately taken in by the plant feeders. The plant itself is fed. In fact, the plants actually feed the earth. Fed regularly as directed, your plants will thrive and grow under the most adverse conditions, when others are stunted, shriveling and dyng.

ONE POUND OF RA-PID-GRO makes 176 Lbs. of Liqued Fertilizer

RA-PID-GRO is economical. Being all usable plant food, it can be dissolved at the rate of one pound of RA-PID-GRO to 22 gallons of water .. .. .. one teaspoonful to one quart .. .. .. for easy application. You pay for no inert materials. One pound of RA-PID-GRO is the equivalent of 100 pounds of any other fertilizer you may have used in the past.

RA-PID-GRO contains as stated above, Vitamin B1 and B2, but, separately or combined, these vitamins do not supply all the nourishment required by plant life. While vitamins have a definite value in the promotion of root growth, it is necessary that other food elements which nature has provided for the development and growth of plant life be included. Therefore, to the vitamins in RA-PID-GRO are added eleven other needed food elements. RA-PID-GRO has been called "The Miracle Plant Food" because of the phenomenal results obtained by this almost perfect combination.

RA-PID-GRO is also called "The Plant Blood Donor" because it is immediately taken in by the plant feeders and sustains life and develops growth.

The principles of this food is to feed the plant itself, not the earth. A healthy plant will itself feed the earth, and healthy plants are produced by RA-PID-GRO which is composed only of the purest chemicals, vitamins and hormones.

RA-PID-GRO insures success, for it speeds up production and assures an abundant crop. Many gardens are in cramped quarters. RA-PID-GRO will make the yield of that small space compare more than favorably with that of much larger gardens which have not been fed.

All plant food must be in liquid form before it is available to the plants. When RA-PID-GRO is applied according to directions a rainfall is not necessary to make the food available to the plant.

SAVE ALL YOUR TREES SHRUBS AND ROSES

By dipping them in a solution of
RA — PID — GRO
before planting.

(*Continued on page* 3)

COOPERATIVE MOVEMENT

ORGANIZATION OF A COOPERATIVE STORE

Intensive preliminary education on cooperative principles should precede any attempt at operating a cooperative store. A series of meetings may be held for the purpose. Before undertaking the establishment of a cooperative store the cooperative association may well designate a survey committee to survey the possible volume of business for the store. Such farm implements as plows, harrows, cultivators, carts, threshers, corn shellers and grinders and livestocks equipment and their spare parts; farm tools, carpenters' tools, kitchen utensils; farm supplies and materials as improved seeds and planting materials, breeding animals, fertilizers, hardware, insecticides and fungicides; prime commodities such as food, salt, cloth, soap, lard, matches, cigars and cigarettes; medicinal and school supplies; petroleum and lubricating oil; and sewing machines, may constitute the stock of the cooperative store.

The warehouse and store facilities should likewise be looked into. The warehouse be accessible; big enough for the purpose and well-ventiated; provided with a alrge, well-drained, preferably enclosed yard; free from fire hazards and "anay", and constructed of strong materials. The equipment facilities of the store such as tables, chairs, stools, shelves, typewriters, and office supplies such as correspondence paper, carbon paper, cash books, stock cards, ledger cards, sales slips, ink, pencils, erasers and the like should be ample.

The personnel of the store such as the manager and the number and quaiifications and wages of the salesmen, clerk-accountants, and cashier should also be considered.

The survey committee should assemble the data obtained on the foregoing and submit a report thereon to the Board of Directors showing (1) the volume of business to be transacted and cost, (2) cost of the warehouse and store, (3) wages of the personnel, (4) burget and (5) number of people willing to take shares in the store.

The enterprise may be financed by assessments from the members or by an increase in the capital stock or by loan from the Philippine National Bank, the Agricultural and Industrial Bank or other banking institutions.

If the decision of the cooperative association is to open a store the following should be considered carefully:

1. Honesty, industry ,initiative, and wages and salaries of the manager and the personnel.
2. Location of store or warehouse; purchase or lease of same.
3. Acquisition of equipment.
4. Acquisition of goods, supplies and materials.
5. License to engage in business.
6. Membership in a retailers' cooperative association.

The latter five items may be left entirely to the resourcefulness of the store manager.

The business of the store should be run on the cash and carry basis.

An accounting system should be installed. The double entry system should be used for the principal account. Daily purchases should be summarized and dailly accounts, especially cash accounts, closed.

At the end of the business year, the store should be closed for a day or two and an inventory of goods and equipment taken. Sales and purchases of members and non-members of the association should be summarized for the proper determination of the patronage dividends. The total purchases and total expenses during the year, including interest on investment and depreciaition, should be determined. Likewise all receivables, liaibilities and total assets should be determined.

An alternate procedure may be resorted to, if the number of persons willing to inivest in a store is small, that is, if it is less than 100. A buying club among those who are interested may be organized.

LIVESTOCK PROMOTION

In 1939 the livestock population of the country was placed at 10,344,277 head of carabaos, cattle, horses, hogs, goats and sheep, with valuation of P216.033.622; that if poultry being 25,365.102 chickens with a valuation of P8,994,391.

The country imported in 1940 P19,396,241 worth of animal products (both edible and inedible), the value of imported dairy products, mostly milk, being P9.285,511. This importation of eggs had decreased from P2,514,100 in 1929 to P490,082 in 1940, the average importation for the period 1937-1940 being P398,144.

What strikes any student of economics as something unusual are the big items representing importations of meat, milk, and eggs, three livestock products that can very well be produced in the country. One has only to observe in markets and hotels in our towns the abject lack even in rural areas of dairy, poultry, and meat products.

Sell-sufficiency in these commodities should be promoted. It is the plan of the government to increase the number of breeding stations, establish breeding centers throughout the country and stock these stations and centers with animals that are most suitable to propagate in each locality, to be sold or loaned to livestock raisers owning good-sized selected herds or flocks.

Farmers' cooperative associations should take advantage of the government program and have members undertake enterprises in livestock, poultry, and dairy production.

Production of poultry and eggs.—Cooperative associations should organize the members in the raising of backyard poultry. The selling of poultry products and the procurement of feeds can be done in a cooperative way. Sta. Maria (Bulacan) farmers have found it profitable to raise White Leghorns in the backyard or in commercial poultry ranches.

The imported breeds of chickens, namely, White Leghorns, Los Baños Cantonese (both egg-laying breeds), Barred Plymouth Rock, Rhode Island Red and Nagoya (the latter three, general-purpose breeds) have been found to thrive well under proper care and management. They can either be bred pure or crossed with native chickens. Breeding centers will be provided with roosters of the foregoing purebreds to be loaned to farmers or groups of farmers owning large numbers of selected native hens.

Native hens lay an average of from 40 to 60 eggs a year. Imported breeds of chickens in the Philippines, White Leghorns especially, lay 150 or more eggs.

Production of milk.—Where members own caraballas (female carabaos) or milk cows or goats, the cooperative can market or process the products.

The crossing of the Indian Buffalo, a high milk yielder, with the native caraballa will be encouraged by the government.

In an effort to produce animals that are high milk yielders and are at the same time resistant to rinderpest, the Bureau of Animal Industry has been crossing Ayrshires with Nellores. The resulting cross can produce from 5 to

ORGANIZATION OF A COOPERATIVE STORE

By H. SILAYAN

7 liters of milk a day. The Red Scindi, another high milk yielder, which had been imported from India, can produce from 5 to 8 liters daily. It is easy to manage and thrives readily on local feeds. Bulls of these breeds will be placed in government breeding centers at the disposal of livestock raisers.

Goat's milk is much more popular in other countries where its value as feed for infants, invalids, and convalescents is well known than in the Philippines. The use of goat's milk in the country should be popularized, conditions being favorable for the raising of goats.

Native Does are bred topurebred imported Bucks to produce offspring with higher milking capacities. The Anglo-Nubian, Toggenburg and the Indian, three foreign breeds, have been found well adapted to loval conditions.

Production of pigs. — The cooperative can operate a breeding station where boars may be kept to serve sows of members. The procurement of feeds and the marketing of hogs and other products can be undertaken by the cooperative in a most advantageous way.

For the commercial raising of pigs, the cross of either the Duroc-Jersey, Black Poland China or Berkshire and the native stock has been found more profitable to produce or keep than the purebred itself. The Berkjala is also recommended.

Improvement of carabaos. — It is the plan of the government to keep in breeding centers bulls to be loaned to farmers or groups of farmers owning selected caraballas. Undesirable bulls will be castrated.

Production of feeds. — The raising and marketing or purchase of corn, camote, barit, culasiman, carabao grass, and other animal feeds and rice bran (and pulot) can be done in a cooperative way, to save handling expenses and thus increase the returns to the growers.

Keeping of pedigree records—In the effort to improve the quality of the animals owned by the members of the cooperative association, the result of the breeding work may be properly recorded in a pedigree book. The advantage of keeping such a book is obvious to livestock raisers and it affords would-be purchasers of the livestock.

Medicine and Livestock equipment chest.—The association can purchase emasculators, caponizing sets, sprayers, medicines and remedies for common ailments of animals and keep these in a chest for use by the members. The following may be of immediate use:

1. Creoline
2. Magnesium sulphate
3. Pine tar
4. Iodine
5. Vermifuge

In all the foregoing enterprises, the Bureau of Animal Industry, being the government entity vested with the duty to promote and conserve the livestock industry of the country, should be consulted for necessary advice and details.

POSSIBILITIES OF COOPERATIVE EDUCATIONS

Cooperative education has been found recently to play an important role in promoting cooperatives. Experience shows that cooperatin can progress no faster than the people can be trained to understand it and administer cooperative business efficiently. It can not be handed to the people ready-made nor can it be administered by others for them. The members themselves have to do it.

Cooperative education, of course, is not a proposed substitute for our present formal education, but it is simply a means to educate the people in cooperative principles and methods. A cooperative movement to be successful must have loyal and honest members. Their loyalty and honesty must be based upon solid foundations, one of which is a thorough understanding of the ideals of cooperatives.

There are two sides to be considered in the business administration of economic affairs and the idealistic reorganization and orientation of the people. The first requires experts who can make business succeed. As for the second, it should suffice to state that a successful cooperative in itself is an educational influence in the community. It teaches quietly a lesson to all who observe it.

Education of the members in the larger social aspects of cooperation and in the philosphy of the movement has not advanced commensuretely with the enhancement of its commercial aspects. For this reason, in many fields of cooperation the cooperative is thought of rather exclusively as a business undertaking. Competitive business has got the people into peculiar habits of thought with regard to their economic relations. The larger social possibilities of cooperation are lost sight of. While it may be true that a cooperative undertaking must be successful and economically profitable to its members, business success is not enough. To consider business alone is to lose sight of the main idea behind the cooperative movement. Cooperation best succeeds when the people see in it a great social enterprise in which justice is paramount and the welfare of the whole is amply safeguarded.

The causes of failure of cooperative association, especially those in the Philippines, could be traced to the lack of a comprehensive educational campaign among the members in particular and among the people in general. The main objectives of cooperative education are:

1. To strengthen the belief of the member in cooperation,
2. To establish harmony among them;
3. To effect expansion of, and continuity, of membership of the organization;
4. To develop undivided member support and loyalty; and
5. To foster public appreciation of the movement.

These objectives when attained will promote not only the welfare of the association but also that of the members and their families, and once the members are convinced of this they will be greatly bolstered up in their belief and pride in and love for their association The public is thereby the better equipped to appreciate the potential value of cooperative organizations in the solution of difficulties met with in the economic and social structures. The cooperatives themselves are unified and strengthened by the impact of education on the members, officers, employees and the general public.

THE SCOPE OF EDUCATION IN COOPERATION

The subject matter of cooperative education varies according to circumstances. College courses and other programs which requires considerable time may include stdy of extremely technical phases such as contracts, by-laws, pooling methods, legal phases, taxes, financing and the like. Usually, however some of the following broader subjects are covered either in detail or in summary.

1. Economics.
2. History of cooperation.
3. Principles of cooperation.

(*Continued on page* 20)

HOME AND WOMEN'S CORNER

DEHYDROFROZEN FOODS—A wedding of two opposites in food processing circles—dehydration and quick-freezing—has been arranged. Dehydrofreezing is simpler than it sounds. Fruits or vegetables are partially dehydrated, then frozen. Housewives will find it as easy to prepare dehydrofrozen vegetables as ordinary quick-frozen foods· researchers say. For example, peas or carrots can be popped into a pan of cold water, brought to a boil and by the time they've finished cooking they wil have soaked up all the water removed in the dehydration process. Partial dehydration reduces weight and volume of the food by about half. This fact promises for food freezers a substantial saving in storage, shipping and refrigeration costs.

ARITHMETIC NO HANDS—An uncanny device, known as an automotic sequence controlled calculator, has been perfected. The most intricate equations can be solved in step-by-step fashion using the elementary operations of arithmetic—addition, subtraction, multiplication, division—plus the very important but routine task of looking up the answers to previously solved problems. This calculator goes beyond ordinary adding machines in two respects; it can "look up" previous answers, often the products of its own earlier work, and once properly set up, it carries through a whole sequence of operations, using one answer as raw material for the next phase of the problems, without further human intervention. Problems go in on a perforated tape something like a player-piano roll. The spaced perforations, instead of telling a piano which notes to play, provide the calculator with instructions. The machine whirs, clicks, pauses, starts again. Then an electromatic typewriter prints the answers in neat tables of numbers. The machine solves every problem in two entirely different ways. If the answers check, they are printed. If they don't, a bell rings and lights flash.

DIRECTORY DIALS THE PHONE—A new desk telephone directory not only finds the number you want but actually dials it for you. All you have to do is to slide the knob on the face of the device, called an Auto Dial, to the name you want, then press the small lever at the foot of the machine. When the lever returns to its normal position, in five or six seconds, your call is made and you pick up the phone. The machine can handle any 50 telephone numbers desired by the user· and changes can be made at will. The signals can be made up of any number of letters and digits, according to the system used in the local exchange. The regular hand dial on the telephone can be used in the ordinary way when the automatic device has been attached.

ROASTER FOR AMATEURS—Fowl up to six pounds and cuts of meat up to 10 can be roasted to an epicure's taste by an amateur in the Rotiss-O-Mat. Basting and turning are unnecessary. The meat has only to be spitted on a stainless steel skewer, fixed at one end by a holder to prevent slipping, and placed in the electric roaster. A motor turns the meat about three times a minute and a Nichrome element on the lid supplies the heat. A six-pound chicken takes about one hour and 20 minutes to cook. The Rotiss-O-Mat weighs 13 pounds, has a bakelite handle and heat-resistance glass sides, and can be put right on the dinner table.

SINGLE VINYL-COATING COMPOUD—The process of coating fabrics with vinyl resins has often been complicated and prolonged by the necessity of working with two different coating solutions. In an effort to get around these difficulties, a formulation which accomplishes the coating in one application has been developed. This single vinyl compound containing a high solids content effects a soft, dry, durable waterproof and flameproof film. Since it is the solution itself that is flameproof, it does not necessarily render the base fabric non-flammable—although it discourages burning. In case of rayon, nylon, celanese, etc., enough coating is absorbed to make them totally fireproof. The vinyl solution is obtainable in liquid form and may be applied by any coating method that is preferable. However, the basic principle in all of them involves its application to moving fabric and the removal of excess by some scraping method.

CONSTRUCTION TIP—The long-used method of employing straw saturated with water to wet down concrete during the hardening or "curing" period may soon go into the discard. Contractors can now handle this phase of concrete operations by using one company's Oozer hose, from which the water seeps gently and continuously. It is made of special fabric· has previously found wide application on lawns and gardens.

SIMPLIFIES ADMINISTRATION OF WAGE-INCENTIVE PLANS—Called the productirule, a wage calculator is paid to slove many difficult computations concerning costs, productivities, wages and bonuses in administering wage-incentive plans. It is a ten-inch slide rule calibrated to include problems involving time units between 1/10 of a minute and one hour.

ICE THAT LASTS—The product called Tw-Ice contains a chemical, introduced during the freezing process, that is claimed to keep the ice packed on perishable foods from melting during a routine shipment from coast to coast. The inventor claims that the chemical does not change the freezing point, but retards meltage from 37% to 40%. Patents are pending on the invention but Tw-ice is being made available to shippers in any part of the country. It is estimated that the new ice will command a premium up to $2 a ton over untreated ice.

NEW ROLE FOR SCREENING—Vinylidene chloride screening is now playing a new and novel peacetime role in the production of a fragrant, tinted soap powder for women's lingerie, hose and similar items. The liquefied and aerated soap is spread on trays of the natural-colored screen, then placed in a drying cabinet. Since the plastics material resists corrosion and rust and does not brittle, its length of service is almost limitless. After leaving the drying cabinet the soap is powered and packaged.

GIVES HARDER FINISH TO FLOORS—Better and more enduring wax finishes for floors is claimed by the use of "Finnel Kote." This wax, which is applied with a special machine put out by the company, is so hard that it contains three of four times as much actual wax as the average floor wax, and that it sets in ten second to a hard· glossy finish, which will greatly outlast other wax finished because the hot wax fills all the pores in the floor.

Soilless Gardening . . .

(Continued from page 12)

established the technique now used universally for laboratory experiments. By this method Knop also found that a plant can make an appreciable gain in weight simply by using the food contained in its seed and that the seed provides nourishment to those parts of the plant which form first. From this Knop concluded that the growth of vegetal tissue of plants is proportional to the nutrient content of their seeds. This theory has since been accepted by plant physio-

(Continued on page 16)

MARCH OF EVENTS

URGE FORMATION ALL OVER PI OF LANDOWNERS—TENANTS GROP

Designed to carry out the social justice program of the administration, is the plan of members of the agrarian commission to urge President Roxas to establish the proposed national landowners and tenants administration, it was learned this morning.

The administration will get together all landlords and tenants irrespective of the crops raised, and allow them to work out harmoniously their relations as bread-earners.

If organized throughout the Philippines, the administration will (1) attempt to solve once and for all the recurrent agrarian troubles existing between landowners and their tenants, (2) prevent the existence of subversive elements and associations, and (3) promote the welfare and interests of both parties in accordance with the social justice program enunciated first by the late President Quezon.

The commission plan calls for the foundation of a common fund to which the landowner will contribute two cavans of palay for every hectare cultivated and the tenant one cavan. Proceeds from this fund will be used in giving education to the children of the tenants in the hospitalization of members of the administration, in maintaining the insurance policies of both landlords and tenants, and in the establishment and operation of a cooperative.

Members of the commission also propose to urge Roxas to consider the amendment to the present 70-30 proportion of share in the rice harvest between the tenant and the landowner, into 65-45. It is claimed that under the existing arrangement the landlords are at a disadvantage considering their various expenses in connection with the maintenance of their property.

₱4 MILLION SET FOR REBUILDING SUGAR CENTRALS

Four million pesos will be spent by the government in the reconstruction of the Binalbagan-Isabel sugar centrals which were greatly damaged during the enemy occupation, according to Secretary of Justice Roman Ozaeta this morning.

Ozaeta who is concurrently the president of the new corporation administering these two centrals, is flying to Bacolod, Negros Occidental, this week, together with Marciano Angeles, NDC engineer and officer-in-charge of the Insular Sugar Refining company, to determine the extent of the damages and to find the best means of reconstructing the plants.

The secretary revealed that the government may award the work to a private contractor if, in the opinion of the central officials, reconstruction by the government will be more expensive.

The government is the majority stockholder in the new corporation with the former owners of the Isabela central owning 42 per cent of the shares. The corporation has assets of over ₱5,000,000.

Following reconstruction, the first unit will be in operation in the 1948-49 season.

US COPRA PRICES TAKE DOWN TREND

SAN FRANCISCO, April 18 (AP)—A downward trend in copra prices is reported here. Large buyers were reported out of the market, which is weak and showing no activity.

Copra brought $225 to $230 a short ton cif West Coast ports in January and February. The price rose to $245 to $247.50 a ton in March.

Quotations have been slipping downward since, with no recent sales. Indications were that buyers would show some interest at around $220 a ton.

The Netherlands East Indies expect to export between 180,000 and 200,000 tons of copra in 1947, Eugene Sayers, director of the NEI copra fund, said, and predicted the critical period of rehabilitation of the copra industry would be passed late this year.

A delivery of 8,000 tons of copra to the United States by June is under contract, part of it at $238 CIF a ton.

Dutch officials are frank to admit that the Philippines have made fast strides since the war and, if it were not for the world fat and oil shortage, would be a difficult competitor.

"We've had to do without almost everything here," one Dutch official who recently visited Manila said. "But in the Philippines copra producers and merchants have had every type of army surplus imaginable made available to them. They have boats, textiles, consumer goods, quonset huts for storage.

"They have a free market in which individual initiative shows up. Ours is controlled. They have no export duty; we must pay a 20 per cent export tax. They pay lower freight rates to their shipping companies.

In Lighter Vein

(Reprint from the Rotarian)

CAPTIVE EAGLE

By: Alma Robison Higbee

Yesterday he was blood brother to an eagle,
Setting his course by white and singing stars,
Today he packs bread loaves in a market basket
And sells green Summer captured in tins and jars.

A pencil behind his ear, he wears an apron,
And clutches an invoice to check the merchandise by,
He weighs hamburger, frowns when he remembers
That his silver wings once curved the lupine sky.

And yet, sometimes when he hears a motor's thunder,
His head lifts quickly, his eyes are hurt and proud,
Then his eager heart goes out from his duty-bound body,
And streaks away on a crimson sunset cloud.

MY FAVORITE STORY

By: MRS. CLAYTON A. PALMER

Old man Brown made every moment pay on his big farm. One fine haying day he fell into the cistern and his wife, hearing the splash, came running. Poking her head over the rim she yelled, "That you, Arthur?"

"Yup," came the answer. "I just fell in."

"Just hold yer hosses" said his wife. "I'll ring the dinner bell and get the hired men from the field to pull you out."

"What time be it, Mary?" came the gruff voice of her husband.

"Just 11:30."

"No, Mary, don't ring the bell yet. Water's cool and not so bad. I'll just swim around till dinner time."

LET'S REST, SHALL WE?

By: WILLIAM W. PRATT

Here lies a jitterbug;
Young; expired.
Ain't gone to heaven yet—
Too darned tired.

★ ★ ★

WITH OUR TENANTS

THE TORCH AS A MODERN FARM NECESSITY

By E. J. Frick D. V. M.

Sanitation is one of the foremost problems of the live stock owner. It matters not how much feed, care, or pedigreed breeding animals you have it they are kept in dirty, infected quarters, the filth-borne diseases will soon take heavy toll. The causes of disease in the shape of bacteria, moulds, virus, fungus, and worms and worm eggs are not easy to get at or destroy. The use of strong disinfectant solutions is an expensive and not always satisfactory procedure. The drawback of disagreeable odor, dampness, leakage of liquid to other quarters and expense all too often prevent its more frequent necessary usage. The common roundworm egg is very resistent and even when kept for years in a formaldehyde solution can be taken out and found capable of growing into an adult worm. Many diseases are caused by germs that form a spore or dry hard seeds as a stage in their development. This spore is very resistant. Freezing has no effect on many diseases. Of all methods extreme heat is the most certain and satisfactory. Properly applied heat will readily kill beyond question all bacteria, virus, larvae parasites and parasite eggs.

The use of THE AEROIL TORCH throwing a temperature of 2000 Fahrenheit answers this purpose. Quarters to be flamed, whether they are chicken pen, drained fish pen, hot lot, fox pen, dog kennel, or dairy barn should be first cleaned of all general bulky litter, such as manure, rags, etc. The lighted torch is slowly swept over the surface of the walls and floor until all has been covered. Care should be taken around inflamable posts, etc.

Tests on the effectiveness of this procedure shows:

1. All eggs of parasites, larvae, adult parasites, germs and fungi are completely destroyed, if on the flamed area.
2. Ordinary odors of pus, manure, mould, and decomposition tend to disappear.
3. The combustion is so rapid and complete that no smoke ordinarily is evident.
4. The moisture content of the surface area is removed.
5. The temperature of a closed room is increased.
6. Balls and piles of manure should be removed mechanically, unless the flame is held on them for at least three minutes or longer, as the moisture content in their center allows the parasite eggs protection against the heat over a shorter period.

There are many other uses for the torch and a long list of disease organisms and parasites that it will destroy could be listed. However, it has been found satisfactory when used around infected quarters and a reliable disinfectant was needed. Breeders of hogs, poultry, dogs, fur bearing animals, fish, hatchery men should avail themselves of this cheap effective means of sterilizing their premises. (This was lectured by Dr. Frick in 1929).

What A U. S. Farmer Says About The Torch Today

"Over 500,000 agriculturists like myself are using kerosene burning torches to KILL WEEDS WITH FIRE! Let me tell you in my own words how I use my AEROIL Burner to kill weeds forever!"

When you kill weeds with fire you consume the stalks, the seeds and eventually cause the roots to rot. In addition, all crop destroying insects lodged in the weeds meet instant death. The "MONTANA FARMER" of July 1940 carried a report by a State Extension Agronomist which read in part:—"None of the test plots which showed complete eradication has ever since produced any sign of the return of weeds." This is only one of hundreds of such reports turned in by Agricultural Experts whose duty is to know weeds and how to kill them forever.

WHAT THE TORCH CAN ACCOMPLISH FOR YOU AS A FARMER

From all over the world today, praise for the Torch as a practical farm implement abound. Whether one is a poultry farmer, a dairy man, an orchard man, a rice grower, etc., the torch is always handy.

Some of the practical uses of the torch are as follows: to kill weeds, as disinfectant, to exterminate shrubs which are hard to eradicate, as stump remover, for bending an straightening frames of a plow and other steel or iron implements, as soil sterilizer, as incinerator for branding animals, as a temporary furnace, as rock splitter, and a hundred other uses.

As a rock splitter, a farmer has this to report: "Three ton granite rock split into small pieces with AEROIL Burner fuel costs only sixty cents."

NOW AVAILABLE HY-MIN MARVEL LIQUID FERTILIZER

HY-MIN a liquid fertilizer, is one of the best of new fertilizers today. It can be applied at the ratio of **one ounce or less to one gallon of water.**

Applied as a rice fertilizer where irrigation is available, the 30 or 50 gallon drum with a controlled spigot is laid down on the dike of the irrigation canal and the HY-MIN fertilizer allowed to flow with the water that goes into the rice paddies. Mixed with the irrigation water, the effect of HY-MIN to the rice plants is immediate as HY-MIN in its liquid state gives nutrients direct to the plant roots and not to the soil. Unlike other commercial fertilizers which is applied to the soil first to break it down to forms that can be absorbed by the roots of the plants before they give beneficial nutrients to the plants.

HY-MIN therefore, has no waste in elements, immediate in effect and economical. On top of these, HY-MIN is a complete N-P-K fertilizer. Farmers should avail of this opportunity by contacting YARAS & COMPANY, FAR EAST, located at the China Bank Building, Manila.

Progressive Farming . . .

(Continued from page 3)

thereafter.

VEGETABLES

Asparagus—As soon as frost leaves ground. Every ten days thereafter

Beans—Feed every ten days, along sides of rows.

Beats, Broccoli, Brussels sprouts—Same as Beans.

Cabbage—Use Liquid RA-PID-GRO in holes, when planting. Feed around each plant every 10 days.

Carrots, Corn, Cucumber, Endive, Koherabi, Lettuce—Same as Beans.

Melon—On top of seed, after planting. Around base of plant every ten (10) days.

Onion (seed)—Same as Melon.

Onion (sets)—Along base of plants after setting. Every ten days.

Parsnip—Same as Beans.

Pepper—Pour in holes when planting. At base of plant, every two weeks.

Peas—On top of seed after planting. Feed along base of plants once after they show above ground. No more feeding.

Pumpkin—Same as Melon.

Radish, Spinach—Same as Beans.

Squash—Same as Melon.

Swiss Chard—Same as Beans.

Tomato—Fill the holes when planting. Then around plants every ten days.

Turnip—Same as Beans.

WITH OUR CROPS

As a refresher to Philippine farmers and as an introduction to those interested in Philippine agriculture, we are here listing Philippine crops as an indication of the diversity of our farming.

I.—Rice and other ceareals: (5 crops)
1. ADLAY. Coix lachryma-jobi Linn.
2. CORN. Zea mays Linn.
3. MILLETS. Setaria italica Bea.
4. RICE. Oryza sativa Linn.
5. SORGHUM. Andropogan sorghum (Linn.) Brot.

II.—Sugarcane and other sugar-producing plants: (1 Crop)
1. SUGARCANE. Sassharum officinarum Linn.

III. Coconut and other oil producing plants; (4 crops)
1. AFRICAN OIL PALM. Elaeis guineensis Jacq.
2. COCONUT. Cocos nucifera Linn.
3. LUMBANG. Aleurites moluccana (Linn.) Willd.
4. SESAME. Sesamum orientale Linn.

IV.—Tobacco: (1 crop)
1. TOBACCO. Nicotiana tabacum

V.—Abaca and other fiber producing plants: (10 crops)
1. ABACA. Musa textilis Nee
2. COTTON. Gossypium brasilience Macfad.
3. FLAX. Lilium usitatissimum
4. JUTE. Corchorus capsularis Linn.
5. KAPOK. Ceiba pentandra (Linn.) Gaertn.
6. MAGUEY. Agave cantala
7. PINEAPPLE. Ananas comosus (Linn.) Merr.
8. RAMIE. Boehmeria nivea (L.) Gaudich.
9. ROSELLE. Hibiscus sabdariffa Linn.
10. SISAL. Agave

VI.—Cassava and other root crops: (13 crops)
1. APULID. Eleocharis dulcis (Burm. f.)
2. ARROWROOT. Maranta arundinacea
3. BEETS. Beta vulgaris Linn.
4. CAMOTE. Ipomoea batatas Linn.
5. CASSAVA. Manihot utilissima Pohl.
6. GABI. Colocasia esculentum (Linn.) Shott & Endl.
7. IRISH POTATO. Solanum tuberosum Linn.
8. PEANUT. Arachis hypogaea)Linn.
9. SEMBU. Canna edulis Ker.
10. SINCAMAS. Pachyrrhizus erosus
11. TUGUE. Dioscorea esculenta Lour.)
12. UBE. Dioscorea alata Linn.
13. YAUTIA. Xanthosoma sagittifolium Schot.t

VII.—Rubber, gums and tannis plants: (3 crops)
1. ANNATTO. (Achute). Bixa orellana Linn.
2. INDIGO. Indigofera tinctoria L.
3. RUBBER, PARA. Hevea brasiliensis (HBK.) Muell.-Arg.

VIII.—Fruits and nuts: (68 crops)
1. ALPAY. Euphoria didyma Blanco
2. APPLE. Pyrus malus Linn.
3. ATEMOYA.—Annona sp.
4. AVOCADO. Persea americana Mill.
5. BALIMBING. Averrhoa carambola Linn.
6. BANAGO. Gnetum gnemon Linn.
7. BANANA. Musa paradisica Linn.
8. BERRA. Rheedia edulis Pl. & Tr.
9. BERRIES. (Strawberry). Fragraria chiloensis Dch.
10. BIRIBA. Rollinia orthopetala A. DC.
11. BREADFRUIT. Artocarpus communis Forst.
12. BULALA. Nephelium mutabile Blume
13. CACAO. Theobroma cacao Linn.
14. CAIMITO. Chrysophyllum cainito Linn.
15. CAMIAS. Averrhoa bilimbi Linn.
16. CASHEW. Anacardium occidentale Linn.
17. CHERIMOYA. Annona cherimolia Mill.
18. CHESTNUT. Castanea mollilissima Blume
19. CHICO-MAMEY. Calocarpum zapota Pre.
20. CHICO. Achras zapota Linn.
21. CIRUELA. Spondias purpurea Linn.
22. CITRUS. Citrus
23. COFFEE. Coffea
24. CONDOL. Benincasa hispida Cgn.
25. CUBILI. Cubilia blancoi Blume
26. CUSTARDAPPLE. Annona reticulata Linn.
27. DAMIA. Macadamia ternifolia Muell.
28. DATE. Phoenix dactylifera Linn.
29. DUHAT. Euginia cumini Dru.
30. DURIAN. Durio zibethinus Linn.
31. FIG. Ficus aerica Linn.
32. GALO. Anacolosa luzoniensis Merr.
33. GRAPE. Vitis vinifera Linn.
34. HEVI. Spondias cytherea Son.
35. PACKFRUIT. Artocarpus integra Merr.
36. KAKI. Diospyros kaki Linn.
37. KAYAM. Inocarpus edulis Forst.
38. LANZON. Lansium domesticum Correa
39. LEMASA. Artocarpus champeden (Lour.) Spreng.
40. LUMBANG. Aleutrites moluccana (Linn.) Willd.
41. LITCHI. Litchi chinensis Son.
42. LONGAN. Euphoria longana Lam.
43. MABOLO. Diospyros discolor Ww.
44. MACOPA. Eugenia javanica Linn.
45. MANGO. Mangifera indica Linn.
46. MANGOSTEEN. Garcinia mangostana Linn.
47. MARANG. Artocarpus odoratissima Blanco
48. MELON. Cucumis melo Linn.
49. MULBERRY. Morus alba Linn.
50. OLIVE. Olea europaea Linn.
51. PANGI. Pangium edule Rwt.
52. PAPAYA. Carica papaya Linn.
53. PARCHA. Passiflora laurifolia Linn.
54. PEACH. Prumus persica (Linn.)
55. PEJIBAYE. Guilielma utilis Oer.
56. PILI.Canarium ovatum Eng.
57. PINEAPPLE. Ananas comosus (Linn.) Merr.
58. RAMBUTAN. Nephelium lappaceum Linn.
59. ROSELLE. Hibiscus sabdariffa Linn.
60. SERALI. Flacourtia ramontchi L'Her.
61. SANTOL. Sandoricum koetjape Merr.
62. SOURSOP. Annona muricata Linn.
63. SUGARAPPLE. Annona aquamosa Linn.

(Continued on next page)

With Our Crops . . .

(Continued from page 15)

64. STRABERRY. Fragraria chiloensis Dch.
65. TAMARIND. Tamarindus indica Linn.
66. TIESSA (Canistel). Lucuma nervosa A. Dc.
67. WAMPI. Clausena lansium (Lour.) Skeels
68. ZAPOTE. Diospyros ebenaster Retz.

IX.—Beverages: (4 crops)

1. CACAO. Theobroma cacao Linn.
2. COFFEE. Coffea
3. MATE. Ilex paraguayensis St. H.
4. TEA. Thea sinensis Linn.

X. —Vegetables and beans: (54 crops)

1. AMPALAYA. Momordic charantic Linn.
2. ASPARAGUS| Asparagus officinalis Linn.
3. BAMBOO. Bambusa spinosa Roxb.
4. BATAO. Dolichos lablab Linn.
5. BEETS. Beta vulgaris Mog.
6. CABBAGE. Brassica oleracea var. capitata Hort.
7. CAMOTE. Ipomoea batatas Linn.
8. CARROT. Daucus carota Linn.
9. CAULIFLOWER. Brassica oleracea var. botrytis DC.
10. CELERY. Apium graveolens Linn.
11. CHAYOTE. Schium edule Sw.
12. CONDOL. Benincasa hispida Cgn.
13. COWPEA. Bigna sinensis Savi.
14. CUMCUMBER. Cumumis sativus Linn.
15. EGGPLANT. Solunum melongena Linn.
16. GARBANZO. (Chick-pea). Cicer arientinum Linn.
17. DADIOS. Cajunus indicus Spreng.
18. DATURAY, Sesbania grandflora Pers.
19. DINYAN. Antidesma ghaesembilla Gtr.
20. KUCHI. Allium tuberosum Roxb.
21. LETTUCE. Lactuca sativa Linn.
22. LIBATO. Basella rubra Linn.
23. LIMA. Phaseolus lunatus Linn.
24. LOTUS. Nelumbium nelumbo Dru.
25. MALUNGAY. Moringa oleifera Lam.
26. MUNGO. Phaseolus aureus Roxb.
27. MUSHROON. Agaricaceae
28. MUSTARD. Brassica integrifolia (West) O. E. Schulz
29. ONION, Allium cepa Linn.
30. PATOLA. Luffa Cylindrica Roem.
31. PEAS, PISUM SATIVUM Linn.
32. PECHAY. Brassica cernua F & H.
33. PEPPER. Capsicum annum Linn.
34. RADISH Raphanus sativus Linn.
35. SEGUIDILLAS. Psphocarpus tetragonolobus D.C.
36. SITAO. Vigna sinensis var sesquidedalis Fruw.
37. SOYBEAN. Glycine max Merr.
38. SPINACH. Spinacia oleracea Linn.
39. SQUASH. Cucurbita maxima Dch.
40. STRING BEANS. Phaseolus vulgaris Linn.
41. TALINUM. Talinum triangulare Ww.
42. TAPILAN. Phaseolus calcaratus Roxb.
43. TOMATO. Lycopersicum esculentum Mill.
44. UPO. Lagenaria leucantha (Lam.) Rusby.

XI.—Spices, insecticidal and medicinal plants: (15 crops)

1. BLACK PEPPER. Piper nigrum Linn.
2. CAMPHOR. Cinnamomum camphora
3. CASTRO BEAN. Ricinus communis
4. CINNAMON. Cinnamomum zeylanicum Nees.
5. CINCHONA. Cinchona ledgeriana
6. CLOVES. Caryophyllus aromaticus
7. COCA. Erythroxylum coca
8. DERRIS. Derris Lour.
9. GARLIC. Allium sativum Linn.
19. GINGER. Singiber officinale Rosc.
11. MINT. Mentha arvensis Linn.
12. NUTMEG. Myristica fragrans
13. NUX-VOMICA. Strychnos nux-vomica
14. ONION. Allium cepa Linn.
15. ST. IGNATUS BEAN

XII.—Cover crops and green manure crops: (15 crops)

1. CADIOS. Cajanus cajan Linn. (cover crop and green manure crop)
2. CENTROSEMA. Centrosema pubescens (cover crop)
3. CALOPOGANIUM. Calopogonium muconoids (cover crop)
4. COWPEAS. Vigna sinensis Savi. (Green manure crop)
5. CROTALARIA. Crotalaria juncea
   C. anajiroides (cover crop)
   C. Usaramenses (and)
   and several (green manure)
   other species (crop)
6. INDIGO. Indigofera hirsuta (Cover)
   I. indico thylla.
7. PATANI. Phaseolus lunatus Linn. (crop)
8. IPIL-IPIL. Leucaena glavca Linn.
9. PUERARIA. Pueraria javanica (cover crop)
10. SESBANIA. Sesbania sesbans green manure crop)
11. SOYBEANS. Glycine max Linn.
12. TAPILAN. Phseolus calcaratus Roxb.
13. TEPHROSIA. Tephrosia candida
    T. hookeriana (cover)
    and several (crop)
    other species ( )

Soilless Gardening . . .

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logists.

By this time it had been established that, if soil nutrients were to be used by plants, they must be present in soluble form. It was also known that the amount of soluble plant food in the soil was very small compared to that which was insoluble. This information provided a scientific basis for Knop's future work. However, methods had not yet been devised for measuring such properties of the solution as osmotic pressure. Nor did scientists have any clear idea as to what these properties might be. So, while knop knew that solutions which were too concentrated might prove harmful, he did not know how this harm was done. Nevertheless, in 1860 he succeeded in growing plants weighing many times more than their seeds and containing a much larger quantity of nutrients. In 1868 buckwheat weighing 4,786 times and oats weighing 2,359 times more than their original seeds were produced by others using Knop's method. This established beyond doubt the fact that normal plants could be grown without soil.

Knop had a fairly good idea of what elements were necessary. As early as 1842 another investigator had compiled a list of nine elements which he believed were the essential ones provided by the soil. A first concern of agricultural chemists and botanists was to determine which elements were needed and which were not. There was no unanimous agreement on this point, nor is there today. From 1860 to about 1920 most scientists thought nitrogen, calcium, magnesium phosphorus, potasium, sulfur, and iron were the only essential elements from soil. But during the past

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twenty years, as purer materials have become available for laboratory research, we have found that the "trace elements"—boron, copper, zinc, and manganese—are also required.

From a wide variety of compounds Knop finally selected calcium nitrate, mono-potassium phosphate, and magnesium sulfate as the chief ingredients of the nutrient solution. Each of these supplied two of the essential elements. Comsequently, he was able to keep the concentration of the solution at a low level, at which plants grow best.

Nevertheless, Knop's choice of chemicals was not a good one. The compounds contained elements which were not used in the same quantities by the plants. As one was absorbed, an excess of the other was released and entered into another combination in the solution. In time the acid-alkaline reaction of the liquid changed. This was contrary to the pattern of nature for the soil solution from which plants derive nourishment in agriculture changes very little if at all. Knop's nutrient solution, on the other hand, became progressively more alkaline. Knop realized this and specified that a good nutrient solution should be slightly acid.

MOLECULES AND IONS

Knop made this recommendation before the theory of electric dissociation of molecules was even dreamed of. It was known in his time that plants exercise "selective absorption" preferring some elements to others. On this principle it might be argued with some validity that it makes no difference how, or in what quantities, the various elements are supplied in the solution. The plants simply absorb what they want and leave the rest. Knop, like the other scientists of his time, had no way of knowing what effect this residue would have on the properties of the solution and on the plants themselves. Today the theory of electric dissociation of molecules tells us that salt molecules in a solution split up into particles, or ions, carrying positive and negative electrical charges. The possitive ions cannot exist unless an equal number of negative ions is also present. As it happens, plants prefer nitrate ions (No. 2) above all others of negative charge. For this reason nitrogen is absorbed quickly and, unless an equal number of positive ions is also absorbed, the solution will turn alkaline. The most preferred of the positive elements is potassium. Consequently, there being no other modifying factors present, a good nutrient solution must have more nearly equal portions of available nitrogen and potassium than of any other elements. Each of the major elements in the solution must be considered in relation to another of the opposite electrical charge.

KNOP'S FORMULA

In Knop's formula of 1868 he added to one liter of water, one gram of calcium nitrate, .25 gram of magnesium sulfate, .25 gram of mono-potassium phosphate, .12 gram of potassium chloride and a trace of iron chloride. In this mixture the ratio of positive potassium ions to negative nitrate ions is about two to eight. No wonder, then, that his solution turned alkaline shortly after plants began feeding from it.

PLANT PHYSOLOGY

Looking back upon Knop's experiments, we see that they threw considerable light upon the question of salt proportions in the solution. Before taking up this important point, however, let us consider the influence of modern chemical analyses upon water culture. New developments have made it possible to measure the osmotic pressure of a solution. Osmotic pressure is a highly important physical property of the liquid. It derives its name from the process called osmosis by which liquids pass through the permeable membranes of tissues of plants. The movement takes place from the region of high water concentration into that of the low. This is because water, like gas, always flows from high-pressure area into a low-pressure area. A solution high in solutes has fewer water molecules per unit volume than one low in solutes. The force of this flow acting on the dissolved substance in the solution and measured as the pressure they exert on a membrane through which they cannot pass is the osmotic pressure.

If roots are immersed in a solution which is too concentrated, this pressure may cut down their intake of water or even draw water out of them. In this way the plants' life processes are deranged. The osmotic pressure is also a measure of the number of molecules and ions in a solution. It is one of the three ways of expressing the concentration of the liquid. The other two are by parts per million, or the ratio of chemicals to water by weight and by melocular concentrations and osmotic properties played an important part in laying the foundation for hydroponics.

Water culture supplied the answers to such important questions as what, when, how, why, and how much of certain elements are necessary for plant growth. Many scientists in all parts of the world have contributed to the knowledge now amassed on these points.

The technique used to determine what elements are essential was quite simple. A mixture was made from which one certain substance was missing, and the plant was then studied to see what effect lack of this element had upon it. The absence of those elements needed in large quantities usually had a more pronounced effect than that of those required in small amounts. This did not hold, however, for those elements which, like iron, play a specific role in plant processes. The effect of these elements is treated in Chapter VII, "Symptoms."

It has long been recognized that the composition of a plant does not remain

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constant throughout its existence. This raises the question: Does the food requirement of plants vary according to the conditions under which they grow? To explain the variation in a plant's composition, we consider that it is composed of two parts; (1) the food which it actually needs, and (2) that which it does not need but stores up in its tissue. It is the second part absorbed during the latter part of the plant's growth, which causes variations in composition. It has been possible, by the use of water culture, to withhold varying amounts of elements from plants during their latter growth stage. In this way scientists have determined how much growth a plant can make from any given quantity of nutrients absorbed during its early growth. In other words, it has been possible to find out just how much food the plant requires to grow normally at any age. From this we have learned that there is a period late in life when the plants absorb only a very small amount of nutrients.

The question of how plants absorb their food has provided the basis for a most intriguing study. We know that they have the power of selective absorption, being able to take one element from a compound and leave the other. The theory that some certain combination of chemicals' would ultimately prove to be the best under all conditions had to be considered in the light of this fact. Now an element taken up separately by the plant is absorbed as an ion. Two ions of opposite charge taken in together will have the same effect on the solution as if they were united in the molecule of a chemical compound. This has a most important bearing on the composition of nutrient solutions. For the reaction of the liquid remains most constant when elements are absorbed as if they were complete molecules. Therefore, the elements should be paired in the solution. Each has an opposite which should be used at the same time, so that they will be absorbed as a unit. Water culture experiments not only opened the way to this discovery but also provided the knowledge as to which elements should be used together. From a great amount of such study a formula was finally evolved which incorporates the chief theoretical features as well as the evidence derived from physiological studies and plant analyses. In this way the physiological basis for hydroponics was laid. The basic formula will be discussed more fully in the chapter on nutrient solutions.

How much of each elements does the plant need? To answer this question we must first answer another; How much growth can a plant make from a given quantity of any one nutrient absorbed? By multiplying the weight of the plant by the percentage of each element it contains, we can determine how much of each has been absorbed. The plant may take in more of some foods than it needs, so that composition is not always an accurate answer to our query. Nevertheless, we must know its composition not only at maturity but also during any of its various growth stages. The elements within the plant stand in complementary relationship to each other. A heavy intake of one will lower the intake of others. Consequently, the amount of any certain element contained in the plant may vary over a wide range. This fundamental complementary relationship between the various food factors must be considered. If we know the range of variation in composition among the different plant parts and the cause thereof, we can forecast how much growth a plant can obtain from a given quantity of food. It was this knowledge which made it possible to compound a chemical formula which would insure the most efficient use of all nutrients.

The question of why various elements

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EDITORIAL

FEATHER BROODER—ANSWER TO PHILIPPINES' BIGGEST POURTRY PROBLEM

In the interest of Philippine Agriculture ,it has been the policy of this magazine to learn the problems confronting our farmers today. One of the major problems of poultry raisers in and around Laguna, Rizal, Manila, Bulacan and Nueva Ecija is the discovery of the right kind of brooder.

For somtime now, we have been carrying out correspondence, personal talk with poultry raisers, and trips to the different provinces mentioned above to see personally some of the more progressive poultry raisers to have a first hand information of their problems. These poultry raisers are unanimous in their experience that a new kind of brooder adapted to Philippine conditions has to be found yet.

Not since the arrival of the few samples of the feather brooder imported by Dr. Santiago R. Cruz from the US, and after testing them on his poultry farm in Bocaue with excellent results, has the brooder problem been properly answered we might say, with conclusive proof.

The Santa Maria poultry fanciers, the Bocaue poultry raisers, the Laguna, Rizal, Manila and Nueva Ecija poultry investors will do well to check for themselves what Dr. Cruz is doing and the good results he has been getting.

Of the initial chicks Dr. Cruz received from the US., he has had 100% non-mortality rate with the use of his feather brooders.

Each unit of the feather brooder is good for 150 chicks with dimensions as follows-34" long, 27 3/4" wide and 10" high. The picture on the cover will give one an idea of its simple and compact appearance. It is the most practical apparatus for giving the chicks warmth and closest to nature in principle, as if they were within their mother's brood. The feather brooder eliminates for the poultryman, the problem of the availability of current and impracticability of the use of generators with reference to electric brooders, not to mention not to mention their hifh cost: the problem of the tediousnese of using kerosene brooders during windy or stormy nights, not to mention the personal inconvinience they cause the poultryman.

We believe, even in this early stage of its initial trial in the Islands, the feather brooder is the answer to the poultryman's search for a brooder adapted to Philippine climatic conditions and the poultryman's limited purse.

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are needed has received a vast amount of study and undoubtedly will continue to draw attention for years to come. There is still much to be learned. At present our knowledge is limited to those elements which are consituents of specific chemical compounds or performs some definite function in plant life. Nitrogen is required as a raw material for proteins manufactured by the plant. It is the only element which we find fixed in a specific chemical product in practically the same amount that is absorbed. For this reason analysis of a plant for its nitrogen content will also reveal the amount of protein it contains. Phosphorus plays a part in the formation of new cells. It is particularly abundant in the growing parts of the root tips and enlarging shoots. At maturity large amounts of this element are stored in the seeds after having performed their specific function in the formation of new cells.

Surfur is also a constituent of proteins. Magnesium is used in the synthesis of cholorphyll, the green coloring matter of plants. Calcium is a binding material which holds together the cells of various plant tissues. So vital is this function that the absence of calcium causes more profound disturbances in many species of plants than does lack of any other element. . . Potassium seems to act more or less as a helper to other elements. It does not enter into any specific chemical compounds inside the plant. The amount of nitrogen absorbed, hence the amount of protein that can be manufactured, is related to the absorption of potassium. Yet the actual synthesis of protein by the plant appears to bear a closer relationship to the amount of calcium rather than potassium which is present. Iron is needed for the manufacture of chlorophyll but is not a constituent of the pigment. The function of the trace elements-boron, manganese, zinc, and cooper-has not been clearly established. It seems to vary with the amount of light provided to the plant. Still this can be said for all elements, since light affects growth and is thus reflected in the nutrition of plants.

There is no doubt that the data accumulated. through water culture experimentation facilitated the birth of the soilless method of crop production in 1929. It was certain to be discovered in time. No insuperable barrier to discovery remained once the general precepts had been established and it became known that crop production required a proper coordination of all the various growth-affecting factors.

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4. The practice of cooperation.
5. Business principles and practices.
6. Organization of cooperatives.
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8. The history and accomplicements cooperatives.

MEANS AND METHODS OF EDUCATION IN COOPERATION

The educational program then may be divided into different enterprises to cover the diverse needs of the members. The types of education, its purposes, and the nature of the groups or individuals to be reached usually determined the means to be adopted. Some of the important enterprises are:

1. Study clubs for the literate and illiterate.
2. Kindergarten and primary schools.
3. Reading circles.
4. Editing and publication of newspapers.
5. Fairs and community asembles.
6. Establishment of a collection.