ARAMCO WORLD
magazine

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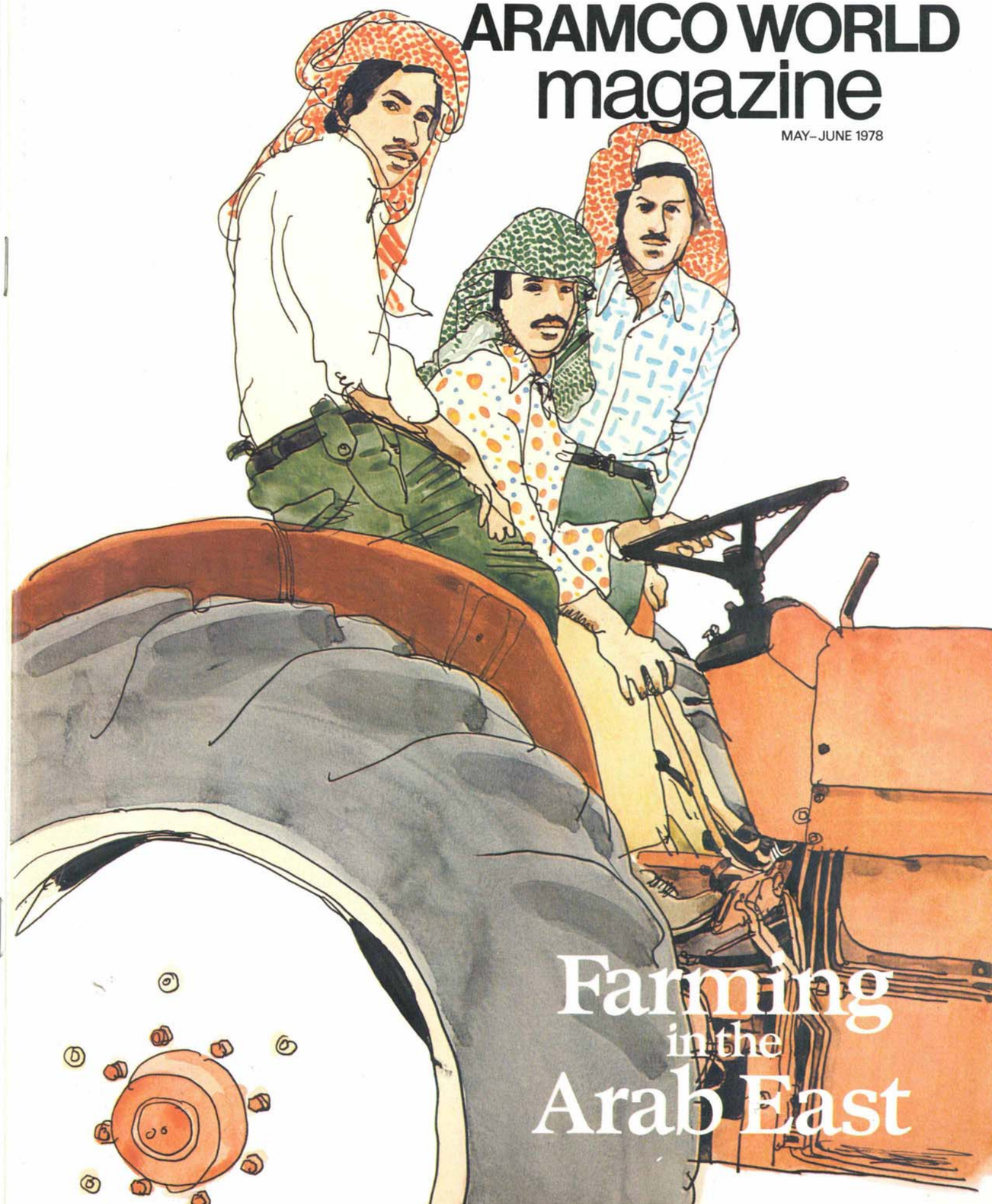
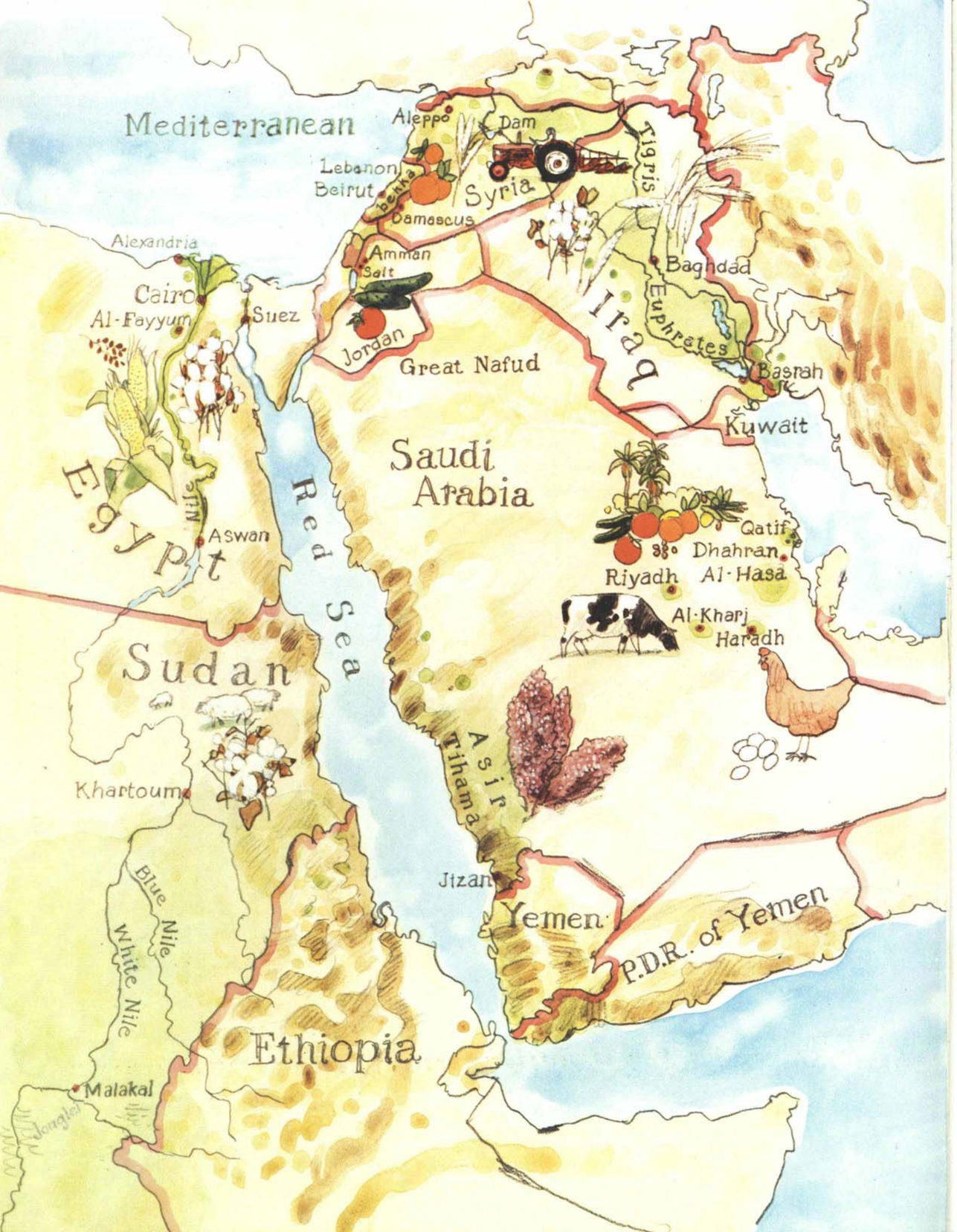
MAY–JUNE 1978



Farming in the Arab East



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Contributors: John Lawton, who researched and wrote most of this issue, and Elias Antar, who wrote the sections on Egypt and the Sudan, are both veteran reporters in the Middle East and Europe. Both are also graduates of the Ford Foundation's Advanced International Reporting Program at Columbia University's School of Journalism. Norman MacDonald, the illustrator, is a Canadian artist who specializes in illustrative reportage: on-the-scene sketching and painting that, he says, are vital for accurate detail, perspective and color.

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Cover: In Saudi Arabia, where farming accounts for a surprising percentage of jobs and income, these farmers and their new tractor symbolize the change now taking place in agriculture in the Arab East: modernization of the traditional – and sometimes primitive – methods of growing food. Back cover: In Lebanon, grafting helps improve the quality of oranges. Illustrations by Norman MacDonald.

Farming in the Arab East an Introduction

In October, 1977, two quietly significant events took place in the Arab East. At a new experimental farm near Aleppo in Syria, agricultural scientists sowed the farm's first experimental wheat crop, and in Amman, capital of Jordan, ministers from 21 Arab states met to discuss integration of Arab agriculture.

Neither event, to be sure, forced any editor to replate his front page. Yet both were of paramount importance. For the agriculturalists in Syria were planting the seeds of what may be a new "green revolution" in the Arab world; and the ministers in Jordan were laying the groundwork for a pan-Arab effort to increase food production throughout the region. Together those events meant that the governments of the Arab East had again joined battle with the land.

Centuries ago, what is now the Middle East was the granary of the known world. From fertile, silt-fertilized farmland by the Nile, from ingeniously irrigated fields in the Tigris and Euphrates river valleys, from the rich soil of Lebanon's Bekaa Valley and from other areas in the Fertile Crescent, ancient farmers supplied much of the world with grain, vegetables and fruit. Gradually, however, war and encroaching deserts destroyed or reduced the region's fertility and its output of basic food crops. By 1976, as a result, Arab countries were importing an estimated 13 million metric tons of food grains to feed their 250 million people.

Some years ago, therefore, Arab governments, individually and collectively, realized that food – even more than oil and industry – was a key to long-term economic survival in predominantly arid lands, and decided that they had to achieve self-sufficiency in all strategic crops.

It was, the governments quickly found, an enormous task. Birth rates in many areas were soaring. Mass migration to the cities was diverting farm labor from the land. Pestilence was ravaging many crops. Much of the land, after centuries of inefficient, often primitive farming, was depleted. And the deserts, in the wake of drought, were again on the move.

As the events in Aleppo and Amman suggest, however, some progress has already been made. Determined to break their dependence on others for food – and to lessen the economic and political problems this implies – Arab governments have been plowing back into the earth some of the vast oil earnings extracted from it. They have built dams, sunk wells and constructed extensive irrigation networks. They have brought in outside experts in modern farming, introduced modern agricultural techniques and, from the West, purchased the machinery and the chemistry needed to supplement those techniques. And, as the Aleppo planting indicates, they have also introduced new high-yield crops.

Even more significantly, they have organized two pan-Arab institutions to centralize and strengthen future efforts: the Arab Organization for Agricultural Development, responsible for planning; and the Arab Authority for Agricultural Investment, capitalized at $450 million and responsible for finance. They have also joined forces with the International Center for Agricultural Research in Dry Areas, a research organization.

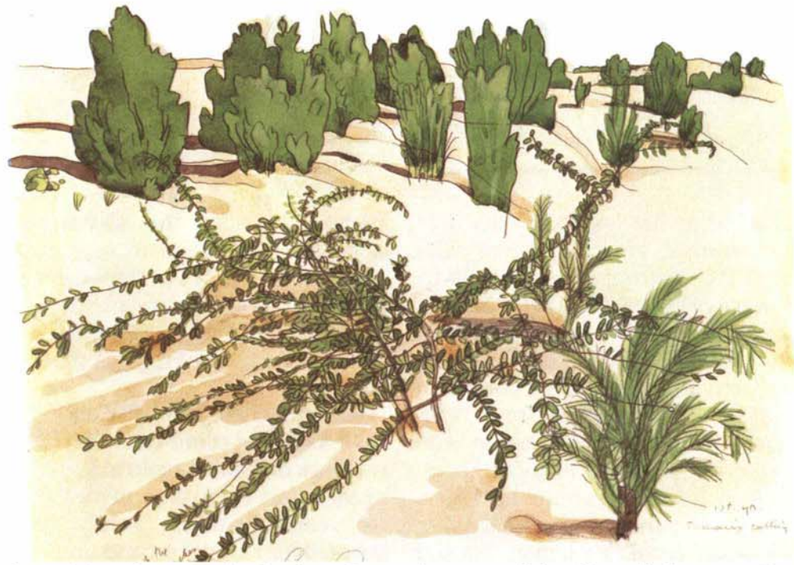
The first of the pan-Arab institutions was set up as early as 1972, but the investment authority, reflecting the new emphasis on agriculture, is relatively new. As is its initial venture: the ambitious attempt to develop the Sudan as the central source of food for the region.

Unlike other Arab states, the Sudan has millions of acres of idle, potentially rich, virgin farm land, along with vast quantities of water available from the Nile. Led by Saudi Arabia and Kuwait, therefore, the 13 Arab countries behind the investment authority have drawn up a $5.7 billion program to double the Sudan's production of meat, oilseeds, fruit, vegetables and fish, boost its output of wheat five times and multiply sugar production six times.

To achieve this goal, agricultural science would have to irrigate another 4.4 million acres of land in the Sudan and open another five million acres of rain-fed cropland. Irrigation specialists are also exploring the possibility of draining the 63,706 square miles of forbidding swamp called "the Sudd" which diverts – and wastes through evaporation – billions of cubic feet of water from the Nile every year.

The third organization involved, ICARDA, takes a different tack. Instead of expanding cultivatable land, ICARDA is attempting to increase output from acreage already under cultivation. An extension of the global network of agricultural scientists who helped bring the "green revolution" to Asia, Africa and the Americas with "miracle" wheat and rice, ICARDA, in January, 1977, opened similar experiments with the basic crops of the Middle East: wheat, barley, lentils, broad beans and chick-peas.

The organization's first move was to open a Middle East experimental station near Aleppo – where its scientists



planted the wheat crop in October – but that was only the beginning. At other stations, to be opened in the future, scientists from 10 nations will endeavor to cross the most hardy local crop varieties with higher-yielding international varieties in hopes of producing plants that will simultaneously resist disease and drought, tolerate high temperatures and salty soil, give greater abundance of more nutritious foods and, for good measure, appeal to the appetite.

None of those experiments is entirely new to the Arab East. Since the 1960's the Arab Lands Agricultural Development Program (ALAD), funded by the Ford Foundation and several Arab countries, has been working hard at improving the basic grains of the region, as well as experimenting with the introduction of the "buffalo gourd" (see Aramco World, November-December 1972). A protein-rich plant that grows wild in arid Arizona, the gourd has roots that can reach water even in deserts.

But ICARDA, which has absorbed most of ALAD's research programs, hopes to carry those experiments even further. Its experts, for example, hope that they will be able eventually to squeeze three or four growing seasons into the calendar, instead of the usual two; improve present Middle East planting, fertilizing and harvesting methods; and combine livestock and food production – traditionally split between Bedouins and settled farmers – by finding crop combinations, such as clover and wheat, that will produce food and feed animals simultaneously.

"We are an insurance policy," said ICARDA director Dr. Harry S. Darling, "against food running short in the Middle East."

The Arab Organization for Agricultural Development is also trying to provide such insurance. Since 1975 the development organization has been working on a Food Security Plan, and it was to review its progress that Arab ministers met last October in Amman.

"The first stage," says Dr. Husni Ahmed Khalifa, one of the organization's senior officials, "was to find out the state of agriculture in the Middle East. Then evaluate the different development trends in each country, and finally, taking into account the advantages of each country, develop one integrated agricultural policy for all the Arab world with the objective of reaching food self-sufficiency."

Although the Food Security Plan is not expected to be completed until 1979, the concept of cooperation rather than competition in agriculture is already widely accepted in the Arab world. "No one country can produce all kinds of crops," says Dr. Subai Kasem, dean of agriculture at Amman University, who foresees an Arab "agricultural supermarket" with Sudan the meat counter, Iraq and Syria the bread counter, Lebanon the fruit counter, Jordan the vegetable counter and Saudi Arabia, Kuwait and the U.A.E. as the bank.

That, of course, is an oversimplification. Saudi Arabia, Kuwait and the United Arab Emirates may indeed provide funds for the agricultural revolution, but that isn't their only contribution. Within their own borders, those countries are also launching important and often advanced agricultural programs. The United Arab Emirates have recently reclaimed some 30,000 acres of land and in Abu Dhabi experts are now experimenting with a radically new method of conserving water. They have laid a thin layer of asphalt in the soil about three feet beneath the surface of a five-acre farm to stop irrigation water from seeping too deeply into the soil and simultaneously prevent salts from seeping to the surface. In Kuwait, another of the oil states that are funding the Food Security Plan, similar ventures are underway – including experiments in "hydroponics," which grow crops without soil – and in Saudi Arabia the government has launched massive programs to improve and modernize its agriculture.

Dr. Khalifa's point, however, is that cooperation is vital. Whatever their individual roles, all of the Arab states must work together if they are to win the endless struggle against difficult climates and arid lands and produce the food their peoples need.

–The Editors

Farming in the Fertile Crescent

Although 90 percent of the Arab East is desert, the fertile 10 percent – the famous "Fertile Crescent" – harbors some astonishing exceptions. Among them are the Jordan Valley, a unique, natural greenhouse below sea level; Lebanon, the Biblical "Land of Milk and Honey;" and the Tigris-Euphrates Valley, where, according to Theophrastus' *History of Plants,* returns from the well-farmed land were once a hundredfold.

Time and turmoil – such as the Mongols' 13th century destruction of ancient irrigation networks in the Euphrates Valley – have taken their toll in this rich swath of fertile land that arches from the lands along the eastern Mediterranean coast across northern Syria to the river valleys of Iraq. But, as a recent survey shows, farming in the Fertile Crescent is still vital to Middle Eastern agriculture and, by 1977, had begun to revive. This is particularly notable in troubled Jordan where, for 10 years, war, internal conflict and droughts have periodically upset the kingdom's already precarious grip on scarce farmland.

Prior to 1967 Jordanian farming was concentrated in the area called the West Bank. There, in fertile fields adjacent to the Israeli frontier, Jordan's farmers grew 30 percent of its cereals, 60 percent of its fruit and 65 percent of its vegetables. But then, in the 1967 war, Israeli forces captured and occupied the West Bank, leaving Jordan with a meager 800,000 acres of East Bank land suitable for agriculture. More problems arose in subsequent years when further fighting disrupted farming on the East Bank too, and damaged the vital Ghor irrigation canal. Jordanian farmers have also been hit by drought in three of the past four years.

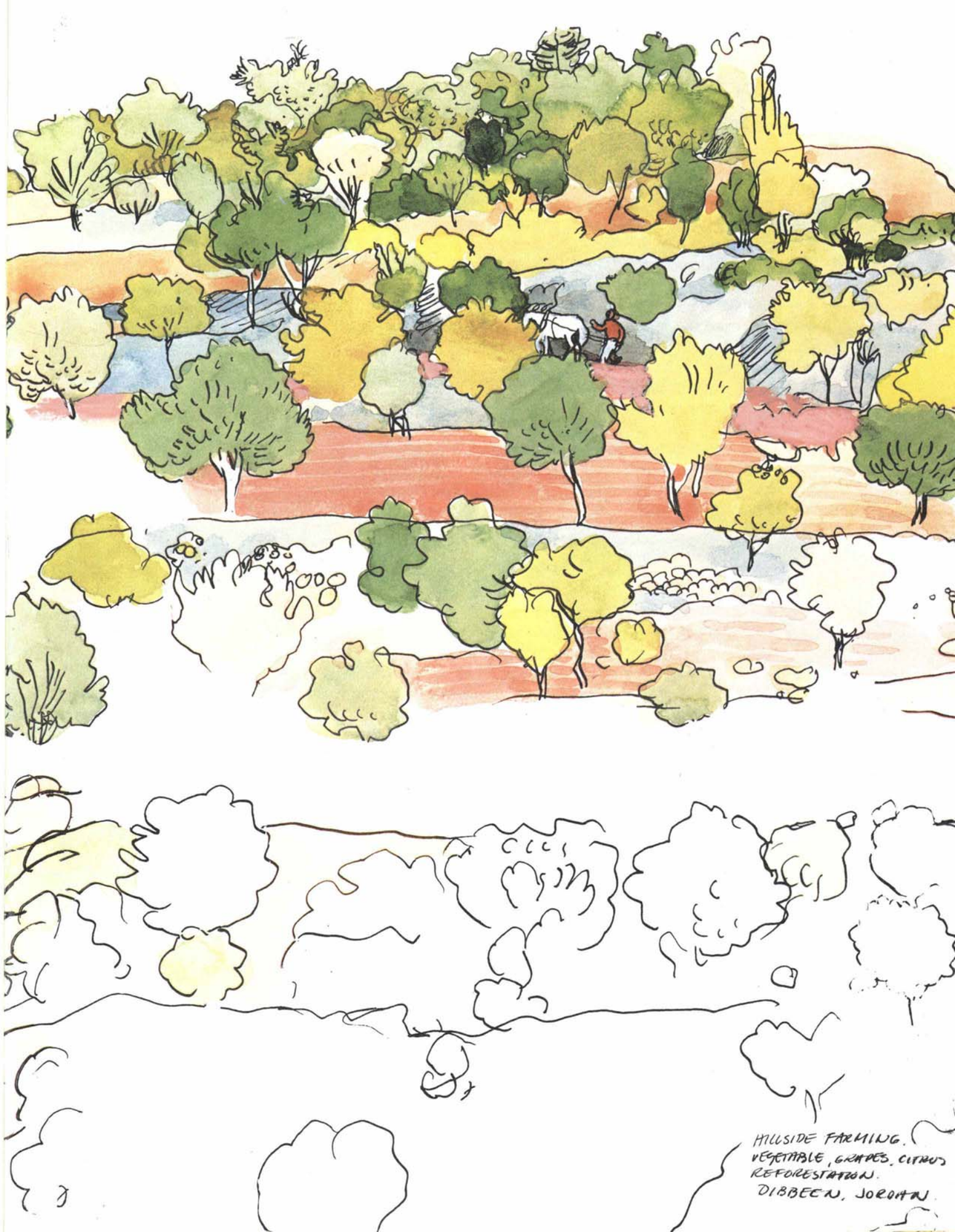
Little wonder, therefore, that agriculture has been a declining sector of the Jordanian economy; its contribution to the gross domestic product fell from 22 percent in the 1960's to 10 percent in 1975. As a result, Jordan now imports more than half the food it consumes. It is wholly dependent on foreign purchases of sugar, rice and dates, relies heavily on imports of wheat, meat, dairy products and vegetable oils, and buys from abroad substantial quantities of potatoes, onions and garlic.

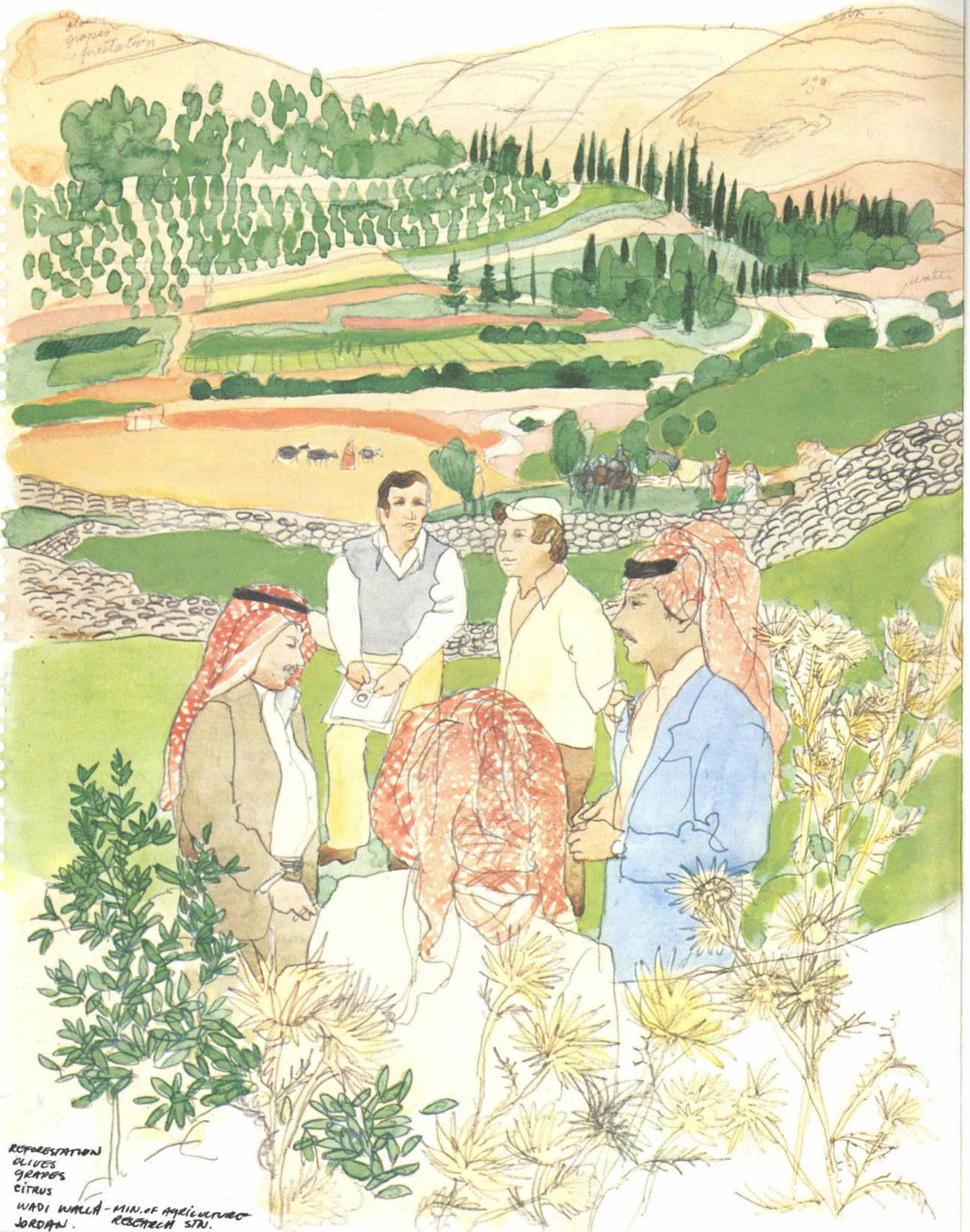
Conditions, however, are now improving – as the changing fortunes of Jack G. Khayyat, Jordan's leading poultry breeder, suggest. "In 1967 I had one of the biggest blows you can imagine", recalled the 43-year-old Jaffa-born Palestinian in one published interview. "I lost 90 percent of my customers in one week's time. I had only two choices: either tell my creditors I was bankrupt or start all over again."

Khayyat chose the latter and, despite losses of more than $600,000, was back on his feet again in less than a year's time. Then came, in the 1970's, civil conflict, which nearly bankrupted him for the second time. Yet Khayyat, in 1977, was recovering. "Since then, fortunately, we have had stability," he said, "and business is beginning to boom."

Behind the revival is a basic change in the economic attitudes of the Jordanian government. A monarchy which has tried to steer development along the free enterprise road, Jordan's government is, nevertheless, increasingly involved in agriculture. In the past five years government aid to farmers has doubled, with state credits totaling nearly $1 million in 1976, most of it for poultry and irrigation projects.

In 1976 the government also launched an ambitious Five Year Development Plan, aimed at increasing the kingdom's growth rate by seven percent a year – for a total





increase of 40 percent by 1980 – with nearly 15 percent of the plan's $2.4 billion in investments earmarked for agriculture.

In the agricultural sector Jordan is giving top priority to increasing its water supply, the shortage of which has sharply limited agricultural production. Because 80 percent of the East Bank's 34,300 square miles is desert or semi-desert – and because rainfall is scarce and irregular even in fertile areas – Jordan's farmers depend almost entirely on irrigation; although accounting for only seven percent of the total land under cultivation, irrigated land produces 60 percent of all the food grown in Jordan. The plan, consequently, concentrates on extending high-yield irrigated acreage, with nearly $216 million allocated for irrigation systems, dams, reservoirs and canals in the Jordan Valley, the Dead Sea basin and the northern uplands; when completed, those projects will double the acreage presently under permanent irrigation for a total of 8,500 acres.

Meanwhile, Jordan has already completed a $36 million dam and a 1.7-billion-cubic-foot reservoir on the Zerka River. The government has also initiated construction of various water diversion projects on the Wadi Arab, the Wadi Hisban and the Wadi Jarum and is planning a $75 million dam on the Yarmuk River. To channel the extra water on to farms, planners are also providing an expanded network of pumping stations, carrier canals and pressure pipes, including a $52 million, 11-mile extension of the Ghor canal.

In an even bolder move, Jordan is also installing sprinklers along the entire 65-mile length of the Jordan Valley, a natural "hothouse" lying 600 to 1,200 feet below sea level between Lake Tiberias and the Dead Sea; the first of the sprinklers was turned on in December, 1977.

Presently watered by canals, pipes and ditches, the Jordan Valley already produces more than half of the food grown in Jordan, but planners hope that by using sprinklers and other modern farming methods they can increase this fourfold. Parts of the valley are fertile enough to support two harvests a year, and its long, hot, humid summers and mild winters are perfect for growing tomatoes, eggplant, cucumbers, broad beans and melons in all seasons.

Because nearly a decade of conflict wrecked many of the valley's key agricultural installations – and forced large numbers of farmers to abandon their land – Jordan's government has been making an extraordinary effort to rebuild and rehabilitate the valley. In 1973, for example, it set up the Jordan Valley Commission to coordinate all development activities in the valley, but with special emphasis on agriculture. One of the commission's first moves was to organize the farmers of the valley under the Jordan Valley Farmers Association, whose objectives are to increase production and help the farmers by raising the $225 per capita income of the farm families – half the national average – to an above-average level. The association is also planning to build new farming communities, to re-equip existing communities with roads, schools and clinics, to provide electricity and drinking water and to organize farmers into cooperatives that can share equipment and market the crops.

"At present", says Mirweid Tell, brother of a former premier and himself a farmer, "both farmers and consumers are at the mercy of the middleman". As this reduces the farmers' already low income and ups the housewives' food bills, the government is providing farmers with four regional fruit and vegetable packing centers at which produce will be collected from individual farms and readied for direct sale by their association to wholesale markets both inside and outside Jordan.

Other activities being carried out on a joint basis include pest control and harvesting, with $1.5 million allocated for the purchase of jointly owned farming equipment. To encourage expansion the government is also waiving import duties on fertilizers, pesticides and seed, and taxes on land and farm income.

Governments, however, can only do so much. In the final analysis, progress in farming still depends on the farmer – and in Jordan the farmers are going flat-out. Although supposedly reluctant to change tried and true methods of the past, the Jordanian farmer has, for example, enthusiastically adopted a radically new approach to farming – the use of plastic greenhouses and tunnels – which is rapidly changing the appearance of the Jordan Valley and simultaneously producing high-earning, out of season vegetables. "The farmers are really running after this one", says a government official. The reason, he says, is that investment is minimal, the return is quick and the profits high. As a result, giant, cigar-shaped plastic blisters are spreading like a rash across the Jordan Valley floor.

Not everyone, however, approves of this development. "What we need," says Tell, "is not expensive cucumbers in January, but enough moderately-priced food all the year round," – a sentiment with which the Ministry of Agriculture agrees. Rather than leaving the farmer free to grow whatever makes the most money, the ministry prefers that farmers change crop patterns to make more efficient use of the land and better feed the nation. Indeed, that approach receives a high priority at the Ministry of Agriculture. Ministry officials, for example, limit production of citrus and bananas, which requires lots of water, and discourage farmers from growing wheat in high-risk, marginal rainfall areas. Instead they press for fodder, for improved livestock production and for fruit trees and for efforts to arrest soil erosion. And although that approach obviously reduces wheat acreage, it

SALT-JORDAN.

doesn't necessarily reduce the wheat crop. By intense cultivation of higher-yield seed, the Ministry hopes to *double* its output of wheat. The government, moreover, is attempting to make more economic use of manpower by turning Jordan's nomadic Bedouins into settled farmers; eight settlements are successfully operating in the desert south of Amman.

There is still, of course, the basic and insoluble problem of rainfall. Because of drought, officials estimate the actual agricultural growth rate during the first two years of the current Five Year Plan was four percent instead of the anticipated seven. But Jordan's officials are by no means pessimistic. "After all," said one, "output is going up, not down."

Lebanon, another Fertile Crescent country, is also trying to recover from the impact of conflict: the 1975-76 civil war.

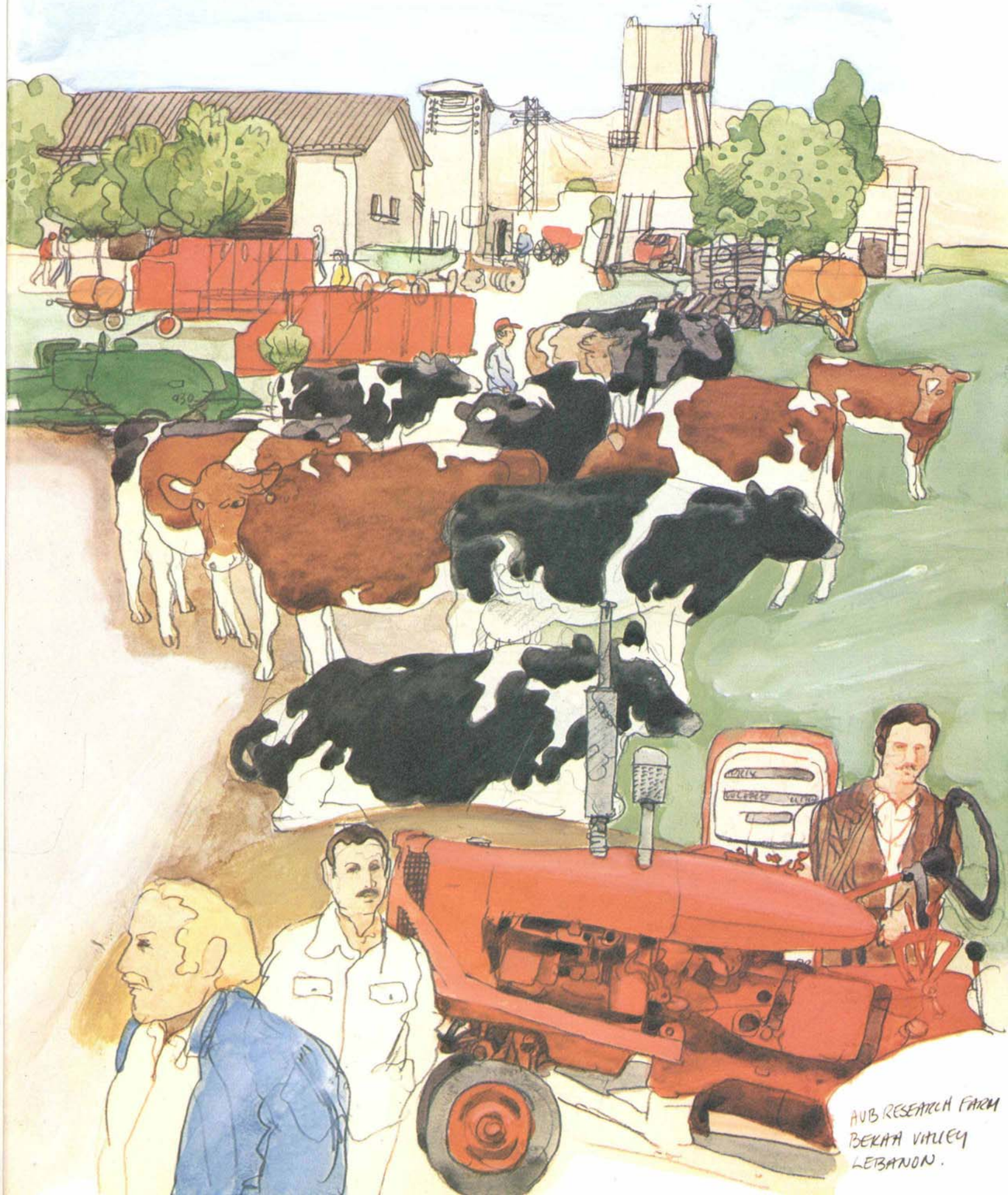
Once known as the "Land of Milk and Honey", and an oasis of peace and prosperity, Lebanon had, over the centuries, developed its coastal plain, its terraced foothills and its magnificent Bekaa Valley into one of the more productive and most modern agricultural centers in the Fertile Crescent. It was, moreover, the home of the college of agriculture at the American University of Beirut, and the college's experimental farm in the Bekaa. From the college, students trained in modern farming theory and technology have been carrying the knowledge of modern agriculture throughout the Arab world for many years, and many of its graduates today hold key posts in agricultural ministries in most of the Arab countries.

During the civil war, however, and during the sporadic clashes that have occurred since, agricultural output dropped sharply. Losses in agriculture already exceed $120 million, much of it in livestock, poultry, citrus groves, apple orchards and tobacco, and in 1977 the country had to import olives and olive oil for the first time in modern memory.

During the war too, Lebanon, which for years had been pouring money into a huge reforestation project called "The Green Plan," lost thousands of trees in the new forests when its people ran short of fuel.

In an interview early this year

BEDUIN WITH GOATS.
ZARQA - JORDAN.



AUB RESEARCH FARM
BEKAA VALLEY
LEBANON.

BEKAA VALLEY
LEBANON

Amin Abdel-Malek, director of agriculture in the Bekaa Valley, estimated that agriculture would take two to three years to recover if there is peace. In late 1977 said Abdel-Malek "olive and tobacco production in the southern border areas was nil."

In the rolling hills of north Lebanon and the central Bekaa Valley, however, the picture was not as bleak. Vegetable production was almost back to normal, poultry farming has recovered to 75 percent of former levels, and eggs were once more being exported.

Some of the recovery was due to help from the United Nations Food and Agriculture Organization (FAO), and to the government of Lebanon, which set up a special $17 million fund for agricultural loans and was subsidizing the import of cattle from the Netherlands to help farmers restock their depleted herds. "But until now," says Abdel-Malek, "much of the comeback is due to the personal efforts of the farmers."

Dr. Nasri Kawar, dean of agriculture at the American University of Beirut, agrees. "Personal initiative is typical of the Lebanese," he said, adding that the Lebanese farmer is "very capable, conscientious and willing to accept and invest in new ideas.

"They also have an excellent incentive," he said, because, with shortages, the prices of fresh produce have almost tripled. "Farmers are making good money with these prices," Dr. Kawar said.

Dr. Kawar is convinced that the Lebanese farmers will eventually recover from the effects of war. "The Phoenicians are known as sailors but in fact the first Phoenician settlers were farmers," he said, "and in the past 20 years the Lebanese farmer has made great advances in agriculture, particularly in mechanization."

In that period, he said, there has been a tremendous improvement in yields of sugar beets and grains. Of Lebanon's 966,000 acres of farm land, 106,000 are planted with wheat, 19,768 with barley and 5,600 with corn. In addition, olive groves cover 69,200 acres, vineyards 40,700, apples 34,500, citrus 27,000 and tobacco 16,300.

AUB still plays a leading role in agricultural experimentation through its Bekaa Valley Farm, but the farm, Dr. Kawar said, suffered $30 million worth of damage, mainly through looting. Fortunately, however, its dairy herd and its heavy equipment were left unharmed.

Further east in the Fertile Crescent, the outlook for agriculture is more obscure. Despite impressive efforts now under way, Iraq and Syria, where mankind first developed both agriculture and irrigation, must look further into the future before they can expect to realize the full potential of their agricultural heritage.

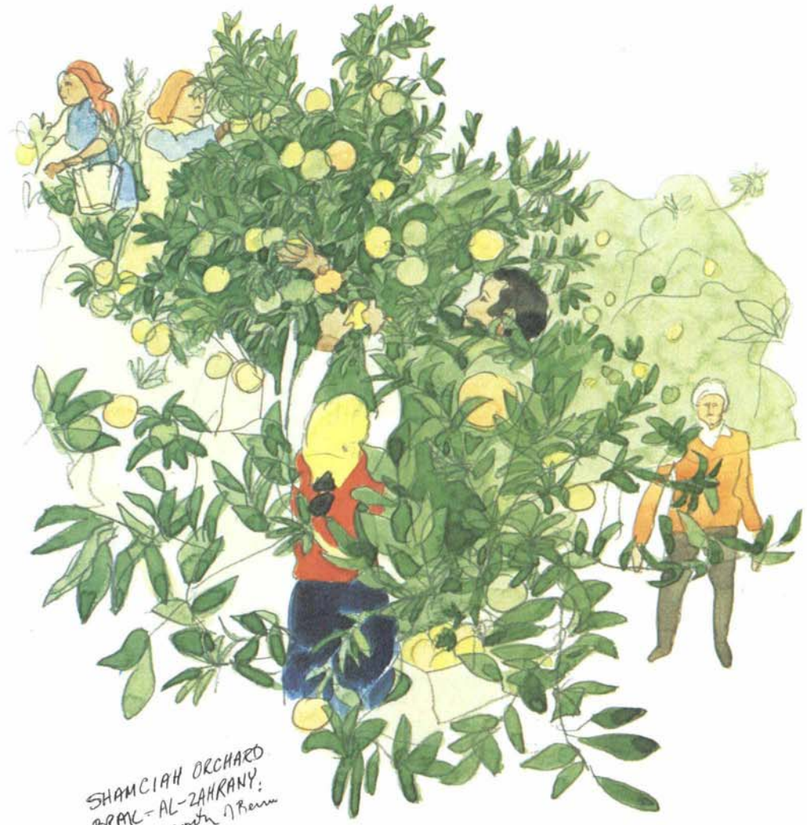
The key to agriculture in Iraq and Syria – the eastern edge of the Fertile Crescent – is the great Euphrates River. Nearly 2,000 miles long, with an average annual flow of 1,024 billion cubic feet, the Euphrates rises in Turkey, crosses northeast Syria and, joining the Tigris River, flows south into the Gulf. Enroute it irrigates the alluvial plain between the lower waters of the Euphrates and the Tigris, site of the ancient fluvial civilizations of Mesopotamia – a word meaning "between the rivers." In ancient times the development of agriculture was swift and by the time Babylon reached its peak, crops were rich and abundant. As Theophrastus observed, "Wheat fields are regularly mown twice, and then fed off with beasts to keep down the luxuriance."

In the 13th century, however, Mesopotamia, then part of the Islamic empire, was devastated by the Mongols – so thoroughly that its precious fields and irrigation systems were permanently crippled. And in more recent times, frequent political upheavals and constant disputes among the three riparian states – over division of Euphrates water – has slowed efforts toward restoration of Mesopotamia's ancient fertility. As a result, writes British historian William de Burgh, "it now requires an effort of imagination to realize that Babylonia was once one of the chief granaries of the world."

Nevertheless, Iraq and Syria, the two Arab nations straddling the Euphrates, are today embarked on unprecedented development programs aimed at restoring their agricultural riches. Iraq, for example, under its 1976-1980 National Agricultural Development Plan, intends to invest $10.5 billion, a 72-percent increase over the amount allocated to agriculture in the previous Five Year Plan. Part of this sum is to go to further development of state farms and mechanization of Iraqi agriculture, currently suffering from a manpower shortage because of the drift of farmers into the cities. Further large sums are to be spent on irrigation – primarily near the Tigris, which is less saline and offers more development potential than the Euphrates because of the latter's damming by the Syrians and Turks.

Syria too is investing money in agriculture – and has for some time. By the early 1970's, for example, government programs worth $100 million had reclaimed some 85,000 acres from an area called the *Ghab,* a huge swamp where, periodically, the Orontes River overflowed its banks in destructive floods. More recently – in its 1976-80 development plan – the government has earmarked $949 million for agricultural investment, 66.5 percent more than during the previous five year program. More than half this amount is going to development of dairy farming with the aim of boosting milk production in 1980 by 86,860 metric tons. According to an official of the Ministry of Agriculture, Syria is establishing 27 600-cow state dairy farms and 250 100-cow cooperative dairy centers. Under Ministry of Industry sponsorship the country will also establish a vegetable oil mill, three canning plants and three dairy plants. Additional sums of money are earmarked for agricultural development in the budget of the Ministry of the Euphrates Basin.

As the existence of this special ministry suggests, Syria's most important agricultural activity is development of the Euphrates Basin.




ICARDA
EXPERIMENTAL
FARM
ALEPPO, SYRIA.

At the heart of it is the recently completed Euphrates Dam, the largest economic project ever undertaken by Syria (see *Aramco World*, January-February, 1974). Located at Tabqa, north of the ancient city of Palmyra, the three-mile long, 180-foot-high dam is – after Egypt's Aswan Dam – the second biggest in the Middle East. Capable of storing 423 billion cubic feet of water, the Euphrates Dam is expected to more than double the present irrigated area in Syria and virtually wipe out the country's vulnerability to erratic weather conditions.

Another major agricultural project in Syria is construction of a national grain silo network with a total storage capacity of 810,000 metric tons. When completed, the $90-million project is expected to save some $18 million annually in wheat and barley losses stemming from storage of those grains in the open air.

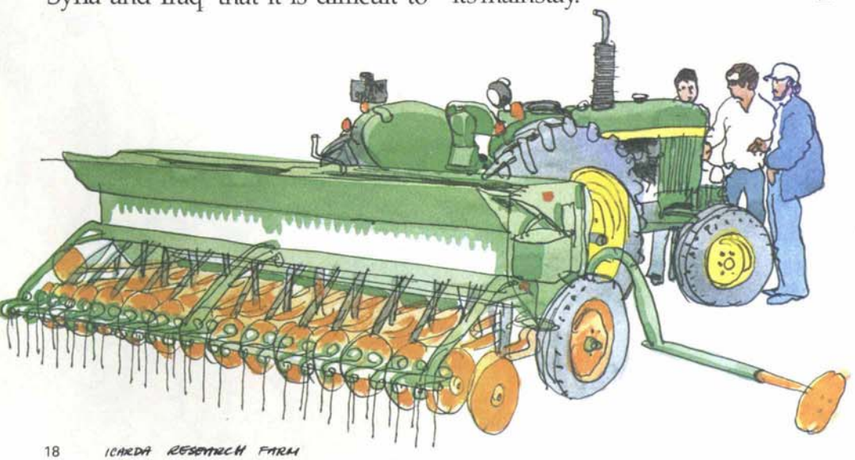
Yet another development which should improve the performance of Syrian agriculture is the implementation – by a new team of technocrats at the Ministry of Agriculture – of a more realistic farming policy. Essentially this policy will modify the enforced land reform of the 1960's with a system of land tenure under which 80 percent of cultivated land will remain in private hands. The experience of the past decade has taught agriculture officials in several countries of the Arab East, including Syria and Iraq that it is difficult to anticipate the results of basic changes in land policy and that reforms, even when urgently needed, must be preceded by careful planning.

With the aid of its increased oil revenues, Iraq is beginning to reverse the centuries of decline and aims at reaching food self-sufficiency by 1980. And Syria has set its sights even higher. Officials, in 1978, were aiming at agricultural *exports* worth $335 million by the end of this decade. Even today, cotton is Syria's second largest export; in 1975 it accounted for 13 percent of all exports.

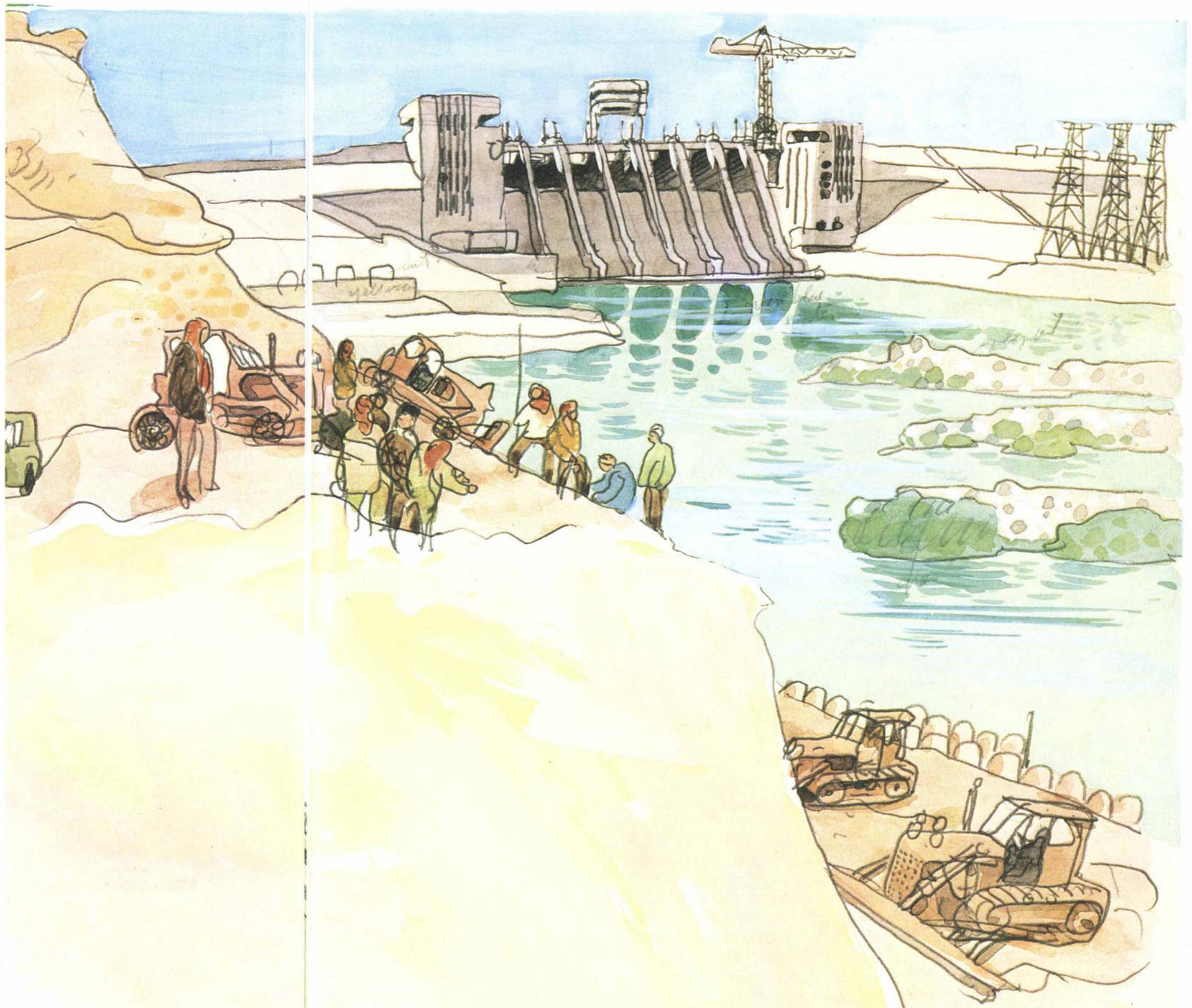
Iraq, meanwhile, is the world's first date producer, with an average total production of 350,000 tons a year. Many different varieties, notably the delicious Zahdi and Sayer, are grown in the Euphrates and Tigris Valleys, mainly in the governates of Basrah and Babylon.

And although the bountiful days of Babylon are long gone, there are those, other than the Syrian and Iraqi planners, who believe the Euphrates Valley still capable of producing plenty. "Syria," says an American agronomist based in Damascus, "has great agricultural potential." And the Euphrates Basin as a whole, adds Dr. Darling, "was a granary of the world in Roman times. Why not again?"

It is not impossible. The Fertile Crescent is an accurate name, and despite recurring difficulties the ancient area can still play a vital role in efforts to improve and expand the agriculture that was once its mainstay. ■



ICARDA RESEARCH FARM
ALEPPO, SYRIA.



EUPHRATES DAM PROJECT SUPPLIES ELECTRIC POWER FOR ALL OF SYRIA. WILL IRRIGATE 640,000 HECTARE AREA

Farming in the Sand

Outside the Fertile Crescent, farming in the Arab East is a perpetual contest between man and nature. On most of the Arabian Peninsula – one of the most arid regions on earth – rainfall is scant, and much of it runs off into the desert sands or quickly evaporates. Yet in Saudi Arabia, the largest and driest country on the Peninsula, current agricultural advances are among the most innovative and most dramatic in the Arab world.

More than 1,000,000 square miles in area, the Arabian Peninsula contains almost no perennial rivers or streams, and its southern section is covered by one of the largest deserts in the world – the inhospitable "Empty Quarter." Until modern technology could reach deep into the earth for well water, therefore, farming in Saudi Arabia was necessarily confined to areas where water was found near the surface: in dry river beds or natural springs. Wherever water *did* exist, however, there was intensive cultivation. On the terraced hillsides of the southwest, for example, farmers in the 16th century began to grow and export coffee and at al-Hasa oasis, one of the oldest in the world, they have grown the vital date palm for centuries. (See *Aramco World*, March-April, 1978.) Until relatively recent times, the date palm provided a pivotal staple food throughout Arabia. Ancient farmers also grew alfalfa, wheat, barley, sorghum, rice and millet.

With the initial search for oil, and the introduction of modern drilling technology, some changes in traditional agriculture – and later in patterns of consumption – occurred in the Eastern Province. And today, with petroleum revenues at high levels and with a government dedicated to improving agricultural output, change is a way of life on virtually every farm in the kingdom. "Nowhere in the world," says an Irish cattleman working in Riyadh, "is a government giving more support to farmers."

This support is transforming every aspect of agriculture in Saudi Arabia. With other ministries providing the immense infrastructure essential to modern farmers – roads, electricity, housing and social services – experts from the Ministry of Agriculture and Water are launching projects bearing directly on farming: irrigation, reclamation and distribution of land. The ministry is also providing seeds, saplings, herbicides and fertilizer; training and supervision in modern farming methods; and, in 1976 and 1977, subsidies totaling $120 million and loans totaling $140 million.

Despite such efforts, Saudi Arabia, in 1977, was still importing most of its food. But its massive investments in agriculture are already beginning to pay off. Locally-laid eggs, for example, were once a rarity, but are now available everywhere, and poultry farms are producing some 150 million eggs a year, many of them on huge, environmentally controlled poultry farms that are springing up all over the country. As natural climate and soil play no part in the production process – the fowl grow up indoors, completely sheltered from the fierce sun, and are fed on food concentrates – this type of farming is particularly suitable for Saudi Arabia's weather conditions.

Investments in dairy farming have been equally successful. In Riyadh recently, fresh, pasteurized milk from Saudi herds went on sale for the first time. The milk comes from a string of six farms near Riyadh and in the Qasim area, a region which a Dublin-based firm finds ideal for intensive dairy farming. "We surveyed the whole Middle East and decided Saudi Arabia was best suited to our system," says Cahal Magee of Masstock, the company which operates the farms.

Like the hens, the cows are kept in environmentally controlled sheds, in which their waste falls through slatted floors into underground tanks

and is drawn off to fertilize nearby fields – where fodder is grown to feed them. Free from the stress of varying temperatures, the animals give three times the milk of animals kept outdoors, and calve more easily too.

The fact that the fodder must be grown in sand does not bother the company at all as long as there is water, says Magee, adding that water on Masstock farms is provided by wells and sprayed over huge, disk-shaped fodder fields by long revolving arms – a measure instituted to prevent soil erosion.

Experts at Masstock, which also operates 600 farms in Europe, believe there is "great potential" in Saudi Arabia. They have backed up this belief by buying a 30 percent equity in four of the farms they operate, and by managing the other two on a profit-sharing basis. Their latest, and largest, venture is an 8,000-head dairy farm at Haradh, in partnership with the Saudi government. "We are totally committed," says Magee, "to the success of dairy farming in Saudi Arabia."

This attitude is warmly endorsed by the Saudi government which, according to Abdul Latif al-Ajaji, director general of the al-Hasa Irrigation and Drainage Authority, has had its fill of "no-risk" foreign farming firms that just want contracts to manage farms. "They expect the Saudi farmers or the government to put up all the money while they simply collect their management fee whether the project is a commercial success or not."

Al-Ajaji speaks from hard-won experience in the al-Hasa oasis. Years ago the government of Saudi Arabia invested large sums of money in an elaborate program to save the oasis and its farms from extinction. Dunes up to 20 feet high had already swallowed five of its 52 villages and were advancing at the rate of 30 yards a year until the government planted some four million hardy tamarisk trees on the dunes near the villages. The government also set about reclaiming oasis land – lost to farming by centuries of unscientific irrigation – and through its Saudi-staffed Irrigation and Drainage Authority made considerable progress.

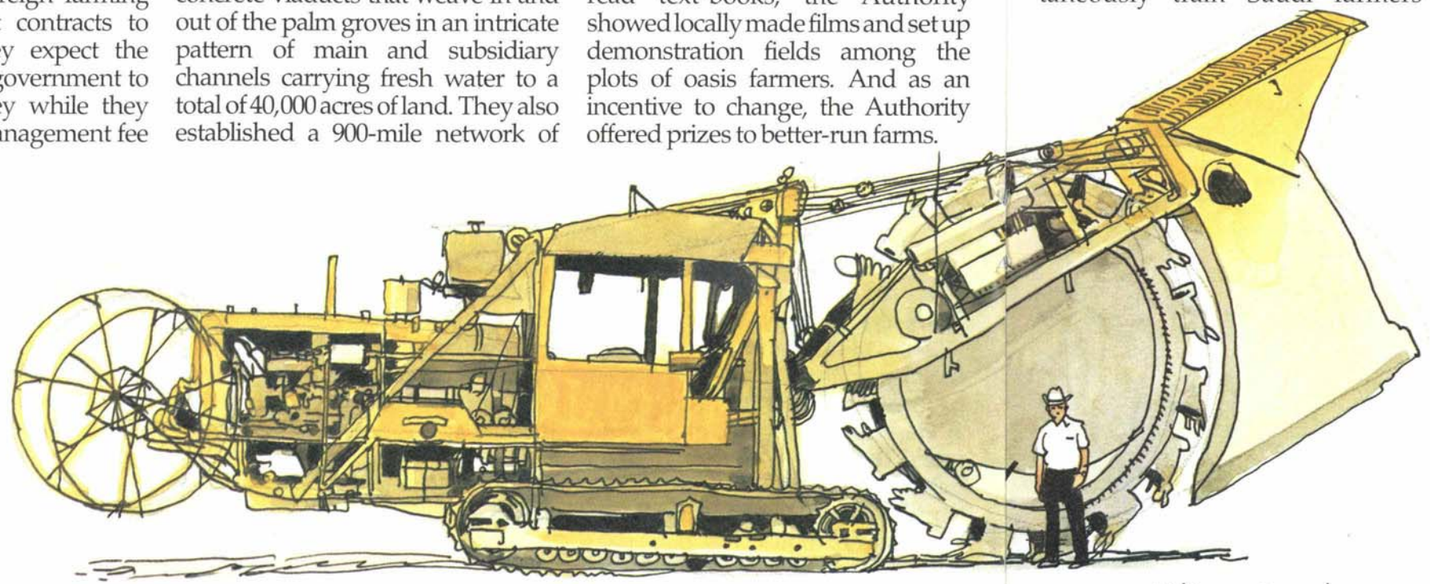
The reclamation problem, studies showed, stemmed from an irrigation system which distributed fossil water – believed to be 17,000 years old – from 60 springs through a network of ditches. Because of improper drainage, much of the water accumulated in saline swamps or evaporated, leaving a white, life-killing crust on the fields. Dying inwards from the edges, Saudi Arabia's largest oasis had shrunk to less than 15,000 acres of cultivated land.

To revitalize the oasis, irrigation specialists built a total of 820 miles of concrete viaducts that weave in and out of the palm groves in an intricate pattern of main and subsidiary channels carrying fresh water to a total of 40,000 acres of land. They also established a 900-mile network of drainage canals and constructed new roads to give farmers easy access to their fields.

As a result, the central section of the L-shaped oasis is today a vast garden that produces 30 kinds of crops, including vegetables and fruits, grown in cool corridors between towering date palm trunks. Around its reclaimed edges sturdy young palms have taken root and lush green alfalfa spreads out toward the protective swaths of tamarisk trees, with the corridor between the swaths earmarked for range land. More importantly, farmers once driven from the land by sand and salt are today moving back to it.

One key factor in the victory of al-Hasa was a readjustment by farmers and land-owners – not always willingly made – to new arrangements. Land-owners where the 35 springs surfaced, for example, once controlled the water supply, and were sometimes reluctant to accept today's system – which distributes water free according to each farmer's needs.

To help train farmers in new methods, the al-Hasa Irrigation and Drainage Authority adopted a subtle and simple approach. Instead of trying to persuade the farmers to read text-books, the Authority showed locally made films and set up demonstration fields among the plots of oasis farmers. And as an incentive to change, the Authority offered prizes to better-run farms.

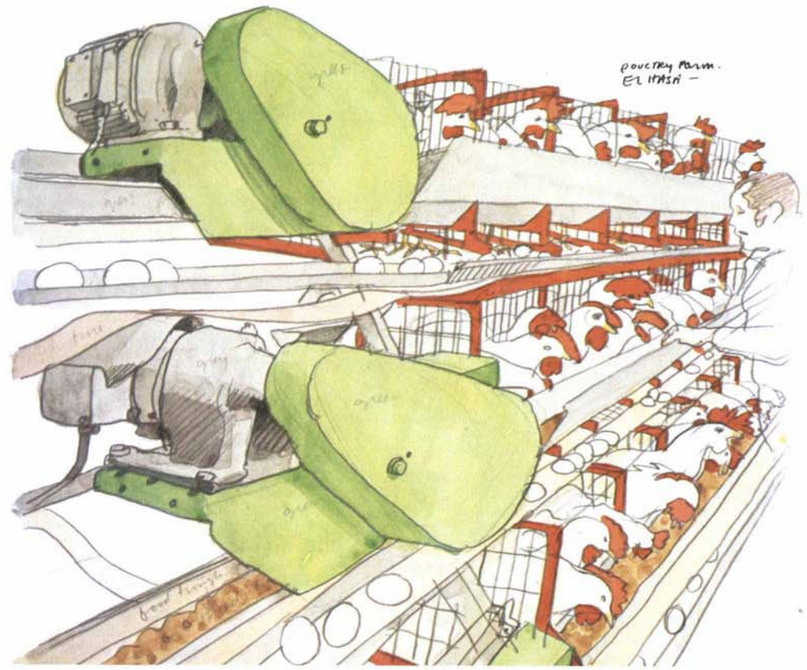


Bob Holthouse on Aramco farm in front of dragline used for levying tiles

Initially, the farmers' response was slow. "You cannot change overnight," says al-Ajaji, "the methods and mistakes of years." By 1978, nevertheless, the reclamation project was definitely making progress and the Authority had begun to open the new land to cultivation. Some of it, of course, will be given over to local farmers. But in conjunction with an effort to establish more productive farms, most of the new land will be farmed by foreign firms experienced in large-scale modern agriculture.

To attract such firms the Authority offers incentives like a free supply of water and the government-financed infrastructure. But the chief incentive is the demand for fresh produce in the oil-producing Eastern Province, where the kingdom's huge Five Year Development Program is expected to boost the population dramatically by 1980, when vast industrial complexes now under construction start operating.

To assist the government in its efforts to improve agriculture in the Eastern Province, Aramco has recently established a 300-acre mechanized demonstration farm on which it hopes to raise eight million pounds of fresh produce per year, supply part of the needs of Aramco and nearby communities, and simultaneously train Saudi farmers in mechanized techniques. And although, as late as January, 1978, the dusty, dead-looking earth of that farm looked far from promising, experts on the scene were brimming with confidence. "Come back in eight months' time," said one, "and there will be rows of lettuce growing here."



In Dhahran, Aramco has also introduced an agricultural system known as "hydroponics" – the cultivation of plants without soil. Instead of soil, the plants are grown in plastic tubes with running water in which plant food is dissolved. A pilot project, the hydroponics experiment is already producing crops; housed in three humidity-controlled greenhouses, crops of tomatoes and cucumbers have already been harvested eight and five weeks respectively after planting – with striking results. "I've never," said a Dhahran housewife, "tasted a better tomato."

Elsewhere in the Eastern Province – at Qatif, 13 miles northwest of Dhahran – Saudi Arabia's farming specialists solved another agricultural problem stemming from an *excess* of water. The second largest oasis in the Eastern Province, Qatif was adequately watered by free-flowing artesian wells, but because the flow of water was both continuous and uncontrolled, and because the drainage system was inadequate, the land had become waterlogged, salts had risen to the surface and many farms had become less productive or had been abandoned. In addition – as the availability of drilling rigs led farmers to drill still more wells – the artesian pressure had fallen and it was feared that the free-flowing water might eventually be exhausted.

As in the case of al-Hasa, it was the Saudi government that moved in to save Qatif, sealing off dozens of uncontrolled wells, installing a complete irrigation and drainage system and, eventually, reclaiming more than 10,000 acres of cultivatable land and assuring the economic future of the oasis.

Adequate water, of course, is the vital factor in all agriculture. But as rainfall in most areas of Saudi Arabia is scarce – and in some areas nonexistent – the problem is particularly acute. In al-Hasa and Qatif, for example, virtually all of the water comes from aquifers: geological strata of permeable rock and sand

CUCUMBERS - DHAHRAN

containing water, located between 300 and 1,400 feet below ground; and although the on-going search for water has recently located several huge "new" aquifers with vast amounts of water, Saudi Arabia's approach has been cautious because the expansion of agriculture depends almost entirely on these finite natural underground water resources, rather than on rainfall.

After an intensive study of the underground water resources, for example, the kingdom has recently drawn up a National Water Plan and a conservation program which reserves natural water supplies – from the aquifers – for farming and will meet domestic and industrial needs with man-made supplies, that is, by de-salting sea water. To achieve this goal the original appropriation for water in the Five Year Development Plan has been nearly doubled – to $19.3 billion, most of it allocated to increasing desalination capacity.

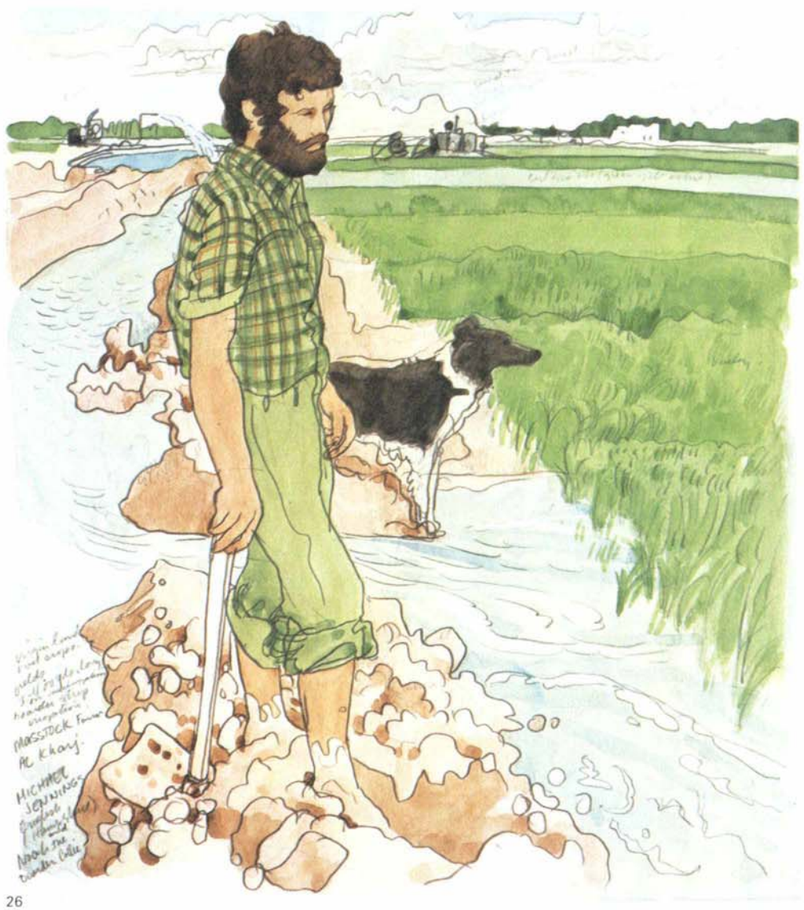
By comparison, the appropriation for agriculture itself is a modest $1.1 billion because, officials explain, there are fairly strict limitations on the amount of money this sector can absorb.

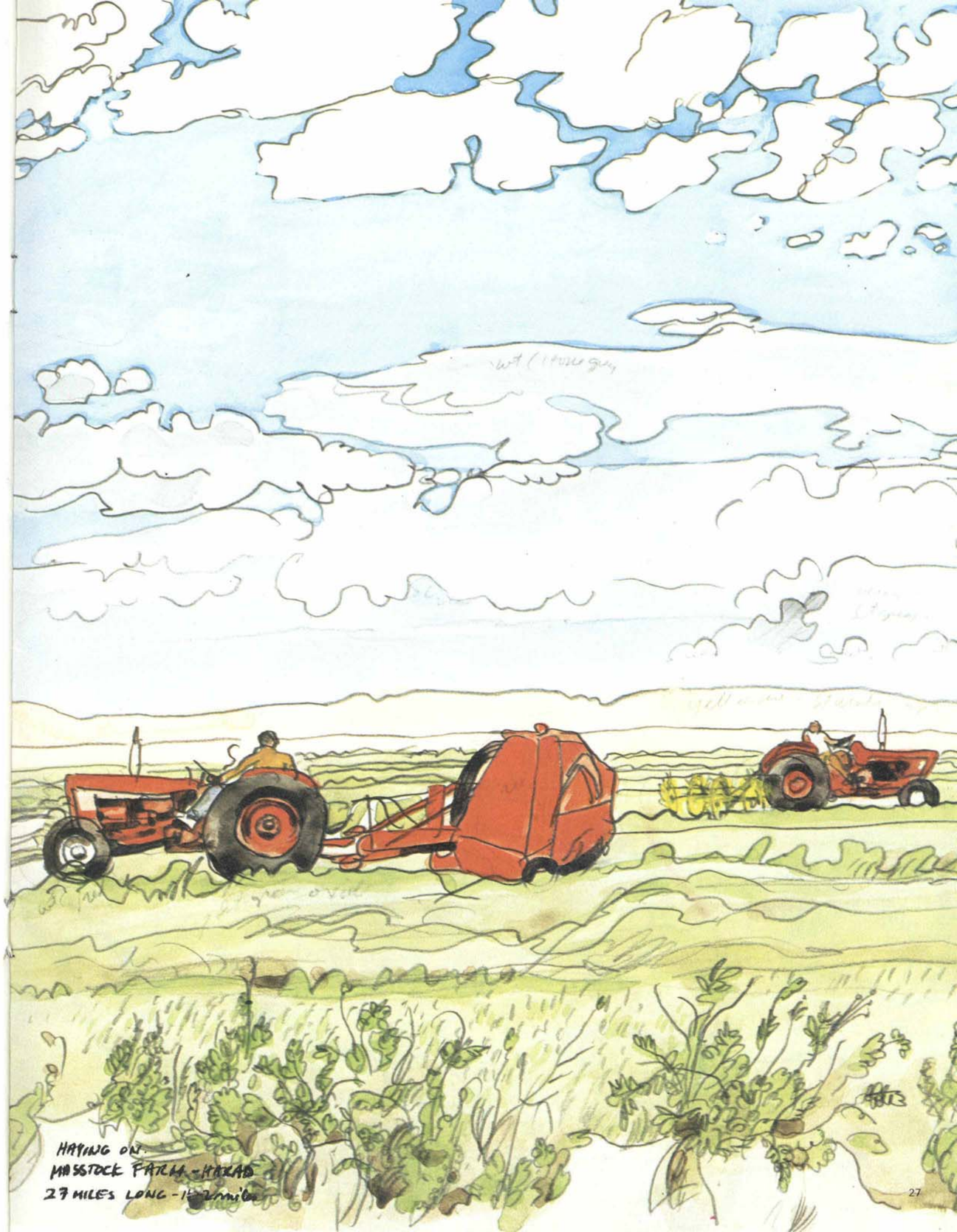
The single most important aspect of the program is the increase in irrigated areas from 288,000 acres to 448,000. As part of the effort to achieve this, numerous dams have been, or are being, constructed in all areas where there is rainfall and particularly in the mountainous Asir Province near the Red Sea coast.

In Asir, in the southern monsoon region, torrential rains have sent floods across the fertile coastal plain called Tihama for centuries. Several years ago, therefore, the government completed a major dam across the Wadi Jizan (see *Aramco World*, March-April 1974). A thousand feet long and 133 feet high, with a maximum storage capacity of 18 billion gallons, the Jizan Dam has helped block the seasonal torrents that once swept down the wadi, washing away topsoil, uprooting plants and seeds and even drowning livestock and destroying homes on the plain below. In addition the Jizan Dam also collects and stores the water for later use. As a result the Tihama plain may develop into the richest agricultural region in the kingdom, particularly when an interlocking series of irrigation and development projects is completed. With support on that scale the region's traditionally skilled farmers are expected to improve and increase their output of sorghum – a key food, and a source of animal fodder – and to expand their range of crops. Cotton, for example, is being grown experimentally, and there are plans to introduce such crops as corn and peanuts, as well as sugar cane and such exotic fruits as papaya and mango. Other plans call for the establishment of nurseries to grow eucalyptus and tamarisk trees – key weapons in the world's newly intensified struggle to halt advancing deserts.

At the opposite end of the kingdom the area surrounding the Great Nafud Desert is a vast steppe-land once eminently suited for grazing but, ravaged by droughts, now in an economic decline. About 37 percent of the area's population is nomadic, and, as elsewhere in the kingdom, special attention is being given to integrating these Bedouin tribes into the national economy.

As water is as fundamental to pastoral development as it is to agricultural expansion, the Saudi government is leaving no stone unturned to maximize utilization of its limited supplies. Studies, for example, are being carried out into possibilities of recycling city sewage water for agricultural use. For as Deputy-Minister of Water Abdullah Gholaykh observes: "We cannot afford to let a single drop of water go to waste." ■





SANDSTABILIZATION PROJECT - ITOFUF S.A.
MacDonald

Farming in the Arab East: a view from Rome

Despite their own problems with agricultural development, the Arab countries are also deeply involved in the world's efforts to help other countries feed themselves. In 1974 the Arab oil countries, along with other members of the Organization of Petroleum Exporting Countries (OPEC), proposed the establishment of an international fund to help finance food production in the world's most needy nations. More to the point, the Arabs, once the proposal was accepted, also contributed nearly one-quarter of the new fund's initial $1 billion in operating capital.

Established on December 13, 1977, as the 13th specialized agency of the United Nations, the International Fund for Agricultural Development (IFAD) was a milestone in the history of the world body. It confounded cynics who believed rich and poor nations could never bury their differences and join together in a unique, common endeavor – and it proved that countries can work together in a spirit of practical charity. As Abdelmuhsin al-Sudeary, the organization's first president, said, "IFAD is the clearest indication so far that the international community is moving towards a new world economic order based on the ideals and spirit of cooperation."

In a sense al-Sudeary himself provides an example of that spirit of cooperation. A Saudi Arab, al-Sudeary represents a country that could have been classified as a needy nation itself 20 years ago. Yet today it is in the forefront of the movement to head off world famine. Al-Sudeary, furthermore, is particularly qualified for the pivotal post he now holds. Although he refers to himself as simply a "farmer's son," al-Sudeary was trained in agronomy at Colorado State and Arizona Universities in the United States, held various posts in Saudi Arabia's Ministry of Agriculture and Water in Riyadh, and served as the kingdom's permanent representative to the United Nations Food and Agriculture Organization in Rome since 1972.

He was, therefore, a logical choice for chairman of the preparatory commission of IFAD in 1976 when the world discovered the "food crisis" and Saudi Arabia decided to put its financial muscle behind an attempt to avert it. Having demonstrated his effective leadership in successful conclusion of the important tasks entrusted to him, he was unanimously elected president of IFAD at the first meeting of the Fund's governing council in Rome.

Although a Saudi Arab, al-Sudeary does not identify IFAD's work specifically with the Arab East. From the presidency of IFAD, he says, Arab contributions to the world's food and farming problems must be regarded as international, not regional. Nevertheless, his interview with correspondent John Lawton was important. In broadening the perspective of this issue of *Aramco World*, it underlined the fact that Arab efforts to improve agriculture are not limited to themselves nor to their own countries.

– The Editors

Interviewer: How was IFAD formed?

Al-Sudeary: It was formed on the initiative of the OPEC countries during the World Food Conference in Rome in November, 1974, in the wake of an international food crisis. The initiative was endorsed by the developed nations and creation of the Fund was one of the major recommendations of the Conference. A preparatory commission worked three years to get the Fund operational and it was formally launched at a meeting of its 91 founder-members in December, 1977.

Interviewer: Why was the Fund established?

Al-Sudeary: The World Food Conference marked a new turn in thinking on the world food problem. The Conference recognized that the problems of food and nutrition were not just the result of occasional crop failures but reflected a deep-seated phenomenon with its roots in the whole issue of development and poverty. Unless the poorest segments of rural society have more employment opportunities and larger incomes, they will remain hungry and malnourished. This philosophy is clearly reflected in the objectives of IFAD.

Interviewer: What are those objectives?

Al-Sudeary: IFAD will concentrate simultaneously on increasing food production while reducing rural poverty and hunger in the poorest food-deficit countries and other developing nations. It will focus on the poorest nations and on the poorest sections of the rural population. The main aim of the Fund's operations will be to liberate the productive skills and energies of the rural people. Very often small farmers, given adequate support, can obtain levels of productivity similar to larger farmers. IFAD will also try to set a new and livelier pace in international lending operations.

Interviewer: What type of projects will IFAD finance?

Al-Sudeary: The Fund will especially welcome projects that have a strong food production orientation, foster the use of appropriate technologies, generate considerable employment and have a direct impact on the nutrition of the poorest. IFAD will concentrate on activities that are directed to solving the critical problems or constraints that impede rural development. Its main target groups for financial assistance will be the small and landless farmers. We expect to finance or co-finance a total of 15 projects in the poorest food-deficit countries and other developing nations during our first 12 months of operations.

Interviewer: How will IFAD's resources be made available?

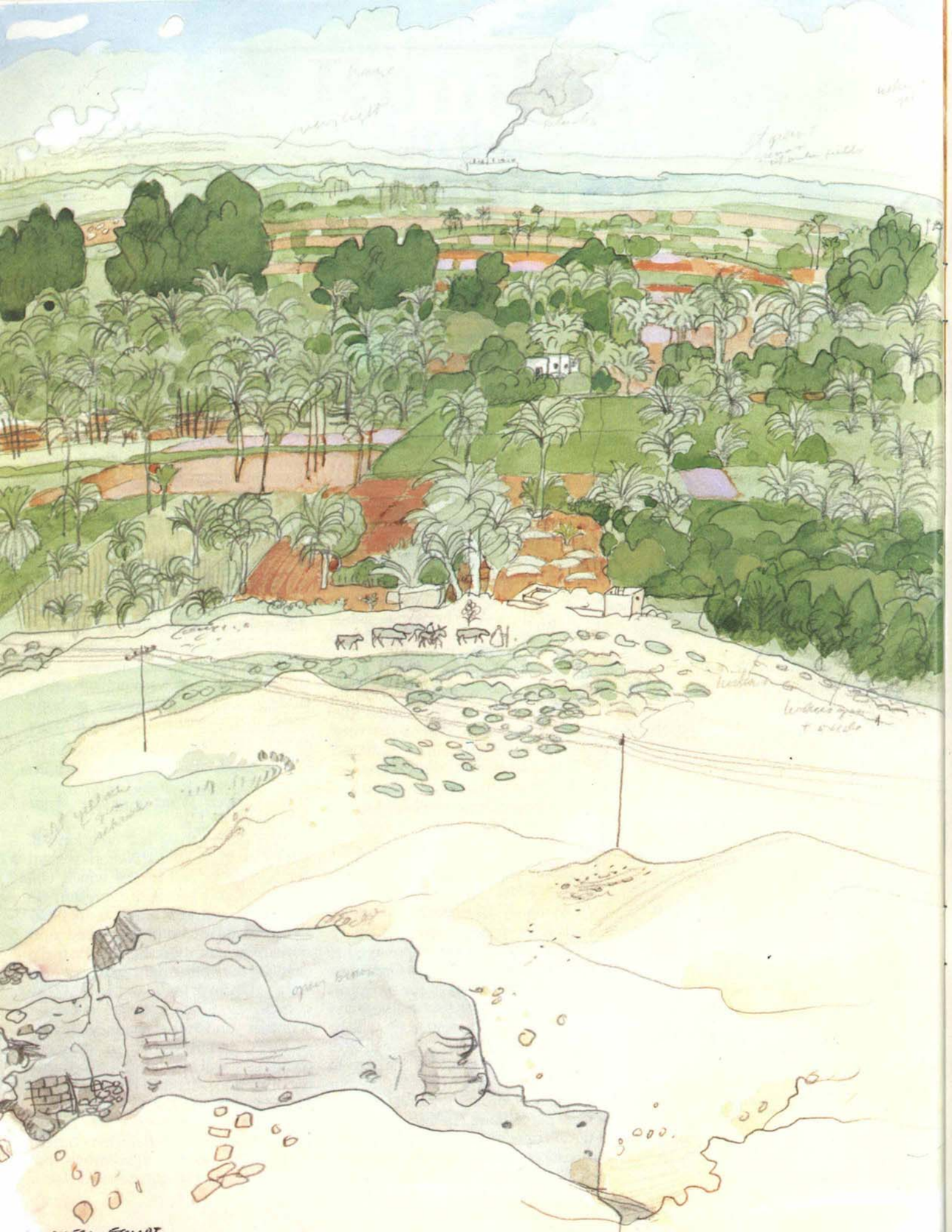
Al-Sudeary: IFAD is empowered to make both grants and loans. Grants are limited to 12.5 percent of the resources committed in any one financial year and the bulk of IFAD's resources will be made available in loans. These will be of three types: concessional, at one percent rate of interest, intermediate, at four percent, and ordinary loans at eight percent per annum. The largest number of IFAD's operations is likely to fall into the concessional category and the largest portion of the Fund's resources will be lent to the poorest developing countries.

Interviewer: How much does IFAD have at its disposal?

Al-Sudeary: The initial resources available to the Fund are slightly more than one billion dollars: $567.3 million contributed by developed countries, $435.5 million by OPEC countries and $19.3 million by developing countries. But the Fund is more than just a pool of money. Institutions, like people, tend to be products of their times. IFAD was born in the questioning seventies, and reflects a new approach to problems of food production and distribution. With its focus on the rural poor and its unprecedented governing structure, IFAD is the first institutional embodiment of the spirit of the new international economic order.

Interviewer: What is unique about IFAD?

Al-Sudeary: IFAD is a new kind of institution in the United Nations system and the governing bodies which will supervise its operations represent an innovative formula bringing together the interests of both developed and developing countries. In most financial agencies the voting rights are generally weighed in favor of donors. In IFAD the donors – i.e. OPEC and the developed countries – and the developing nations – i.e. OPEC and the developing recipient countries – will both have a two-thirds majority, since an equal block of voting power will be exercised by each of the three groups. Additionally the Fund's staff will not exceed 100, an experiment in the U.N. which might prove that bureaucracy can be conquered.



Farming by the Nile

Early in his presidency, Anwar Sadat of Egypt announced the start of an important battle. "I will start this invasion," he said, "God willing. I want this invasion… to be based on the strength, the capability and the ambition of the Egyptian individual."

President Sadat, however, was not discussing a military campaign. He was talking about Egypt's part in the world's battle against hunger and Egypt's own struggle to feed itself.

In a sense, it is a battle that is both tragic and ironic. For Egypt is one of the most agriculturally prolific places in the world and is by far the leading producer of food among Arab nations. Each year the valley of the Nile brings forth a cornucopia of cereals, fruit and vegetables, as well as cash crops such as cotton, perhaps the finest in the world. But despite 20 years of intensive effort to boost the total food supply, an increasing population is rapidly outpacing the country's ability to feed itself. Briefly put, there is too little green land, too many people and too much waste of the river's abundant water.

Hence Sadat's invasion: a leap out of the narrow, unchanged confines of the verdant Nile Valley into the surrounding desert in a concerted effort to establish new farms, produce more food and, by diverting people from the cities, relieve overcrowding.

This effort – which agronomists drily call "horizontal expansion" – is both bold and costly. It calls for young Egyptian pioneers to migrate from the banks of the Nile to a challenging environment in which they will wrest a living from the sand and make the desert bloom. It will cost billions of dollars and take at least 20 years to make an impact.

It is, moreover, only one part of Egypt's effort. In tandem with the conquest of the desert, the country is also launching a program that the technicians call "vertical expansion," the no less daunting task of making the existing green land produce even more. This will require more mechanization, a reduction of the farm animal population, the shifting of vast areas now given to fodder into more useful products, and proper drainage of large swatches of farmland now threatened with waterlogging. The investment needed for all this may well exceed a billion dollars, and the effort will take time. But Egypt, officials believe, must proceed simultaneously on both fronts – and quickly – if the country is ever to have a chance of providing enough food for itself, or at least reducing the cost of food imports to a more acceptable level than the present $1 billion a year.

The vital element in both programs, of course, will be the Nile, that tranquil flow of life without which Egypt would not be possible. It is still Egypt's only sizeable source of fresh water, just as it was millennia ago when it gave rise to one of the first organized civilizations in history.

In ancient times, the Nile, a great brown river of potable water pouring through the desert, naturally drew people to its banks. But in addition the Nile, gorged with floodwaters from Central Africa, brought an annual bounty of rich black silt before subsiding to its natural size. At first, historians theorize, the scattered tribes living near the Nile withdrew to the desert highlands when the flood came and returned to gather food when the water receded. But then, as populations grew, it became important to make maximum use of the Nile and from this grew the need for organization, which in turn led to the establishment of a centrally-directed state. It is not an oversimplification to say that the Nile created ancient Egypt.

This, specifically, applies to food. In taking control of irrigation and storage of the flood waters – by devising a network of ditches and catch basins –

the central government in effect guaranteed abundant supplies of food. In a good year, there was so much grain in Egypt that it could be exported and the lush verdure could support livestock – goats, sheep, pigs and cattle – which in turn gave the Egyptians a constant source of protein and animal power to utilize farm implements. In addition they were able to grow flax, sesame, castor-oil, plants emmer and grapes, harvest the plentiful date palm groves and, from the papyrus plant, make an early form of paper, which expanded trade because of easier record-keeping.

There were, moreover, cultural offshoots from the Nile as well. Once the government stepped into farming and irrigation it also began to impose taxes; they were levied on land which was flooded every year, which was flooded only occasionally or which was permanently out of reach of the water. The Nile also encouraged the development of geometry, since the boundaries of the land had to be redrawn after every flood, and even determined Egyptian seasons: from about June to September was "inundation," October to February was "emergence of the fields from the water," followed by "drought," March to June.

In many ways the Nile Valley today is still unchanged since those ancient times. It is still the same daub of green in the desolation of the surrounding sand, a daub extending some 750 miles from the town of Aswan, near the Sudanese border, to the Mediterranean. From Aswan to Cairo, the valley cuts through rocky highlands and is only nine miles across at its widest point. North of Cairo, the Nile branches into a V, forming a flat, green and crowded delta. Altogether, there are six million acres of cultivated land, an area virtually unchanged since the turn of this century, making up only 3.5 percent of Egypt's total area of 385,200 square miles. The rest is sand.

There are now about 25,000 tractors in use in Egypt, but the bulk of agricultural work is still done by hand, using implements virtually identical to those exhibited behind glass cases in the Egyptian Museum. Mechanical water pumps now assist irrigation, but farmers turning water screws by hand and draft animals powering water wheels are still a common sight in Egypt.

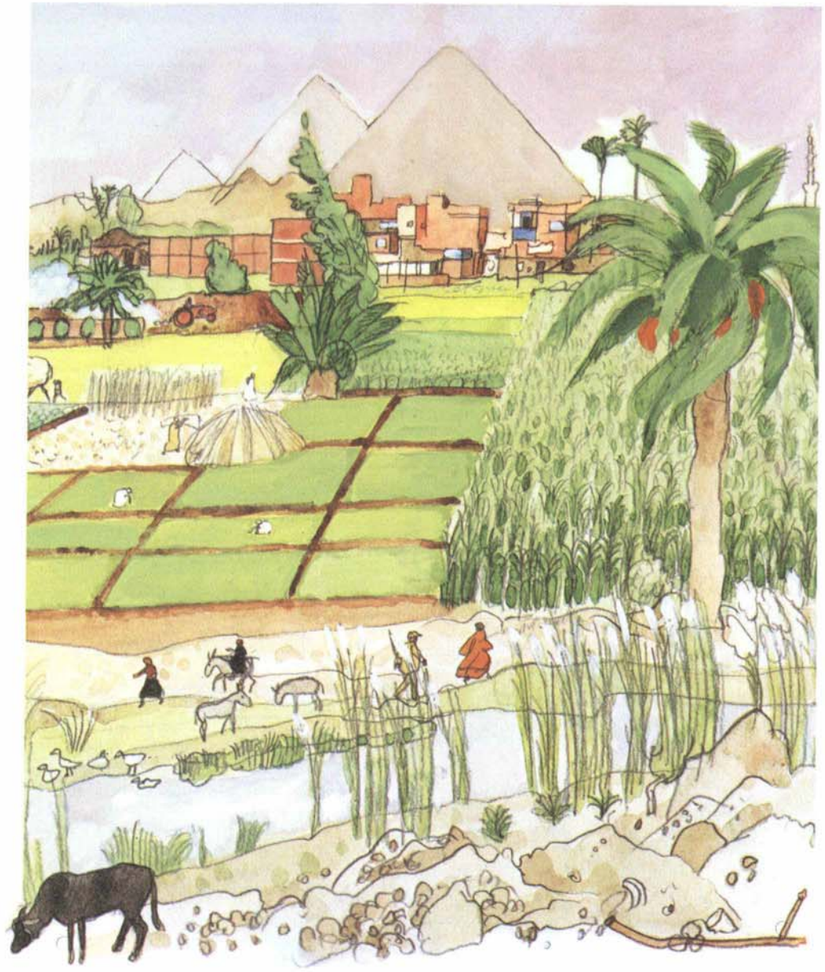
There have been changes, however. The most noticeable is the disappearance of the annual flood – controlled by the Aswan High Dam since 1965 – and the old system of collecting floodwaters in basins for irrigation; replacing the basins is a network of ditches and canals that provide perennial irrigation and three consecutive cropping seasons per year. Planting and harvesting still take place, however, in the same periods observed by the ancients.

But perhaps the most telling change is simply people. In 1907, Egypt's population was 11 million, and arable land was six million acres. The same six million green acres must now support a population that, despite government efforts at control, is now almost 40 million. As a result, the farmland-to-man ratio has shrunk from half an acre per man at the turn of the century to only one sixth of an acre today. By comparison, there are five acres per capita in the United States. "We cannot cope with the increasing population here in Egypt. We have to go into the deserts," says Dr. Rifky Anwar, Vice-Chairman of the Agriculture Development Organization in the Egyptian Ministry of Agriculture. "This is something that we have to do because of the impact of the population. We have to grow crops for the future generations." The urgency of the problem can be seen in studies which predict a population of 60 to 70 million people by the year 2000 – when, if everything goes on schedule, the reclaimed desert areas may just be starting to produce fully.

The record of land reclamation in Egypt is, at best, spotty. Starting in 1954, the government began reclaiming marginal desert land at the western edge of the delta. With the availability of year-round water from the High Dam, the pace of development picked up in the 1960s, but new reclamation starts came to a dead stop in 1967 because of the war with Israel. "Since 1954, about one million acres have been reclaimed," says Dr. Anwar. "Most are now under cultivation, except some areas with problems." Egyptian officials admit many mistakes were made in the reclamation projects to date, such as insufficient provision of drainage, but insist the effort was worth it. Others say only about 50 percent of this land is under full cultivation, with the rest ranging from still-barren to almost fully productive. Hassan Aly el Tobgy, the Ford Foundation's regional agricultural adviser in the Middle East, says in his book *Contemporary Egyptian Agriculture* that the reclamation schemes to date have had "an almost negligible share in total agricultural production or gross domestic product."

At any rate, Dr. Anwar says, the government has spent a total of $923 million since 1954 on land reclamation outside the Nile valley, on formerly sandy soil which now produces sugar cane, cotton, rice, corn, alfalfa, vegetables and citrus fruit. Estimates of the people attracted out of the valley to the new land range as high as 500,000.

One highly-visible example of reclamation exists just southwest of Alexandria. Bisected by the desert highway from Cairo, that area, in 1962, was desert on both sides of the road all the way to the coast. Now, for the last 30 miles, it is rich with crops of sugar cane, and stands of tall pine trees – planted as windbreaks. There are also irrigation canals and tidy villages with names like "Palestine" and "Algeria." Where once there were only nomads with camels, thousands of Egyptian peasants now have extended the imprint of civilization westward out of the valley, if only for a relatively short distance.



Some of the reclaimed land is managed by a number of state-owned organizations, especially where yields are low and the land still has not reached the break-even point. "There has been no complete failure whatsoever," says Dr. Anwar. "The Egyptians are very persistent; but there are different kinds of success. Some lands are only 50 or 20 per cent successful in terms of cultivation and yield. But we never abandon a project."

Despite all this effort, however, it is clear that the old six million acres are still basic to Egyptian farming. They produce an amazing variety of crops – cotton, rice, corn, wheat, sugarcane, tomatoes, sesame, onions, potatoes, clover, grapes, cucumbers, oranges, watermelons and such lesser-known products as fenugreek, chickpeas and lentils. In addition, this land sustains some nine million cows, *gamoosas* (buffalo), sheep, goats, camels, horses, mules and donkeys.

Perennial irrigation, furthermore, now permits three crops a year, and sometimes more where certain crops can be interspersed. Experts say there have been impressive developments in the use of high-yield seeds and fertilizer, in pest control and in marketing. As a result of these changes, productivity – the amount produced per acre – is among the world's highest, according to available statistics. Production of wheat in the 1970-74 period, for instance, averaged 1.26 tons per acre in Egypt, compared to 0.78 tons in North America and a worldwide average of 0.64 tons. Rice, the other major food crop grown here, averaged 2.11 tons per acre compared to 2.03 tons in North America and 0.93 tons worldwide.

Cotton, Egypt's main cash crop, also showed high productivity – 0.3 tons per acre in Egypt, compared to 0.24 tons per acre in North America and 0.14 tons worldwide. The comparison is about the same for most of the other products grown in Egypt, according to figures from the Food and Agricultural Organization and the Egyptian Ministry of Agriculture.

Agriculture is the most important sector of the economy here," says Dr. Mohammed Kamel Hindy, Director of the Agricultural Economic Research Institute in Cairo. Net agricultural production – gross production minus the value of imports – was $1.988 billion in 1977. "This represents about 32 percent of Egypt's national income, compared to 20 percent for industry," Dr. Hindy says. But nevertheless, because there are so many mouths to feed, it is not enough.

Egypt now imports about $1 billion worth of food a year, including about 3.5 million tons of wheat in 1977, plus various kinds of edible oils. "Egypt is short of fats in general," says Dr. Hindy, adding that two thirds of the 300,000 tons of cottonseed oil consumed in Egypt comes from abroad. Exports, also, are affected by growing home consumption. "Last year Egypt exported about 230,000 tons of white rice, but this year I doubt that it will be more than 170,000 to 180,000 tons, because production levels remain the same but consumption is higher," Dr. Hindy says.

Cotton, for which Egypt has long been famous, generates income with which to pay for some of the imports. "It provides cash for the farmer and is

WATER WHEELS FAYOUM OASIS
EGYPT

the base for the major types of industry we have," says Dr. Hindy. About 1.2 million acres are planted with cotton, with a total production of about 450,000 tons last year. About 75 percent – the coarser varieties – is consumed domestically and the "extra long staple" is exported for cash. It is estimated here that cotton exports in 1977 brought in some $200 million, but the income is expected to go down about 20 percent in 1978 because of a depression in world prices.

Sadat has said Egypt will be "self-sufficient" by 1980, except for the import of wheat, which is expected to continue for the foreseeable future. At face value, this was taken to mean that Egypt will grow everything it needs except for wheat, but the experts say this is not so. "The President meant to put it simply for the public, but what he really means is that we are trying to maximize our resources," Dr. Hindy says. "The aim is to produce the maximum for local consumption and at the same time to export as well. Real self-sufficiency, for instance, would probably require that most of the cotton acreage be turned over to wheat or other edibles. This would cost more than importing wheat, when the loss of cash from cotton exports is taken into account. Self-sufficiency was a principle developed many, many years ago when there were barriers in trade."

"Besides," says Agriculture Ministry Undersecretary Hassan Abdullah, "we are dealing with plants, animals and human beings, and they don't always stick to official timetables."

For "vertical expansion" to give all it can, some present problems will have to be tackled forthwith. One is waterlogging – in some areas of Egypt if you stick your finger into the ground water seeps out – which is bad for most crops except rice. Because the Nile is so big and seemingly everlasting, water is often wasted in the Egyptian countryside. "The efficiency of the irrigation system in Egypt is not more than 55 percent, which means that there is 45 percent wastage through evaporation and leakage," says Irrigation Minister Abdul Azim Abul Atta.

Farmers tend to water their fields by opening irrigation sluices and letting the water flow in, some 8,000 tons per acre yearly. This produces the waste mentioned by the Minister, and also the waterlogging which is cutting back production. Almost 20 percent of the areas presently under cultivation have been virtually ruined by waterlogging and the attendant increase in the salt level of the soil, el Tobgy estimates. This proportion may reach 60 percent unless measures are taken. A vast program is now underway to install underground drain pipes to lead off the surplus water. A $96 million project has begun to install drainage systems in 892,000 acres of existing farmland, and Egyptian officials hope to obtain another $350 million loan to drain an additional million acres. Agronomists estimate that efficient drainage of these areas could raise their yields by as much as 40 percent. The U.S. Agency for International Development has provided $31 million to build factories producing 10,000 miles of plastic drainage pipes a year, but the needs are three times as high.

Mechanization, of course, would also increase production, but it has its limits in Egypt. To start with, land reform instituted in the 1950s reduced many farms to plots of only five acres, an inefficient size. In addition, families live on or near their land and efficient mechanization would require a more rational distribution of people. Perhaps more importantly, experts say, increased mechanization could result in high unemployment in the labor-intensive agricultural sector here. On the other hand, mechanization would reduce the need for draft animals, and a portion of the 2.8 million acres planted with fodder at various times of the year could be turned over to producing

Farming by the Nile The Sudan

The Sudan, Africa's largest country, is classified by the United Nations as among the 15 least developed countries in the world and in the mid 1970's was on the verge of bankruptcy more than once. But in terms of potential it has always been one of the most promising regions on earth. As C. L. Sulzberger wrote recently, the chemical balance of the Sudan's soil is so rich that "nourished by sufficient water, it could become the greatest agricultural region known." And soon that promise may be realized. With financing from Arab states, plus agricultural planning and expertise from western sources, the Sudan in the 1980s could be the breadbasket of the Arab world.

At present, a meager 15 million acres in the Sudan are under cultivation – a fraction of the country's estimated 80 million-acre potential. Furthermore, because of inadequate road and rail transport, most agriculture is fragmented and the isolated farmers resist the mechanized approach necessary to modern agricultural production. Recently, however, the Arab oil countries have begun to invest what eventually will total billions of dollars, and western companies have begun to supply farming know-how and management in hopes of raising agricultural production by 80 percent in 10 years. If those moves bear fruit, the Sudan, by 1985, will be providing 42 percent of the Arab world's total vegetable oil consumption, 58 percent of its meat and 20 percent of its sugar needs – altogether a 300 percent boost in agricultural exports. In 1980, in fact, production of sugar will probably reach 1.2 million tons, of which the Sudan could export 775,000 tons. By comparison, current production is about 200,000 tons and domestic consumption about 350,000 tons.

The Sudan measures about one million square miles, nearly one third the size of the United States. It has a small population – some 17 million inhabitants – a fine climate and adequate rainfall. More importantly, the Sudan is watered by not one but two Niles: the Blue Nile, bringing floodwaters from Ethiopia, and the White Nile rising in Lake Victoria. North of where the two rivers meet at Khartoum, the country is mostly flat desert, but south of the capital stretch hundreds of miles of open savanna and, further south, areas of lush semi-tropical jungle and forest; altogether, studies show, these areas offer some 80 million acres of potential cultivable land plus another 120 million acres suitable for pasture.

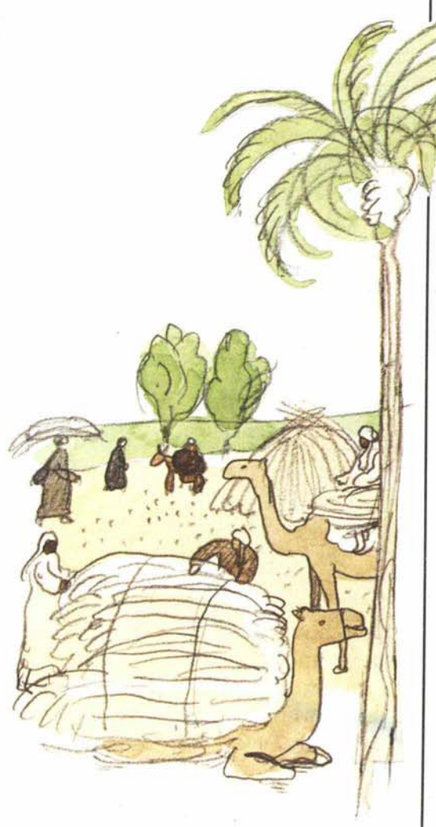
To tap these potential riches the Arab countries have begun to funnel money into two programs, one a massive long range program, the other a 10-year program that will require an investment of $6.5 billion. Drawn up by the Kuwait-based Arab Fund for Social and Economic Development, the programs will be carried out by the new Arab Authority for Development and Agricultural Investment with further funding coming directly from other Arab funds and private investors. Saudi Arabia's Saudi Development Fund, for example, has already participated in important projects affecting cotton and cereals and private Saudi capital has been invested in efforts to produce cotton, sorghum and groundnuts. Recently one private investment group, led by a prominent Saudi investor, was reported to be putting $50 million into a huge farm complex south of Khartoum on which, it is said, a British management firm will plant 6,000 acres in sorghum, sesame and cotton and allocate 28,000 acres of pastureland to sheep and cattle, all for export. Other funds will be invested in the all-important infra-structure – roads, ports, power and storage – without which the farm programs would undoubtedly falter.

Some projects have already started or are about to be launched. One is establishment of a $93 million 1.2 million-acre cattle ranch on which ranchers would raise 68,000 head of cattle and 18,000 sheep. The value of the project would not be only to increase the available livestock; the Sudan already has 40 million head of cattle, goats, sheep and camels. Rather, it would permit their breeding in an organized way to provide animals suitable for export. Another is the $240 million irrigation project at Rahad which will boost the output of cotton and peanuts, two important cash crops. With 50,000 acres under cultivation already, 150,000 acres scheduled for cultivation this year and settlement of new families moving rapidly the project is already considered a success.

Although water is plentiful in the Sudan, still more will be needed in the years ahead, and one source may be the "Sudd," a great swamp covering an area the size of Florida. Historically mysterious, plague-ridden and almost impenetrable, the Sudd has hampered navigation, diverted water and ruined cultivated land from the beginning of time. Because the swamp is lower than the river, the White Nile spreads out as it flows through the Sudd, and the overflow, each year, floods potentially usable land – and about half the total overflow is lost to evaporation, seepage and stagnation. Sudanese officials estimate that about $3.6 billion worth of water is lost every year in the Sudd.

One key to the project of tapping the Sudd is known as the Jonglei Canal. By deepening some existing channels through the Sudd and opening a new 173-mile canal, planners hope to rechannel the overflow back into the Nile for use on farms in both the Sudan and Egypt. According to one estimate, some 14 billion cubic feet of water a year could be recovered when the Jonglei Canal is finished in 1981. Whether planners can meet that deadline is still uncertain, but digging was scheduled to start in May when an enormous excavation scoop was to be sent into action; under construction for a year, that scoop, eight storeys high will reportedly move 9,000 tons of earth per hour.

Bold in scope, the canal, 170 feet wide and 12 feet deep, will cost $250 million. But it will also permit development of about 700,000 acres of land and in addition have a significant impact on all farming by the Nile.



food for humans, or cotton, full time. Each decision, therefore, has to encompass a wide variety of factors.

Farm experts say that horizontal and vertical expansion should proceed together, but it is clear that the current focus of government action is on the "invasion" of the desert – primarily because migration would ease the high population density in the Nile Valley. But as the government is short of money, it is trying to achieve this by inviting foreign businesses, mostly American, to enter joint ventures with Egypt. Vast areas of semi-desert land between the delta and the Suez Canal are capable of reclamation, officials say, and planners envision vast agribusiness concerns producing citrus for export, poultry for home consumption, and even fish. Some foreign concerns have already responded. East of the delta, for example, Egypt has set aside 15,000 acres for one American company which plans to establish what is expected to be the largest citrus plantation in the world – with some of the output allocated for canned fruit juice and virtually all of it for export in one form or another. Other American firms said to be looking into investment possibilities are American Maize, Continental Grain and Conagra. The projects in various stages of discussion are cornstarch and sweeteners production, broiler production, soybean processing and vegetable oil refining. A number of European firms are already operating pilot projects for cattle breeding and mass production of broilers.

Still, the actual reclamation of land from the desert remains a formidable undertaking. About 2.8 million acres have been identified as being worth reclamation and settling. It will be a lengthy and expensive process, requiring, from the pioneers, patience and perseverance, and from the government, money.

Reclamation takes from two to ten years, depending on the kind of soil involved, and even at the end of that period the output of the land may not have reached its maximum. "It would take about 10 years for the land to reach break-even point," says Dr. Anwar. "The current cost per acre averages $2,120, depending on the kind of soil, including site selection, water drains, levelling, roads, electricity, buildings, livestock and so on." Reclaiming the total 2.8 million acres, even at today's prices, thus would require about $6 billion over the next 20 years – not an impossible sum to raise if the initial results are encouraging.

"We feel that if the population continues growing like this, all our people will be hungry," says Mohammed Maisara, an engineer involved in land reclamation. "We have to go as far as possible." Sadat sees the reclamation program as starting with land and water, with the government establishing community centers to provide medical care, fertilizers, equipment and financial credit. This would attract the pioneers, mostly agricultural engineers and assistant engineers, to get the projects started. Eventually, it is hoped, people in sizeable numbers will move away from the Nile Valley, but no information is available on the size of the hoped-for migration, or what crops will be grown in the desert.

The government this year will launch the first reclamation projects since 1967. This will entail starting work on 321,000 acres, at a cost in 1978 alone of $178.65 million. Maisara says full production could be reached in two to eight years, depending on local conditions. Significantly, the five government-owned land reclamation companies that did most of the work in the past will handle only 44,500 acres. This is deliberately meant to lessen the government's outlay and get people to put a financial stake in the projects, thus increasing the likelihood of faster completion. Almost 90 percent of the total outlay expected in 1978 will come from the private sector, Maisara said.

The U.S. Department of Agriculture has produced recommendations for the AID program in Egypt that, among other things, urge that U.S. funds be committed to the Egyptian land reclamation efforts. None of the present AID projects involve actual investments, and there is understood to be a preference for vertical expansion among AID officials. But as Egypt "will charge into the desert anyway," says a U.S. Department of Agriculture official, "we should not hesitate to help them with what expertise we can offer."

Over the long run, the various programs to improve agricultural output will be connected with several large-scale schemes. One involves piping fresh water *under* the Suez Canal into the Sinai desert for the first time in history. Another entails building a 14-mile canal from the side of Lake Nasser – the largest man-made body of water in the world, located behind the High Dam – to a depression in the western desert where some reclamation schemes are already underway. The canal would siphon off surplus water from Lake Nasser and at the same time provide irrigation for lands to be reclaimed. In addition geologists, using satellite surveys and other methods, have located a vast layer of water-bearing sandstone beneath the western desert which, an official report says, could provide 181 billion gallons of water a year if efficiently tapped. This could produce the on-the-spot irrigation needed to turn certain areas of suitable lowland desert into model farms.

"Why should we not emerge from this narrow valley to new horizons in the lands where there is space and water?" asked Sadat. "We would be serving two goals: creating new communities to avert the population explosion in the narrow valley and, since these communities would be based on production, in fact realizing prosperity for this country." ■