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EXPERIENCES USING FERTILIZERS IN RESOURCE DEVELOPMENT

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EXPERIENCES USING FERTILIZERS IN RESOURCE DEVELOPMENT[1]

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Traditionally in the United States, and I suppose in most other developed countries, we look upon fertilizers as a low-cost way to increase output per acre of land and give the farmer a high economic return for his labor and capital investment.

But there is another gain, that of development and conservation of a nation's resources -land, water, and human. It is to this end that I would like to speak today. I would like to speak in the context of the experiences of the Tennessee Valley Authority which, over the past 35 years, has used fertilizer as one of its major tools in total resource development of the 40,000-square-mile Tennessee Valley.

Basically, fertilizer -if used wisely with other good practices -is a key resource development tool for the following reasons:

* It makes land more productive. The fertility of the soil can be increased and maintained regardless of how intensively it is used or how badly it was abused in the past.

* Through increasing protective plant cover, fertilizer permits reduction in soil erosion which not only conserves the land but in turn decreases siltation of reservoirs, lakes, and streams.

* By providing more cover, root growth, and plant residues, it increases water infiltration into the soil; allows more moisture for plant growth but also reduces peak runoff, thus having value in flood control; and increases the hydropower capacity of rivers and streams.

* It permits more efficient use of soil moisture by crops.

* Fertilizer makes for more efficient use of land. Fewer acres are required for crops. Better use is made of level land. The hillsides can be devoted to forage and forest.

* As a result of higher yields and better use of land and water, farm incomes are improved. The general economy benefits and capital is generated for investment in the farm, in agri-business, and in the nonagricultural sectors of a nation.

* Greater capital permits investment in labor-saving devices-- electrified operations, tractors and other heavy equipment--thus releasing farm manpower from the drudgery of manual labor and permitting their employment in higher skills at higher pay.

* And finally, fertilizer is the great technological backlog of national security for the production of food. And among the developing nations it, along with improved crop varieties, is the greatest single hope that the hunger and starvation from overpopulation may be avoided in this century.

All these benefits have been witnessed in the Tennessee Valley during the period since 1933 when TVA dusted off the cobwebs at the old Muscle Shoals nitrate plant and converted it into a fertilizer research center serving the entire Nation. However, TVA's experience emphasizes that we cannot look to fertilizer as a simple cure-all for resource problems, or one that can be applied solely by itself. Agronomists know that we don't get much response from fertilizer unless it is used along with good crop varieties, and control of pests and diseases. The same principle applies to use of fertilizers in total resource development, but in much broader perspective. Total resource development comes only with the concurrent development of all the resources--natural, man-built, and human alike. It involves such things as the development of industries, services, and marketing and processing facilities; the control and the improvement of water resources; improvements in transportation, health, and education; and development of electric energy, forests, and mineral resources--to mention only a few.

But fertilizer does have its place--an important one. It is a basic building block, and without it the whole framework would crumble. Further, fertilizer not only is compatible with all of the other building blocks, but also frequently makes them more effective.

Now, let me turn to some of TVA's firsthand experiences in using fertilizer as a resource development tool.

By the early 1930's, the Tennessee Valley had become one of the gall spots of the Nation.

[1] For presentation at the Fourth FAO Conference on Soil Fertility and Fertilizer Use in Latin America at Bogota, Colombia, November 18-22, 1968.

Productivity of the soils was gone as a result of continuous cropping. Most soils were acid and extremely deficient in phosphorus. In order to stay alive, farmers had only one choice--keep farming the same land in the same way. This they did by planting row crops year after year--corn, cotton, and tobacco--often on steep lands. Erosion was rampant, runoff unchecked. Top soil had disappeared; gullies were everywhere. When a field got too bad to farm, it was abandoned and cropping was further intensified on another field, usually on steeper land. And the cycle worsened. Each succeeding year brought greater impoverishment. Per capita income was among the lowest in the Nation.

No one was starving, but much of the rural population was suffering from malnutrition. Health was a problem, 30 percent of the population was weakened from recurring attacks of malaria. Damaging floods occurred practically every year. There was almost no industry, income for the region was almost totally dependent on the failing agriculture. Education levels were among the poorest in the Nation; and there was little tax money to support schools, or for that matter, libraries, hospitals, or other public services. There was little electric energy, and this only at exhorbitant prices.

Obviously, one of the first things to be done was to improve the land--restore its fertility, reduce erosion and runoff. Fertilizer--mainly phosphates--was the primary instrument for accomplishing this goal. Phosphate was extremely deficient in most of the Valley soils. The scheme worked this way: Apply phosphate and lime to the impoverished soils so that grasses and legumes would grow. This would provide cover the year around, checking erosion. Farmers could shift into a livestock economy on steep lands and plant row crops only on level lands. Crop rotations could be followed, and nitrogen fixed by the legumes could be used by the row crops. All of this was expected to have marked influence in decreasing flooding and siltation and improve not only the lot of the farmer but help all of the communities and people in the Valley.

The method used to accomplish this vast rural face lifting was to involve as many farmers as quickly as possible. The state extension services provided the guidance and technical assistance. Thousands of farmers were selected to demonstrate these revolutionary new practices to their neighbors. In the early years, they were given phosphate free to encourage them to participate.

The outcome was amazing. In a relatively few years, erosion in the Valley was largely under control, row crop acreages declined, crop yields increased, sales of livestock doubled and then redoubled, and farm incomes and family living standards climbed. One of the most surprising things was the effect on the farm people. They became more self-reliant and began to move ahead. Many of the early demonstrators eventually rose into positions of Valley leadership--one or two even became governors of states.

While the hub about which this chain reaction started was fertilizer, the lot of the farmer and his city neighbor would not have improved greatly without the companion programs which brought additional tools to use along with improved fertilizers. The harnessing of the Tennessee River and its tributaries brought low-cost electricity. As power lines were extended down the country roads, the immense labor-saving productivity of electric power became available. The navigable waterway became a commercial artery bringing low-cost feed from the midwest granaries to an area which could not produce enough to satisfy its own growing livestock economy. This source of low-cost feed became the mainstay of a new farm industry, the production of poultry, which has become the largest in the Nation. Forest nurseries helped farmers restock their woodlots; management demonstrations showed how to sustain them to produce steady income. Even flood control, once thought of mainly as a means of preventing damages, took on new importance by safeguarding the sites along the waterway where industries could build and provide new jobs for the men and women leaving farms for more profitable employment.

And it is interesting to recall that the test-demonstration program which was begun as an educational effort to encourage better uses of fertilizers evolved into a program encompassing the use of all these tools. Farmers and their wives were encouraged to look upon their farm enterprise as a whole--to discover the ways they could use electricity as a substitute for manpower, and to provide refrigeration. The higher incomes from fertilizer widened the horizons of farm living, lightening the household chores, improving the family diet, and brightening the day and night with the radio and later television. Even self-education became possible with the shorter, less demanding day, and the reading made possible by the passing of the coal oil lamp.

Farmers and agricultural areas in the United States no longer are in such a severe plight as faced the Tennessee Valley in the 1930's. Greatly expanded use of fertilizer over the country and in the Valley has removed soil fertility as a severely limiting factor, and improved technology has reached even the poorest farmers to some extent. We still have many rural-based problems, but these have changed.

I would suspect, however, that these early lessons with fertilizer in the Tennessee Valley do have application in many of the lesser developed countries of the world. In fact, the outcome today should be even more dramatic from the crop production standpoint since we now have greatly improved fertilizers; new high-yielding, fertilizer-responsive crop varieties; and vastly improved pesticides.

TVA and its land-grant university cooperators have continued to use fertilizers as a resource

development tool. However, the concept has changed somewhat with changing times and situations. Our major concern now is in making the Valley farms more profitable and more competitive with other agricultural regions of the Nation and in adding to the overall economy of the Valley and the Nation. Despite great progress during the earlier years in the Valley farming sector, we still find thousands of small farms with low incomes.

Any improvement that can be brought about in the agricultural sector starts a chain reaction that multiplies to benefit the total resources and economy. A dollar from any source turns over several times in a community. New services are added--restaurants, gas stations, stores, and the like. Schools and hopsitals benefit. Fewer people are on welfare, and fewer people leave the area to further congest cities that already are overcrowded, thereby adding to their personal misery and to the conditions which create riots and other problems.

TVA's cooperative unit test demonstration program of later years illustrates this changing concept. In this program, all farm inputs and operations are considered as a whole-farm unit. Each adjustment in land use, fertilizer and cropping practices, livestock enterprises, labor use, buildings and equipment, and management techniques is aimed at increasing farm income. On a dairy farm, for example, equal concern might be expressed on amounts and ratios of fertilizer nutrients, producing high quality forages, improvements in the herd through breeding, and building a milking shed to meet Grade A milk production standards. The result usually is markedly improved income and a higher standard of living for the farmer. His success triggers neighbors to follow in his footsteps. Supporting agri-businesses develop to serve the farmers needs. In the end, everyone profits. In each case, fertilizer is the opening wedge, the incentive, to get the farmer to want to try some different alternatives and then to participate. To interest the farmer and get him started we provide fertilizer at about 65 percent of the going market price. The quick profits possible from fertilizer use help the farmer to accumulate the capital needed to undertake further improvements in his farm business.

In recent years, TVA and its university cooperators have added a new ingredient to the agricultural resource development package--that of rapid adjustment farms. The idea here is to take a few farmers--about 50 in the entire Tennessee Valley--and use them as guinea pigs to define more exactly the real problems and find out just what is needed to bring about rapid and maximum improvements in farm income. Then TVA and the educators use this information in helping other farmers, including those participating in the less intensive unit test demonstration program.

In the rapid adjustment farm program, we determine several alternative plans for the farm which will produce a rapid income growth. The farmer and his family choose one. We then provide him with supervision, counsel and technical know-how needed to put the selected plan into action. He keeps careful and complete records for study and analysis. As an incentive to the farmer to follow the proposed plan as closely as possible, TVA provides most of the fertilizer needed at no cost.

Financial results to date have been dramatic. For example, the seven farms that went on the program in 1962 had an average net income of $2,936– an income that is considered very minimal. Four years later, incomes averaged $13,251 per farm even after the fertilizer was valued in at going retail prices. The farmers also greatly increased their investment–from $38,626 in 1962 6o $68,866 four years later--mostly for livestock, feed, seed, farm supplies and equipment.

Frankly, we have found it impossible to multiply income improvements of this magnitude over a broad area. To make dramatic and rapid improvement such as in the rapid adjustment program apparently requires close personal assistance and systematic planning with each individual farmer. But we can still make very satisfactory progress with the effort we can put forth.

A case in point is TVA's most recent effort to improve farm incomes in multi-county areas of the tributary watersheds of the Tennessee River. Many of these areas have not benefited from industrial and general economic development to the extent that has occurred along the navigable main stream of the river. They still rely heavily on agriculture, and incomes are generally low. Citizen organizations in these areas seek to mobilize region-wide efforts to improve every possible resource potential--water supplies, transportation, forestry, recreation, education, as well as agriculture.

I would like to cite as an example our experience in improving agriculture in the seven-county Elk River area in south central Tennessee. Here the University of Tennessee and TVA pulled out all the stops in involving thousands of people farmers, businessmen, fertilizer companies, civic leaders, and youth groups. We sold incentive priced fertilizers to some 3,800 farmers to get them to follow a package of improved agricultural practices. We included test demonstration and rapid adjustment farms, and conducted over 1,000 field plot demonstrations. We had soil testing campaigns, utilized the radio and newspapers to the fullest, and conducted innumerable field tours and farm management schools. We hit the livestock end hard through improvement of brood stock and feeding practices.

From 1961 to 1967, average net farm income of the ten thousand farmers in the area increased 26 percent as compared to little or no gain for farmers outside the seven-county area. Gross income growth rate in the area was $2.3 million a year. Considering that each dollar turns over about four times within the community, this means that the economy of the

area is being influenced by about $9 million annually. Such a large injection of dollars into the economy is having its effect on businesses, schools, and the general welfare of the people. Fertilizer use also increased dramatically. Nitrogen was up 233 percent, phosphate 67 percent, and potash 66 percent—double that of outside areas. The gains in fertilizer use continued even after TVA dropped its initial price incentive. All of this is encouraging and income undoubtedly will continue to improve. But it was short of what we had originally hoped to achieve, and far short of the income improvement that was achieved on individual unit test demonstration and rapid adjustment farms.

We also have successfully used fertilizers in the Tennessee Valley to help launch specialty crops needed to meet consumer demand and simultaneously to increase the income base of an area. A good example is the introduction of vine-ripened tomatoes in the mountain area of western North Carolina. Here, farms were small and unsuited to conventional agriculture, the farm labor supply was large, and farm incomes very low. A crop was needed that would find a ready market, produce a reasonable income from a small acreage, and employ family labor. Vine-ripened tomatoes were selected as best meeting these criteria. Through a program involving selection of good varieties, correct fertilizer use, good cultural practices, plant disease control, and development of processing and marketing cooperatives, over 2,000 farmers are now grossing an average of $4,000 per acre. All told, vine-ripened tomatoes now amount to a $5.5 million annual business that did not exist in this area before.

Success in this venture was dependent partly upon the high income incentive and partly on the fact that the farmer had no previous experience with the crop. He had no previous concepts or bad habits to overcome. His only alternative was to accept a whole new package of technology or fail entirely.

We in TVA have had many other experiences in using fertilizers for resource development, But to continue the list would be simply to develop with more detail the central theme I have sought to spell out.

In closing, I would like to emphasize that fertilizers have played a rewarding role in the total resource development of the Tennessee Valley. I want to stress, again, however, that fertilizers alone cannot bring about mass improvement. On the individual farm, fertilizers must be used in conjunction with improved crop varieties, pesticides, livestock improvement, sound farm mangement, and the like. And in total resource development of a region, concurrent development also must take place in education, health, markets and processing facilities, industries, transportation, and electric energy. When such occurs, fertilizer becomes increasingly effective.

Productive land is the basic framework upon which total resource development must rest.

SUMMARY

Fertilizer has been a major resource development tool used by the Tennessee Valley Authority to develop and improve the land, water, and human resources of the 40,000–square mile Tennessee Valley. It has been a major factor in improving farm incomes and upgrading the total economy of the region.

Experience has shown, however, that fertilizer cannot be used as a simple cure-all for resource problems. It must be used with good crop varieties and pest and disease control for maximum benefits. Also, in total resource development, concurrent development must be achieved in all resources--natural, man-built, and human.

By the 1930s, Tennessee Valley land was unproductive, soil erosion rampant, flooding frequent, and farm incomes the lowest in the Nation. One of TVA's first major steps in regional development was to restore the productivity of the land through use of fertilizer and lime. Thousands of farmers served as demonstrators. Within a few years erosion and flooding were largely controlled, crop yields increased, and incomes improved. Concurrent development of other resources stimulated the general economy of the region.

TVA continues to use fertilizer as a resource development tool, but the emphasis now is on improving the whole farm and on making Valley farms more profitable and competitive with those in other parts of the Nation. Several types of fertilizer-based programs have been developed, and productive land is still considered the basic framework upon which total resource development must rest.

RESUMEN

EL USO DE FERTILIZANTES EN EL DESARROLLO DE RECURSOS

Los fertilizantes han sido uno de los principales, instrumentos utilizados por The Tennessee Valley Authority para el desarrollo de los recursos naturales tales como, la tierra, el agua y de los recursos humanos en las 40,000 millas cuadradas de este valle. Ellos han sido uno de los principales factores para elevar el ingreso de las fincas y para incrementar el nivel de la economia total de la región.

La experiencia ha demonstrado, sin embargo, que los fertilizantes no pueden ser utilizados como una panacea para la solución de los problemas de recursos. Deben ser utilizados en conjunción con otras medidas, tales como la selección de buenas variedades de cultivos y el control de pestes y enfermedades, para que se alcancen beneficios máximos. Además, para lograr el desarrollo total de los recursos, debe realizarse un desarrollo simultáneo de todos ellos, tanto los naturales, los humanos, como aquéllos que resultan de la acción del hombre.

Al correr de los años 30 las tierras del valle de Tennessee estaban inproductivas, la erosión del suelo se expandía, las inundaciones estaban frecuentes, y los ingresos agricolas estaban los más bajos de la nación. Uno de los primeros y principales pasos dados por The Tennessee Valley Authority para el desarrollo regional, fue el de restaurar la productividad del suelo a través del uso de fertilizantes y de cal. Miles de fincas fueron utilizadas para efectos demonstrativos. En el espacio de pocos años tanto la erosión como las inundaciones fueron mayormente controladas, los rendimientos de los cultivos aumentaron, y los ingresos mejoraron. El desarrollo simultáneo de otros recursos estimularon la economía general de la región.

The Tennessee Valley Authority continúa utilizando los fertilizantes como un instrumento para el desarrollo de recursos, pero el enfasis ahora se está colocando en el mejoramiento de la finca como un todo, transformando las fincas del valle en unidades más rentables y más competitivas con respecto a otras regiones de la nación. Varios tipos de programas basados en el uso de fertilizantes han sido desarrollados, y la productividad de la tierra sigue siendo considerada el marco básico dentro del cual se debe sustentar el desarrollo integral de los recursos.