Water in the desert—the largest reservoir in the study area.

An Additional Source of Water

Runoff from Small Desert Watersheds

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Arizona must have more water. Our irrigated acreage already has been reduced because there is not enough water. It is well-known that at present we are using more water than nature can supply. The difference between supply and demand has been made up by "mining" the water in our ground-water reservoirs. This "mining" operation cannot continue forever.

Except for water from the Colorado River, Arizona's only source of water is the rain which falls on the watersheds within the state. Most of this water is lost by direct evaporation or transpiration. The small remainder finds its way to streams or percolates to ground water reservoirs. In order to have a continuous water supply, runoff must be stored during periods of high flow.

Nature's Way Is Slow

Nature's method of storage is in ground water reservoirs. It is superior in many respects to storage in surface reservoirs since evaporation losses are lower. However, natural recharge of surface water to ground water reservoirs is a slow process and most of the runoff is lost before it can be recharged. This condition prompts the question, "Can we improve upon nature in this recharge process?" The Agricultural Engineering Department at the University of Arizona is trying to find an answer.

Artificial recharge has been tried with success in several states. Two methods in common use are water spreading and recharge wells. In the water spreading method, water is spread over permeable soils and percolates downward to the ground reservoir. In the recharge well method, water is injected directly into a well. It operates as a "well in reverse." Each method is suited to different conditions. Water spreading is limited to areas with very permeable soils. Recharge wells can be used where surface soils have low permeability.

Any recharge operation requires a source of water .This water must be near the ground water reservoir and must presently be going to waste. It must also be free from silt and algae. Surface runoff from semi-desert watersheds meets the first two requirements, but has a high silt content. This silt must be removed before either recharge method will be successful.

Measuring Runoff

Since we do not know how much runoff is available, we have begun a rainfall-runoff project. The study area is a typical semi-desert watershed of 18 square

(Cont'd on next page)

D. A. Woolhiser points out features of a runoff measuring flume to Experiment Station Director R. S. Hawkins (left) and Agriculture Dean Harold E. Myers.

Effect of aphid infestation, in comparison with control. The brown thin and dying area is a strip which was missed when the insecticide was applied.

Many Weapons Used In Battle Against

Spotted Alfalfa Aphid

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The spotted alfalfa aphid was discovered in Arizona in 1954 and soon became the most important alfalfa pest in the state. Although early tests by University of Arizona entomologists resulted in effective insecticide recommendations, which did much to reduce losses from aphids attacking alfalfa foliage, it was soon apparent that other important problems remained to be solved. For example, insecticide applications of the type used on alfalfa foliage were relatively ineffective for controlling aphids on young seedlings.

A need for foliage insecticide treatments of lower cost, greater effectiveness and without objectionable toxic residues at harvest also was recognized. More information was needed on the importance of natural enemies, weather, and other factors as agents for aphid control.

More effectively to find answers for these and other problems, an expanded cooperative research program was begun in the summer of 1955 between the University of Arizona Agricultural Experiment Station and the Agricultural Research Service of the United States Department of Agriculture. Under an agreement, which was aided by a new allocation of federal funds and additional support from U of A funds, a unified research program involving both federal and university workers is now in progress in Arizona.

Salt River Valley Study

Basic studies of the spotted alfalfa aphid, its natural enemies and its control by introduced parasites, are being made by O. L. Barnes and W. M. Nielson at the U.S.D.A. Cereal and Forage Insects Laboratory in the Salt River Valley. These workers are also cooperating in the evaluation of alfalfa varieties for aphid resistance, in experimental plantings by the Department of Agronomy at the University of Arizona research farm at Mesa.

Further investigations of insecticides for aphid control are being made by D. M. Tuttle and V. D. Roth at the University of Arizona's research laboratory near Yuma.

Attacks Young Seedlings

The destruction of newly-emerged alfalfa seedlings has been one of the most serious forms of injury caused by the spotted alfalfa aphid in Arizona. Growers have frequently been forced to replant as many as three times to obtain an adequate stand.

Conventional types of applications of insecticides to alfalfa seedlings have been ineffective and wasteful of material. The feasibility of treating seeds with insecticides to protect young seedlings from aphid attack was, therefore, investigated. During the past year, 24 insecticides have been used one or more times as seed soaks, or as dust or emulsion formulations for seed surface applications.

Only a small number of these materials have been conclusively promising as thus far tested. Of these, only Thimet (when legally registered and approved for sale) and lindane, both at the rate of four pounds of actual toxicant per 100 pounds of seed, appear suitable for early use by growers. Seeds were more readily coated with insecticides after a preliminary coating of five percent methyl cellulose solution applied at the rate of ¾ ounce per pound of seed.

During the past three seasons, 72 formulations of 34 different insecticide compounds have been used in numerous tests against the spotted alfalfa aphid in Arizona. This work is still in progress in an attempt to develop cheaper and more effective treatments which will leave no illegal residue deposits.

A summary of the best available suggestions for controlling this pest, based on tests conducted in Arizona, is contained in University of Arizona Agricultural Experiment Station Report No. 131, entitled "The Spotted Alfalfa Aphid (A Progress Report)," which may be obtained on request from the Mailing Bureau, University of Arizona, Tucson.

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miles. It is located about 10 miles east of Tucson. Normal rainfall in this area is around 11 inches a year. Most of the runoff occurs in the summer as the result of intense local thundershowers. Very little, if any, of this runoff ever reaches the ground-water reservoir. Twenty-seven standard rain gauges and two recording rain gauges were installed in the summer of 1955. Records of rainfall are complete from August 1955 to the present. Runoff is measured volumetrically in three reservoirs on the area. These reservoirs were equipped with automatic water level recorders in the spring of 1956 and we have complete runoff records for the summer of 1956. Flow rates from a portion of the area are measured in a critical-depth flume.

1956 Unusually Dry

The year 1956 has been a year of low rainfall. Total average rainfall on our study area during the period January through September was 6.45 inches, 2.25 inches lower than the normal rainfall for this period at the University of Arizona. Three storms occurring in July and August produced 248 acre-feet of runoff, or almost 14 acre-feet of water per square mile of area. This yield is lower than we could normally expect, but since we have only one year of record, we cannot be sure. However, this yield is encouraging since our study area is located in the area of lowest rainfall in the upper Santa Cruz Valley.

Another phase of our project will be to carry out laboratory and field experiments on artificial recharge. There are many serious difficulties to overcome, but we hope to make artificial recharge a reality in Arizona.