PROGRESSIVE

agriculture in arizona

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JULY — AUGUST 1967

Volume XIX Number 4

DDT Detective, Donald Vessey, Using Ultra-centrifuge

(See article, Page 9)

Cochise County
KAWT, Douglas — 6:15 a.m.
KAPR, Douglas — 6:15 a.m. Wednesday and Friday 12:10 p.m. Monday through Friday.
KHIL, Willcox — 6:10 to 6:15 a.m. Monday through Saturday.

Coconino County
KCLS, Flagstaff — Tues. and Thurs., 8:45 a.m.
KCLS, Flagstaff (Home Agent) — Wed., 10:15 a.m.

Gila County
KIKO, Globe-Miami Monday, 12:45 p.m.

Graham County
KATO, Safford—Sat., 9:30 a.m. Mon. thru Fri., 12:45 p.m. (daily)

Maricopa County
KTAR, Phoenix—Mon. thru Fri., 5:55 a.m.
KOY, Phoenix—Tues. thru Sat., 5:40 a.m.
KOY, Phoenix—Sunday Garden Club of The Air, 8:35 a.m.
KPHO, Phoenix—Mon., Cotton Report, 12:40 p.m.
KPHO, Phoenix—Thurs., Dairy and Livestock Report, 12:40 p.m.
KUPD, Phoenix—Mon. thru Fri., 5:30 a.m. and 12:30 p.m.

Mohave County
KAAA, Kingman — Mon., 9:06 a.m. (Extension Home Economist)

Navajo County
KDJI, Holbrook — Tues., 12:15 to 12:30 p.m.
KINO, Winslow — Sat., 12:15 to 12:30 p.m.

Pinal County
KPIN, Case Grande—Mon. thru Sat., 6:55 a.m.; Mon and Fri., 9:30 a.m.; Tues., Thurs. 11:30 a.m. on Monday and Wednesday and Sat., 12:20 p.m.

Yavapai County
KYCA, Prescott — Mon., Wed., Thurs. and Fri., 3:45 p.m.
KNOT, Prescott — Mon., Wed. and Fri., 6:25 a.m.
KVIO, Cottonwood—Mon. and Fri., 8:15 a.m.

Yuma County
KVOY, Yuma — Mon. thru Fri., 5:45 a.m.
KYUM, Yuma — Tues., Thurs. and Sat., 6:25 a.m.
KYUM, Yuma — Saturday, 4-H Program, 10:05 a.m.

STILL OPPORTUNITIES

IN THIS ISSUE

PROGRESSIVE AGRICULTURE IN ARIZONA

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Volume XIX Number 4

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Editorial Board Members: Director George E. Hull, chairman; Dr. William Kneebone, Dr. Norman Oebker, Dr. J. W. Stull and Dr. Bessie Jean Ruley.

Automation has made such great advances — and appears to be advancing so rapidly and so widely — that the high school student of today wonders just what jobs there will be left, when he grows up, for humans to do on their own.

Will everything be programmed for automation? Will all tasks be done by huge involved machines? Will all decisions come out of a mechanical monster "fed" information from which alternative choices can be made?

The Arizona farm or ranch boy need have no fear. In a wide listing of agriculture-related fields there is ever-growing demand for human talents, talents which no machine is apt to have. The number of agricultural college graduates is still far from meeting the demand, and that demand itself is growing.

Some fields have an exceptional need, with critical demands for graduates trained in sciences related to the food processing industry. These related fields include bacteriology, foods and nutrition, meat and animal science, biochemistry and food science.

Requests run far ahead of demand — this is true in most states, including Arizona — for graduates in soil science, agricultural journalism, poultry science, agricultural engineering and agricultural education.

The rural boy or girl trying this summer to decide on a college career should remember that there is a new and vast "export market" for agriculturally trained workers. The AID and FAO programs, plus half a dozen private concerns furnishing agricultural leadership to foreign nations, all create this completely new "market" for the graduate from a recognized College of Agriculture.

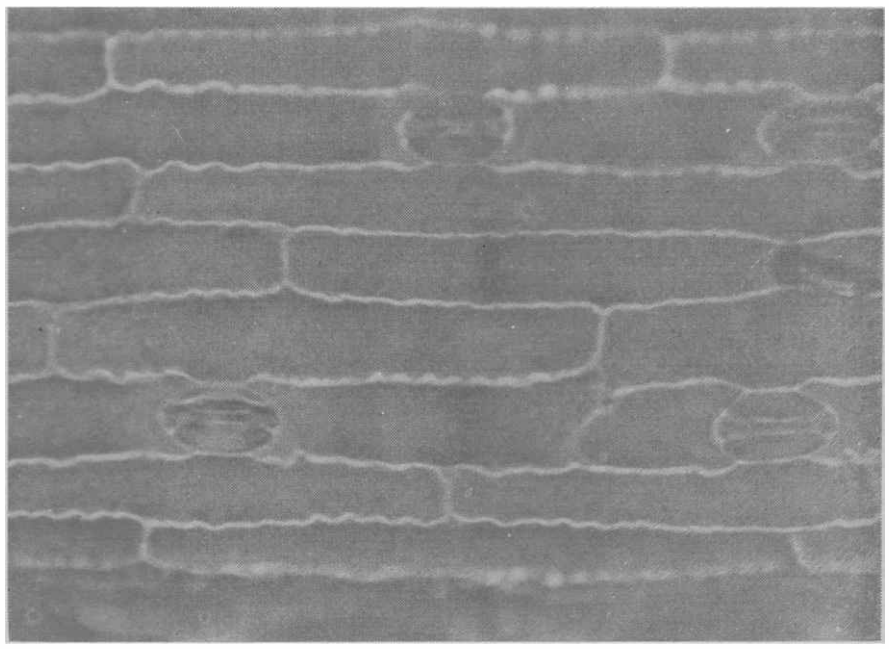
Don't worry about those frightening new machines. There still is a vast need for men and women, for college-trained scientists who will use these machines with other tools in the awesome task of feeding and clothing a needy world.

Harold E. Myers

Dean
College of Agriculture
and
School of Home Economics

HOW EFFICIENT IS WATER USE BY CROP PLANTS?

By A. K. Dobrenz
W. R. Kneebone
M. A. Massengale
K. Matsuda
L. N. Wright



UPPER SURFACE of a leaf of Blue Panicgrass, showing epidermal cells and the stomates. Most of the water absorbed by the plant is lost in the form of vapor through small pores in the leaf.

Agronomists at the University of Arizona are asking these questions: Do plants really need to absorb 800 to 1500 grams of water for every gram of dry matter produced? Is all this water lost by plants as vapor into the atmosphere absolutely necessary in the biochemical processes of the plant? Can agronomically important plants be improved so that they will produce more dry matter with less water?

Scientists in the Agronomy and Botany Departments at the University of Arizona are attempting tc answer these and other questions related to more efficient use of water by crop plants, through a grant supported by the Cooperative State Research Service of the Department of Agriculture.

Some Drink More Water

Grasses and legumes are being grown in controlled environmental growth chambers and used to determine "high" and "low" water users. These plants will be used to compare differences in morphological, biochemical, and anatomical features in search of the key to water efficiency. We need a good selection "tool" so we can separate the more water-efficient plants within a species from the less water-efficient ones.

The number, size, and daily activities of the stomates will be investigated in detail. The stomatal apertures (small slit-like openings in the leaves through which most of the water absorbed by plants is lost into the atmosphere) of blue panicgrass as shown in the accompanying photo, may be the selection tool for water efficiency. Plants have been shown to have from 1,000 to 60,000 stomates per square centimeter of leaf area. Some plants have stomates on both the upper and lower sides of the leaves, and some have these small pores only on the bottom side.

Learning What Goes On

Biochemical constituents such as free amino acids, total amino acids, and various other metabolites concerned with hydrophyllic fractions of cells will be investigated in an attempt to better understand biochemical processes between efficient and non-efficient water-using plants.

The Arizona farmer is being faced with the problem: What crops can I now produce with the least amount of water? Competition for water is inevitable. As industrial and urban demands for this natural resource grow, less and less water will be available for agricultural enterprises.

Our research will try to find the reasons why some plants use water more efficiently than others. Then we can incorporate these features into agronomic plants, so that more food can be produced with less water.

BERMUDAGRASS RESEARCH plots at ← UA's Yuma Branch Experiment Station. Note bagged plants in left foreground. Middles are kept free of weeds by use of herbicides.

Breeding Seeded Bermudagrass; Unique Arizona Research Problem

By William R. Kneebone

The only intensively managed production of bermudagrass seed in the world is on some 9,000 acres in Yuma County, Ariz. Several million pounds of seed are sold annually in the southeastern United States, Mexico, Hawaii, and more exotic places like Australia and Africa.

Such a volume of seed for a specialty crop makes a substantial contribution to Arizona's economy. Recognizing that the seed market could be appreciably expanded if improved seeded varieties were available, the seed growers and seed dealers in the state joined with the UA Agricultural Experiment Station to organize research in this direction. A program has been under way since 1960, supported by grants from the seed industry and by Experiment Station funds.

Produced for Outside Markets

Since most of the bermudagrass seed produced in Arizona is used outside Arizona, the research program for variety development has been concerned as much with outside needs as with those within the state.

This is a unique situation. We are in the business of developing a better product for Arizonans to sell. To sell, it must not only be better in Arizona but in Georgia or Tennessee or Alabama.

Our program has two phases: 1. Development of superior varieties for turf and forage uses in Arizona and also in other parts of the United States. 2. Development of systems for more profitable production of seed of these varieties in Arizona.

Improved varieties of common bermudagrass that have been named, released and are in use in the United States are, without exception, vegetatively propagated. Most of them are quite infertile and none breed true to type from seed. In meeting the objectives of the Arizona program, we must find not only superior potential parents but must make sure that they will produce adequate amounts of seed that will in turn produce superior seeded pasture or turf. As with any other crop, bermudagrass varieties must be *Usable* as well as *Valuable*.

An essential part of the breeding program is evaluation for seed production. This is being done in the Yuma area at the University of Arizona Branch Experiment Station, with related studies in grower fields and at the University's Marana and Casa Grande Highway farms near Tucson.

Selections made at Tucson from among seedlings of many Arizona collections, introductions from other parts of the world, and experimental seed lots obtained from other stations are being grown at the Yuma Valley Station for evaluation of their seed potential and to produce seed for progeny testing. In addition, there are selections received from other workers for testing. Many of the selections at Yuma, plus some newer ones, were established in a replicated plot test at Marana in 1965.

From these studies many things are becoming clear, some of them expected, some of them not; some of them favorable to research progress, some disappointing. Most striking is the very wide range in seed production potential found among types of bermudagrass. Potential yields range from zero to a probable maximum of 1500 pounds per acre of hulled seed in two harvests. Selections that are good seed producers have been rare, and the best seed producing selections thus far have been from Arizona common.

Controlled by Two Factors

Studies on components of seed yield have shown that total yield is dependent primarily on two factors, number of heads per acre and percentage of florets setting seed. Since many sterile types produce numerous heads, the percentage seed-set becomes very important. In grower fields and in research plots, large heads tend to have lower seed-set.

Since types with large heads tend also to have fewer heads, their seed yield potential is still further reduced. Large-headed types, however, also have larger seed and their seedlings are more vigorous. The ideal variety from a seed production standpoint should have many large heads which have, as near as possible, 100 percent seed-set of large seed.

To combine the disease resistance, hardiness and seed size of large-headed types with the good seed production of small-headed types requires an extensive crossing program. To make crosses, and perhaps later develop hybrid varieties, we must know the degree of self-fertility and percentage of natural crossing in bermudagrass.

Controlled Self-Pollenization

To do this we take developing heads and cover them with a special paper bag before they have flowered. The bag prevents outside pollen from getting to the stigmas. Seed set under the bag must be from the plant's own pollen, and is a measure of self-fertility. Selfed seed-set is very near zero under bags in experimental plots at Yuma and Tucson and in grower fields in Yuma County. Normal seed-set in grower fields can be as high as 90 percent (a very high figure for grasses). Heads exposed to outside pollen and then bagged, set seed just as well as unbagged heads.

These data indicate that bermuda-

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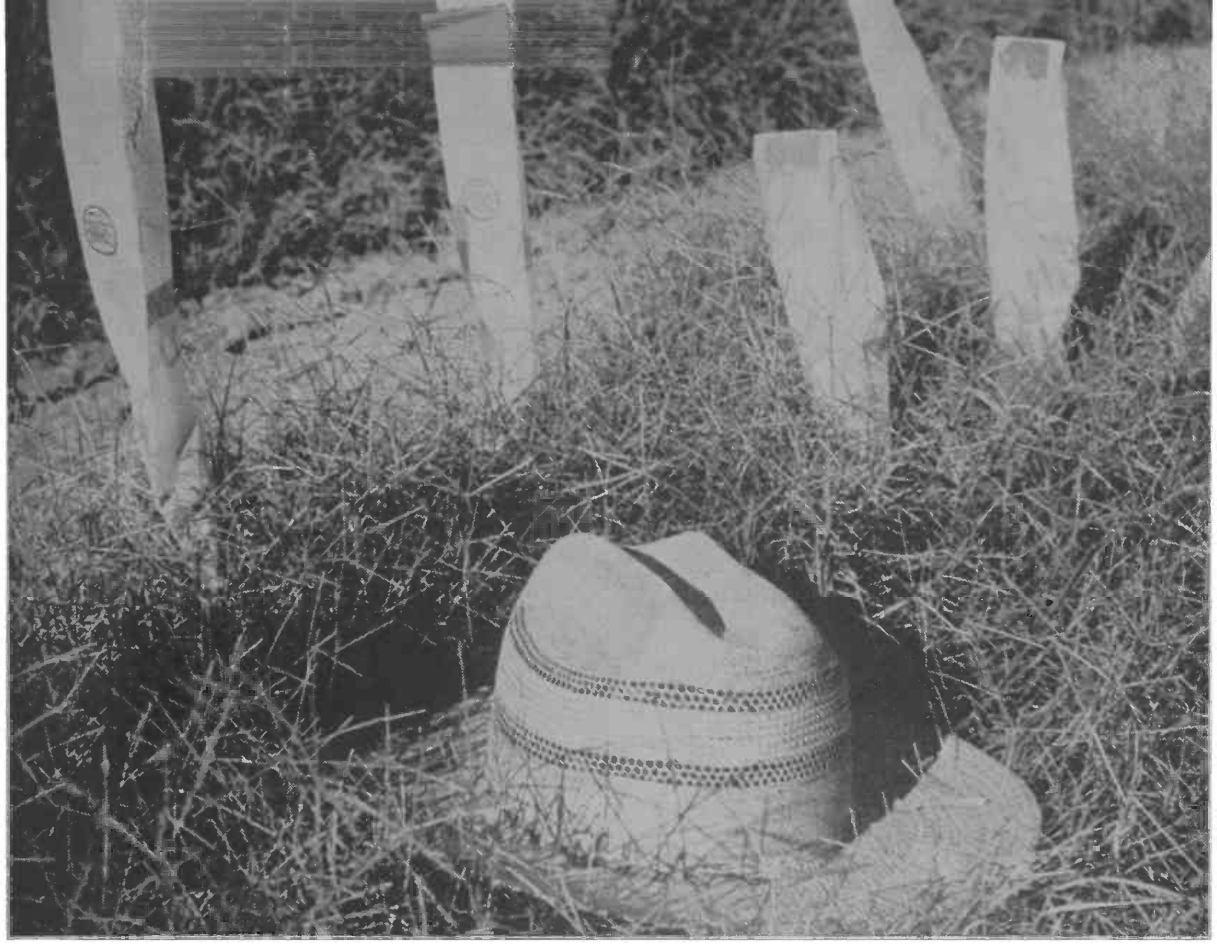
Dr. Kneebone is a professor in the Department of Agronomy.



BAGGED PLANTS — Three to five heads of the female are enclosed in a bag, at the top of which is a vial of water with male heads, to give completely controlled pollenization.

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grass is nearly 100 percent cross-pollinated. Here are two very important implications: 1. Vegetative propagation of a single selection for seed production is useless, because the only seed it will set must come by outcrossing. 2. This assurance of outcrossing allows us to make crosses without emasculation of the female parent. We can therefore bag the female and supply heads of the male parent set in vials of water within the same bag. As suitable parents are developed, commercial production of hybrids can be done by vegetatively propagating two or more lines in alternating rows with suitable isolation from other bermudagrass. All seed produced would then be the desired hybrid.

Poses Many Problems

Studies of crossability between types have just begun after first working out techniques for crossing. They have brought other unexpected problems. Apparently there are barriers to crossing between certain types. These barriers must be overcome if characters are to be taken from one for use with the other. For example, some very promising forage types with cold hardiness and yield potential but low seed-set do not cross well with common even when used as male parents. Not only do we need seed production data, but we also need basic information on chromosome behavior and species relationships within the bermudagrass genus.

Another part of seed research concerns seed germination. A grower wants his seed to be of the highest quality possible, and germination is one measure of quality. Ideally, the seed should germinate well immediately after harvest. Seed from most common types and from some giant types does germinate well shortly after harvest. Most of the selections from other sources that we have tested have many hard seeds, seeds which refuse to take up water, and do not germinate under standard conditions. This is another of the unexpected research problems which have been identified and must be considered.

Test of Management Factors

Commercial seed production systems have developed over the years which normally assure a profitable crop. Little information is available on the exact effect of various management practices, or on the effects that changing one or more might make. Tests of seed production from different selections also provide a way to investigate management factors. Nitrogen fertilizer, for example, appears to delay initiation of heads in the spring but also induces formation of more stems that will later head.

Phosphorus by itself does not improve seed yields, but may do so when high rates of nitrogen are applied. In the Yuma trial we applied a soil sterilant (Hyvar x) to the row middles to keep selections from growing together. There was a wide range of susceptibility among selections. This, along with greenhouse demonstrations of different reactions among selections to other herbicides, may have considerable importance both in development of varieties and in present control programs to remove giant from fields of common.

Much of the research effort to date has gone into definition of problems. Problems we have found, but we have also discovered the areas of greatest opportunity. These have not been the ones expected when the program was initiated, but perhaps the potentials are greater than originally hoped for. The opportunities are, like the goals of our research, unique. We aim to capitalize upon them for Arizona.

IN YUMA COUNTY Bermudagrass is cut for seed after irrigation has been stopped, the grass raked into swathes, then threshed with a pickup combine.

Common Market Shapes Farm Plan

By Roger W. Fox

Representatives of the six European Economic Community nations (Belgium, France, West Germany, Italy, Luxembourg and the Netherlands) have been struggling since the signing of the Treaty of Rome in 1957 to establish a common agricultural policy. Establishment and implementation of this policy is nearing completion. This article reviews the development of the common agricultural policy, its major features, and indicates possible implications for U.S. and Arizona agriculture.

The main policy goals for agriculture, as contained in the Treaty of Rome, were stabilization of markets and an increase in farm income. In addition, the general goal of eliminating all internal trade barriers and the adoption of a common trade policy for nonmembers also applied to the formation of agricultural policy.

Dissension Nearly Ruins It

The task of determining an acceptable agricultural policy that would permit abolition of tariffs and quotas between member countries was monumental, much more difficult than creating a common market for manufactured products. Primary reason for this difficulty was the widely divergent agricultural policies existing in the member countries. National agricultural policies ranged from protecting the interests of highly efficient, export-oriented farm production in the Netherlands, to relatively high-cost, import-substituting production in Germany.

Add to this the necessity of establishing a common trade policy toward nonmembers and the complexity of the task comes into focus. It is little wonder that disagreement on agricultural policy led to a deadlock in negotiations and the virtual collapse of the Common Market in 1965. However, compromises were made and the prospects appear certain for implementing various regulations governing agriculture. Many of the regulations currently operating on a transitional basis will come into full effect this July.

Protecting EEC Agriculture

Common Market agricultural policy has evolved on a commodity by commodity basis. Starting in 1962 with a set of detailed market regulations for six of the major commodities produced in the EEC (grains, pork, poultry, eggs, fruit, wine), a series of additional regulations has been approved by the Council of Ministers. These regulations relate to rice, dairy products, beef and veal, olive oil, oilseeds and sugar. Commodity programs govern over 90 percent of the agricultural production in Common Market countries. Additional agreements are planned for tobacco, nonedible horticultural products, hops and fisheries.

These market regulations attempt to stabilize farm income by maintaining high, uniform prices throughout the Community by means of a price support program. Imported commodities from nonmembers are subject to a variable levy in order to eliminate any competitive advantage that foreign products may have. Surplus production is to be exported, subsidized when necessary. Domestic price-support expenditures are to be borne by the members, financed in part from levies on agricultural imports from outside the EEC.

Impact on U.S. Exports

What effect will these elaborate programs have on U. S. agricultural exports to the EEC? This is of considerable importance, since our food and fiber exports to the EEC represent about 30 percent of the dollar sales of U. S. agricultural products.

Because a number of the regulations have been in effect on a transitional basis since 1962, we can get an idea of their effect by looking at the export figures in the accompanying table. It presents the dollar value of U. S. agricultural exports to the EEC for fiscal years 1961-62 through 1965-66. Variable levy commodities receive the most protection under EEC policy and, consequently, are of major concern in evaluating the outlook for U. S. exports.

Total U. S. agricultural exports to the EEC were $1,593 million in 1965-66, 16 percent above the preceding year and 35 percent above 1961-62. During the same five year period, U. S. exports of commodities entering the EEC under the variable levy system increased 48 percent. In comparison, exports of farm products not subject to variable import levies were up only 25 percent. Surprisingly, the increase in exports subject to variable levies was greater, both absolutely and relatively, than the increase in nonvariable levy commodities.

Feed Grain Outlook Good

Feed grains accounted for the largest share of total exports to the Common Market. In 1961-62, feed grains represented 23 percent of U. S. agricultural exports to the EEC. Their share expanded to 34 percent in 1965-66. Although production in the EEC increased during the five-year period, the demand for animal feedstuff grew more rapidly than production, and imports were used to fill the gap between production and total requirements.

A study completed by the author in 1965 indicates a continued increase in the EEC feed grain deficit. Projections for 1970 suggest that the U. S. will be the major beneficiary of the increased deficit. Feed grain exports to the EEC are expected to double, and possibly triple, from the 1959 to 1961 average. Even with an anticipated reduction in wheat exports to the EEC, gross revenue from U. S. wheat and feed grain exports to the Community is expected to be substantially greater in 1970 than at the start of this decade.

Chicken War Cut Exports

The reduction in exports of poultry and eggs between 1961-62 and 1962-63 reflects the outcome of the "Chicken War." Current EEC policy is aimed at a goal of self-sufficiency in poultry meats. EEC production has increased 35 percent from 1962 to 1965, while import requirements have fallen from 316 to 164 million pounds. It seems unlikely that the U.S. will be able to maintain the recent level of poultry meat exports to the EEC.

Expansion of soybean, oilcake and protein meal exports to the EEC has been remarkable. Between 1961-62 and 1965-66, exports of these items more than doubled. A recent U. S. Department of Agriculture study indicates a strong demand for oilseeds and oilseed products through 1970. Since the United States is the principal world supplier of these products,

(Continued on Next Page)

Dr. Fox is a member of the staff of the Department of Agricultural Economics.

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exports to the EEC should continue at a high level.

In general, the outlook for U. S. agricultural exports to the EEC is favorable, at least through 1970. Exports of certain commodities, such as wheat, cotton, poultry and lard, will probably decrease. However, increased exports of feed grains, soybeans, oilcake and meal will more than offset the losses.

Implications for Arizona

What are the implications of the EEC policy for Arizona agriculture? Definite answers to this question are hard to give. Agricultural production in Arizona is only a small part of total U. S. production. Furthermore, although U. S. exports to the EEC constitute about 30 percent of our dollar exports sales, these sales represented only 3.8 percent of the cash value of agricultural output in 1965. However, a few generalizations pertinent to Arizona can be made from the data presented in the table.

Cotton exports to the EEC from the United States have declined, due principally to increased competition from developing countries and the greater use of synthetic substitutes. For example, during the three-year period 1963 through 1965, total EEC imports of synthetic fibers, fabrics and yarns increased 39 percent from $519 million to $719 million. U. S. cotton exports to the EEC for the same period declined from $132 million to $70 million. Obviously, cotton exports to the EEC will not solve the surplus situation facing U. S. and Arizona cotton producers.

The continued demand for feed grain imports by Common Market members means very little to Arizona producers or users of feed grains. U. S. feed grain exports to the EEC in 1965 were only 7.6 percent of domestic production by value. Furthermore, Arizona produces only one-half of a percent of the total U. S. supply of feed grains. Internal conditions are much more important in determining supply, demand, and price for feed grains. Nevertheless, if domestic conditions stay fairly constant, a strong export demand could result in slightly higher prices.

Beef Exports Small

Although U. S. beef and veal exports to the EEC have increased during the 1960's, they still represent an insignificant portion of total production. Further increases in exports would result in only minor changes in prices received by U. S. and Arizona producers.

U. S. Agricultural Exports to the European Economic Community

	1961-62	*1962-63*	*1963-64*	*1964-65*	*1965-66*
			(1,000 dollars)		
Variable Levy Commodities:					
Feed grains	271,080	273,709	277,655	377,238	536,988
Rice	17,170	13,028	15,569	9,817	14,915
Rye grain	9,206	24,160	8,080	1,753	2,834
Wheat grain and flour	121,450	41,950	94,002	36,961	102,944
Beef and veal	21	111	599	2,066	1,820
Dairy products	1,620	7,091	40,744	44,280	18,479
Lard	3,266	2,568	2,703	1,170	1,229
Pork and swine	444	383	10,200	520	1,249
Poultry and eggs	64,957	29,837	33,957	28,336	28,830
Other	8,316	23,323	22,680	27,230	27,847
Total	497,530	416,160	506,189	529,371	737,135
Non-Variable Levy Commodities:					
Canned poultry	1,696	1,572	2,986	3,864	2,925
Cotton	157,093	86,847	191,148	127,227	53,719
Fruits and vegetables	80,595	95,763	88,115	88,157	99,188
Hides and skins	21,957	16,610	23,623	27,844	31,158
Oilcake and meal	32,302	54,027	55,379	101,865	129,473
Soybeans	147,095	163,826	193,934	200,642	260,763
Tallow	32,266	22,926	32,691	35,396	36,276
Tobacco, unmanufactured	104,529	103,115	105,702	104,064	105,003
Variety meats	16,724	18,140	26,335	32,532	33,015
Vegetable oils	18,368	13,346	29,630	40,660	17,692
Food for relief and charity	18,445	9,964	8,535	5,348	3,838
Other	55,416	67,319	68,640	73,977	83,205
Total	686,486	653,455	826,718	841,576	856,255
Grand Total	**1,184,016**	**1,069,605**	**1,332,907**	**1,370,947**	**1,593,390**

Source: U. S. Department of Agriculture, *Foreign Agricultural Trade of the United States,* September 1966, p. 44.

Fruit and vegetable exports to the EEC have been fairly constant during the period 1961-62 through 1965-66. Because of the stringent regulations adopted by the community, increases in imports of these products are unlikely. This means that Arizona citrus exports to the EEC will remain fairly constant, or possibly decrease as southern Europe increases production and as the use of concentrates and synthetics expands.

In general, U. S. experience with Common Market import regulations on agricultural commodities has been far better than anticipated. Full implementation of the common agricultural policy this year is unlikely to alter the overall situation in the near future, at least through 1970. The expanding EEC economy will continue to require substantial imports of agricultural products, with a large portion still coming from the United States.

THE HARVEST

The harvest is more than cutting grain
And hay, or husking corn when it is ripe.
Good crops are the fruition of faith;
They are the sweat of toil, and pride
In doing well. Harvesting begins with
A well-fed soil, turned by knowing hands;
And as the patient farmer works, he dreams
Of golden crops upon his fertile lands.
The seed he sows must be the honest kind
Which, given soil and sunshine, care and rain,
Will paint a landscape to beautify the earth;
A picture showing thankfulness and grace
Is in the toiler's thoughts and heart,
Reaching, beyond the task of garnering crops,
To hungry brethren, to patient beasts at work.
He is grateful for all things given,
And satisfied in his staunch heart that
When the harvest is complete, he has done his part.

—Cora G. Sheafor in THE FURROW Magazine

JULY

24-28 — State 4-H Roundup — U of A Campus.

AUGUST

21-26 — American Society of Parasitologists & American Microscopical Society Meeting, U of A Campus.

SEPTEMBER

25 — Annual Arizona Turf Conference — U of A Campus.

30 — National 4-H Club Week.

MUCH AVAILABLE information for the consumer comes from the U.S. Depart-
←— ment of Agriculture, University of Arizona and other sources. Mrs. Simmons stands before the bulletin display in the Gila County Extension offices at Globe.

The Consumers' Corner

By Mary K. Simmons

Competition for the consumer's dollar takes place in forms other than price. For example, free delivery, credit, convenience of location or attractive store furnishings. Most consumers are unspecialized — they buy many products. Slight price raises are not noticed by the consumer, and usually he will continue to deal at the same place out of habit.

Most people have only a vague idea of the regular price of a promoted item. The way the retailer shows his item affects the way a consumer will buy. Articles at eye level outsell those above and below eye level. If you have to stretch or bend to get something, you will probably not buy it. People buy more from a full rack than from one half empty.

Once, when you bought potatoes, it was by the sack. Now there are au gratin, hash browned, mashed and french fried. Convenience has its price but the price is not always higher. U. S. Department of Agriculture research shows that out of 153 convenience foods, 42 cost more to fix from scratch.

You can't watch prices for a short time and conclude that the prices are "always lower at this store" and shop there forever after. To benefit from special prices you have to keep comparing.

1. Pay attention to prices; you never will be able to recognize a good buy until you know what you usually pay.

2. Note cost per unit; when things are sold in multiples, figure out what you pay for one. Do the same for things sold by weight. You then have a solid basis for comparing prices. (Remember the store where an item sold slowly at 8 cents? When the merchant put up a sign, "Special — 3 for 25c" it went like hot cakes).

3. Make a list — buy what you need but fight back the impulse to pick up things you neither want nor need.

Packages Captivate

Where there is little difference in price or quality among like products, the packaging design can make success or failure to a manufacturer. Advertisers target in on the ear, the eye and the nose. The approach through the nose is called Time Mist, which markets captivating whiffs of chocolate, stimulating fragrances of root beer and lemon pie, and are supposed to whet appetites and increase sales.

Color is also an important selling device — some colors put people in a buying mood. Research shows red is the most effective package color, but if too much red is used, it tends to make people restless. Yellow is the next best color — it has "appetite appeal". Sometimes the shape of a package causes consumers to buy. Fancy tissue boxes caused a rise in sales.

The shape of a bottle influences your choice. Research shows that regular weight watchers unconsciously pick up vegetable oil in a round bottle nipped in at the waist, even though it contained six ounces less than the old bottle. *Remember that most advertising and marketing practices are intended to impress rather than inform.*

New Labeling Law

With all these enticements, what chance does the poor consumer have? Well, there will be a new look on grocery shelves after July 1, when the Fair Packaging and Labeling Act goes into effect. Package labels must state the truthful net weight in ounces or pounds. If number of servings are listed, weight of each serving must be given. The phrase "jumbo pound" and "giant quart" have been eliminated. And, if and when the government decides that regulations are necessary to prevent deception, then non-

(Continued on Next Page)

This is second in a series of columns by Mrs. Simmons, Home Economist in the Gila County Extension office at Globe, Ariz.

Pesticide Detectives Analyzing Body Cells

By Donald A. Vessey, J. W. Stull and W. H. Brown

Use of agricultural chemicals has made it possible to increase yields and improve production efficiency in many crops and types of livestock. These materials include fertilizers, herbicides, defoliants and pesticides.

(See Photo on Cover)

In recent years there has been some concern about the residual effect of these chemicals after their initial application or use. The fact that these residues may linger in the environment — soil, water, food, air and animal life — long after their usage, has stimulated researchers to analyze the environment for the distribution or occurrence of these materials.

One type of chemical of interest is the pesticide DDT. If the effect of residual pesticide in animal life is to be accurately determined, investigations must be carried out at the level of individual body cells.

Trail of DDT

With this in mind, DDT has been fed to experimental rats and then the different components of a cell have been assayed for the pesticide. Furthermore, the manner in which the cell handles the DDT has been characterized. This was done by following the DDT over a period of time in various cell preparations, noting when, where and if it is changed (metabolized) to other chemical forms which are called DDD and DDE.

Research of this nature is confronted with two major problems. The first is concerned with how to separate the cell into its different components. This may be accomplished with a high speed machine called an ultracentrifuge. In this machine a suspension of broken cells is spun at an extremely high speed, thus developing sedimentation forces many thousand times greater than the force of gravity. The larger and heavier cell components are seen to settle out or sedimentize first, being followed by smaller and lighter components. Proper choice of the sedimentation force enables one to selectively remove the specific cell components from the suspension (namely; nuclear, mitochondria and, lastly, microsome) leaving behind soluble cell materials. Each of these fractions has specific functions in the metabolic processes in the cell.

The second problem is how to analyze precisely for small amounts of DDT and its metabolies (DDD and DDE). This is done by means of gas chromatography. Compounds are first separated on the basis of solubility differences on a long column loosely packed with the appropriate material. The separated components (DDT, DDD and DDE) are then passed on to a detecter which measures the chlorine atoms on the pesticide molecule.

Tracing Metabolism

Using these tools, it was possible to make the following observations on DDT uptake by liver cells from rats which had been fed DDT:

(1) The pesticide did not end up exclusively in any one cell fraction.

(2) Pesticide was depleted with time from the liver cells and was presumably excreted or stored in other tissue.

(3) The pesticide appeared to be transported around in the cell by means of certain other substances.

(4) The liver cells were actively changing or detoxifying the DDT to DDE and DDD within 16 hours after feeding, and the efficiency of detoxification continued to improve for a number of days.

(5) DDE appeared to be rapidly transported out of the cells while DDD remained longer to be further metabolized.

Amount and Time

The accompanying table contains a portion of the data used in arriving at the above conclusions. This table shows what percent of the total pesticide found in the respective fractions is represented by DDT and its detoxification products (DDD and DDE) for two points in time, namely 16 hours after feeding and 1 week post dosing.

Percent of DDT and Its Analogues in Cell Fractions

Fraction	*DDT*	*DDD*	*DDE*
16 hr. post treatment			
Microsome	69.4	25.7	4.9
Mitochondria	64.0	31.8	4.2
Nuclear	69.1	27.1	3.7
Soluble	67.0	28.8	4.2
1st week post treatment			
Microsome	61.2	27.6	11.3
Mitochondria	59.9	31.0	9.1
Nuclear	61.0	29.0	10.0
Soluble	54.0	30.8	15.2

The authors are members of the Department of Dairy Science.

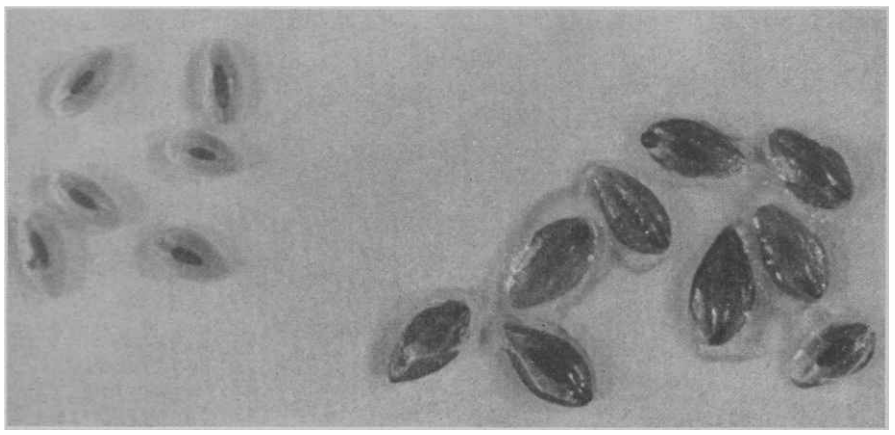
(Continued from Previous Page)

functional, slack-fill packages (for example larger than necessary cereal boxes), will be forbidden.

Although these provisions are not all that the backers of the bill had hoped for, the new regulations should make shopping easier, especially weight comparison.

But remember, there can be a big gap between passage of a law and results. A well-intentioned law may prove unworkable, and a workable law can be laxly enforced.

So don't leave everything up to the government. Don't abandon the oldest form of consumer protection — self-protection. Anyone who figures he can outsmart the market — get something for nothing — and who can't take the time to think before he spends, or figures it doesn't matter where his money goes — no one can assure him of getting his money's worth.



PLANTAGO SEEDS. Those at right were soaked for 12 hours; those on left are normal dry seeds. Note gel around soaked seeds. Water absorbing qualities make it possible for seeds to swell to 12 to 15 times normal size.

PLANTAGO OVATA plants are grasslike in appearance, with leaves in rosettes and seed stalks terminating in spikes which grow to 8 to 12 inches. Small bags are for controlling pollination to obtain "selfed" seed.

PLANTAGO--New Crop for Arizona?

By D. D. Rubis and L. D. Massman

The authors are professor of Agronomy and formerly graduate assistant in Agronomy, respectively.

PLANTS IN BREEDING nursery in Tucson in March, 1966. During previous months several frosts with temperatures as low as 17° occurred. At left, remnants of plants of commercial variety, completely frozen out. At right, new frost-tolerant variety, showing no frost damage.

Considerable evidence exists that man has used species of Plantago as sources of medicines since ancient times. Seeds of the European species, *Plantago psyllium* have long been known as the psyllium seed of commerce and the seed of *Plantago ovata* of India has become known as "Blond Psyllium Seed".

The United States imports annually an average of three million pounds of blond psyllium seed or husks (seed mucilage) from India and Pakistan. It is used in pharmaceuticals, principally as a laxative.

Establishing a Crop

There have been various attempts to grow plantago (P. *ovata*) as a crop in Arizona during the past 20 years. Most of the failures were due to frost damage and root rot diseases. Renewed efforts to establish plantago as a commercial crop have been made during the past three years. Although partially successful, the possibility of frost damage still plagues the crop.

Some research on plantago has been conducted at the Arizona Agricultural Experiment Station since 1952, and these efforts were intensified during 1961 to 1966. Most of the research during the past six years has been directed toward development of varieties which are frost tolerant. Varieties have been developed with these characteristics and seed is being increased. It is possible that these new varieties could firmly establish plantago as a crop in Arizona.

As a commercial crop, plantago is planted in the lower valleys of Arizona, where temperatures less than 22°F. usually do not occur. It is planted in November and harvested in May. The crop requires light sandy loam soils, well drained and free of weeds.

Plantago is planted in borders and flood irrigated;

(Continued on Next Page)

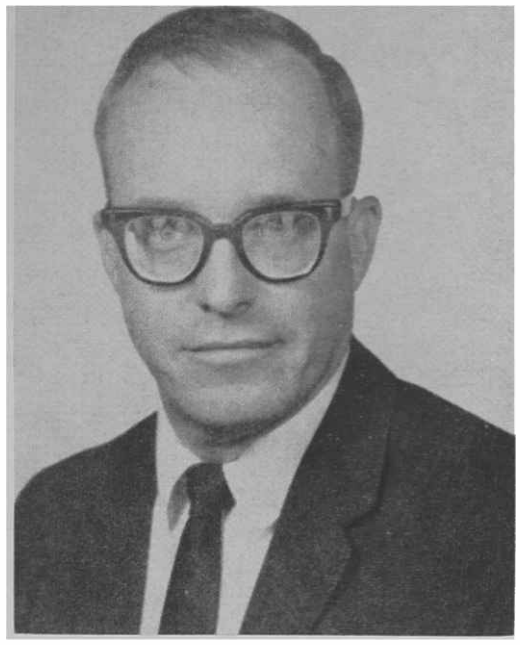
Dr. George Ware New Head of Entomology

Dr. George W. Ware becomes head of the Department of Entomology in The University of Arizona College of Agriculture, July 1.

Dr. Ware came to the UA a year ago from Ohio State University, where for the last 10 years he conducted research and taught courses in insect toxicology and pesticide residue analysis. Prior to that, he served four years as an independent cotton entomologist and two years as a medical entomologist in the army.

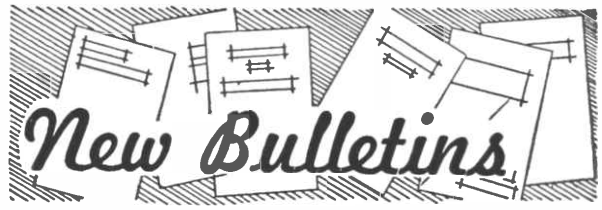
He received his B.S. and M.S. degrees from the University of Arkansas and his Ph.D. at Kansas State University. He has authored or co-authored more than 50 scientific papers, chapters and articles.

Dr. Ware plans a revised entomology program with strengthened graduate and undergraduate curricula supported by new projects in both basic and applied research. The applied aspects are aimed at solving some of the more serious insect and insect-related problems of Arizona.



Dr. George Ware

As department head, Dr. Ware succeeds Dr. Laurence A. Carruth, head of the Entomology Department the past 18 years. Dr. Carruth will remain as a professor in the department.



C-195 Household Pests (revised)

C-282 Home Citrus in Arizona (revised)

A-33 Growing Grapes in Arizona (revised)

The world is full of magical things, patiently waiting for our will to grow sharper — Eden Phillpotts (in "A Shadow Passes," issued by Macmillan)

Accident — An event frequently descended from a long line of advice not listened to.

You can preach a better sermon with your life than with your lips—Oliver Goldsmith.

No man can justly censure or condemn another, because indeed no man truly knows another — Sir Thomas Browne.

(Continued from Previous Page)

some is also planted on new unleveled land and watered by sprinkler irrigation. Yields of experimental plantings with good stands have varied from 1000 to 1200 pounds of seed per acre.

Plant Description

Plantago ovata plants are grass-like in appearance. However, the species is not of the grass family but of the plantain family. Plants are stemless herbs with leaves in rosettes, and seed stalks (scapes) terminating in spikes at a height of 8 to 12 inches. In Arizona the plants grow as a winter annual.

Seeds average 1.5 mm. wide and 2.5 mm. long, are boat-like in shape, are reddish-brown in color, and average about 30 percent mucilage by weight. The seed mucilage is the outer layer of the epidermis of the seed coat. It can be removed from the seed mechanically. It is a white fibrous material which absorbs water readily to form a thick gelatin-like mass.

In Arizona many are familiar with the native *Plantago insularis* which is commonly known as the Indian wheatgrass of the desert. The *P. ovata* and *P. insularis* species are so similar in appearance that they are often difficult to distinguish. Their growth habits, however, are different and they do not cross naturally. *P. insularis* is more cold tolerant and root rot resistant.

Frost Tolerance and Yield

Objectives of the breeding program are to make improvements in cold tolerance, root rot resistance, height, shattering resistance and yield. Early efforts in improving *Plantago ovata* were futile because of its susceptibility to frost damage, thus the first major objective was to improve cold tolerance.

Because of the lack of variability in *P. ovata*, an interspecific cross between *P. ovata* and *P. insularis* was attempted. With special techniques a few crossed seeds were obtained in 1957 and 1958.

FROST SURVIVAL tests, Tucson, in March of 1962. Over 700 selections were planted the previous November. Excellent stands were obtained, but about 99 percent of the plants froze out in January. Staked plants (above) are survivors, saved for future interpollinating tests.

Progenies from these were grown in Tucson, where severe frosts froze out as much as 99 percent each year. By 1963 lines were obtained that withstood frosts with temperatures as low as 12°F. and had seeds of the *P. ovata* type.

From this interspecific cross new variability is now available so that improvements can be expected in yield, root rot resistance and other agronomic characteristics.

Future of Plantago

The future of plantago largely depends on development of improved varieties for economic yields and frost tolerance. Successful development of a local processing plant is also important. A few thousand acres could supply current demand.

However, development of new uses could increase this demand. Experiments conducted by various researchers elsewhere have shown the seed mucilage to be a good stabilizer in ice cream and other foods, a good sizing in printing and finishing cloth, and a good stabilizer in hair setting lotions.

Some day, because of plantago mucilage, you may be able to eat a chocolate candy bar in the heat of the Arizona sun without it melting.

Fred Voorhees, manager of Yerba Buena Ranch near Nogales, designed and built this portable corral-transport. Those who have seen it in operation are impressed. Fred calls it the handiest tool on the ranch. It gives him an extra corral anywhere that can be reached by pickup or tractor. In fact, he'd rather have this unit than several more permanent corrals on the outlying ranch areas.

Detail plan drawings are available by writing to: Extension Agricultural Engineer, University of Arizona, Tucson, Arizona 85721. Ask for Plan No. A155.

By W. T. Wel

The authors
Engineer and S
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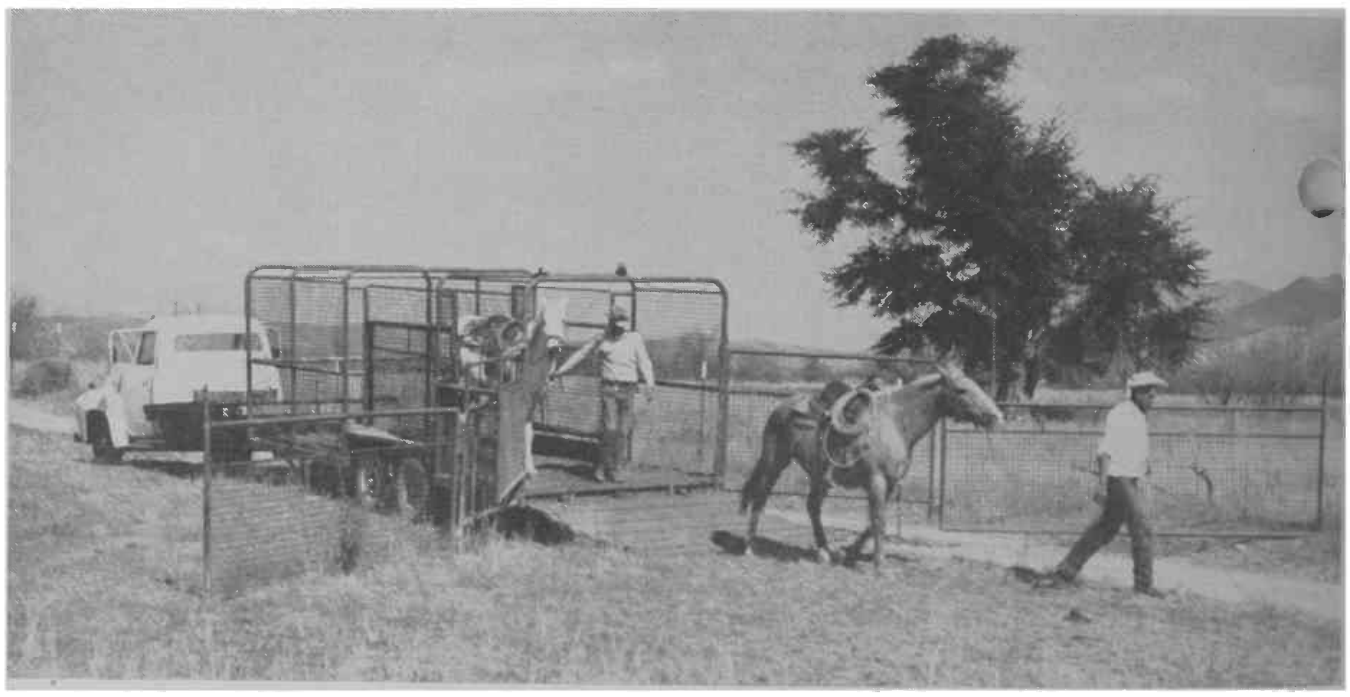
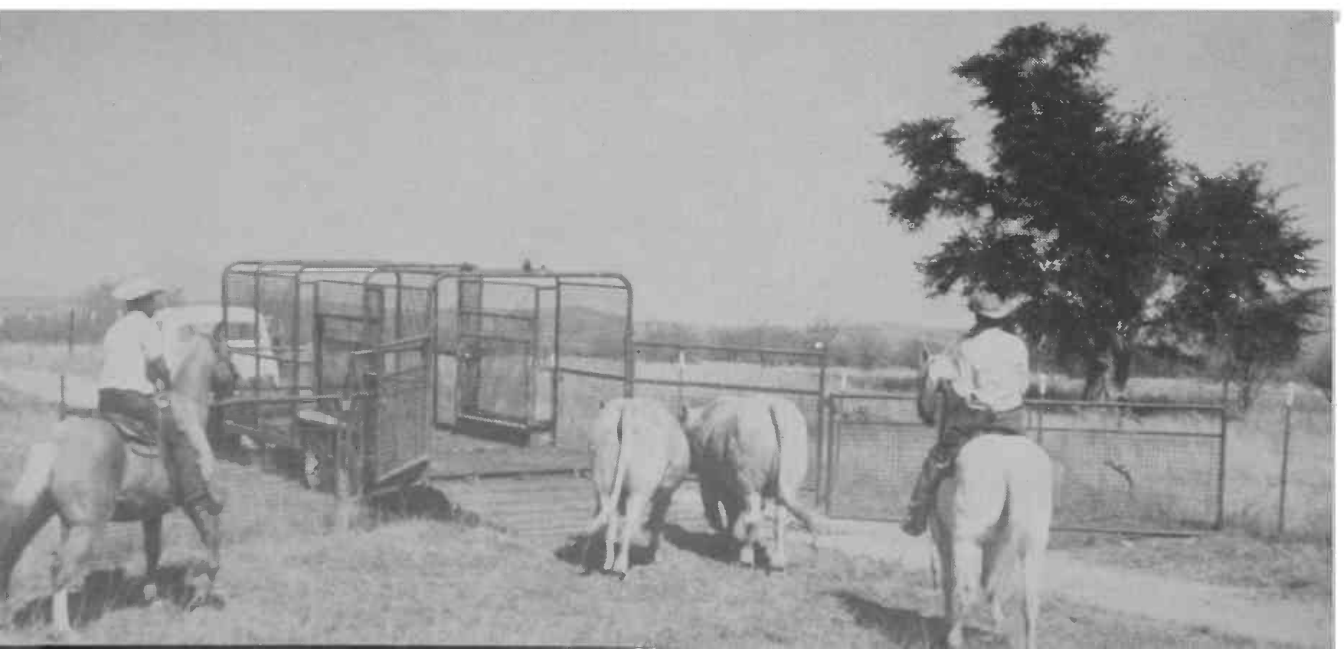


A pickup or tractor tows the implement to the range and is parked near a fence line. The loading ramp is lowered by a winch and corral wings are extended. Saddle horses are unloaded and the roundup begins.



Here, two bulls are to be transported to another range. Animals load easily and seem to have little fear of the implement because they can see through and beyond it. Low clearance and mesquite hulls on the floor also seem to help.

rtable Corral - Transport

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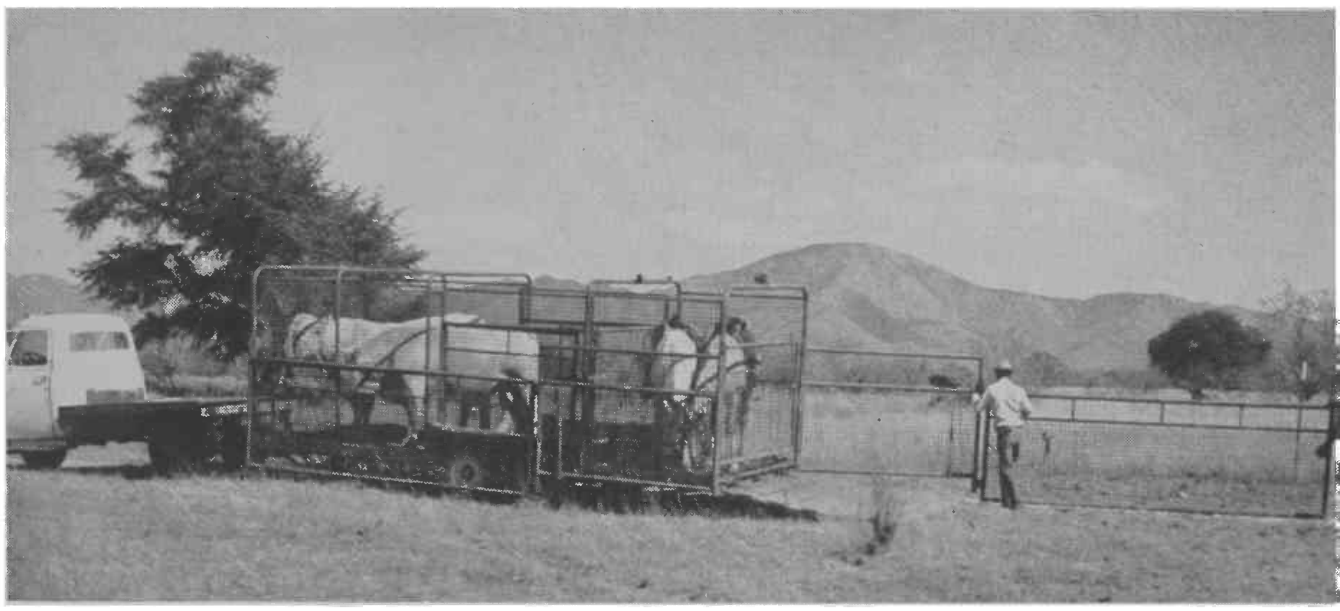
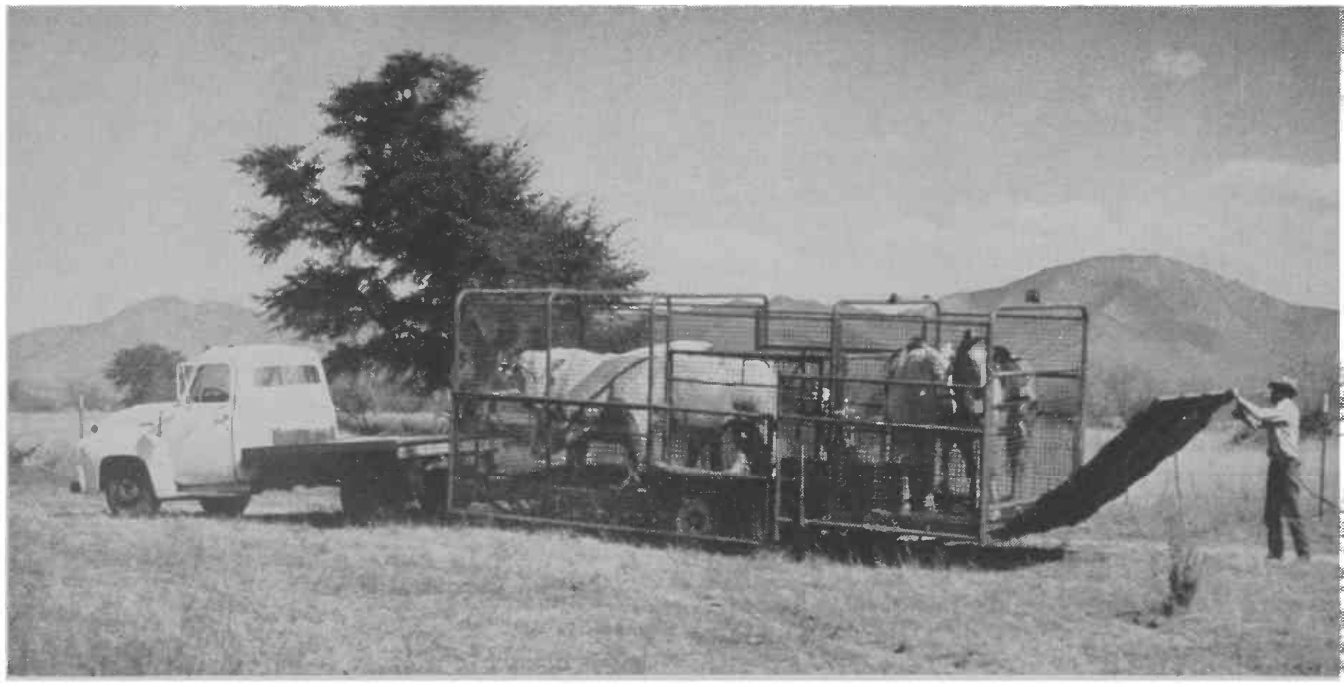


The gate is closed in the forward compartment, isolating the bulls from the horses. The corral wings are folded back and hooked to the side of the implement. Actually, there are three compartments. The front compartment will hold six mature cows. The middle will hold about six calves and the rear two saddle horses. All three compartments will hold about 25 400-pound calves.

With the loading ramp winched into carry position, the trailer is ready for transport to another range or corral system. Since the maximum load will approach 10,000 pounds, a wide front wheel farm tractor is recommended, particularly in rough range country.



Here, 25 calves are being unloaded at the ranch headquarters. On the Yerba Buena, this corral-transport has been used for a variety of cow-calf treatment operations. Sick or "down" animals have been winched onto the trailer. First calf heifers have been picked up for special care at the main corral. Vaccinating, tagging, marking and spraying can be done out on the range.

Eventually, Mr. Voorhees plans to equip the front compartment with a head gate or squeeze chute system for artificial insemination, dehorning, branding and similar functions. He also intends to relocate the "winch" on the front end of the unit. Here it could be connected to the power take-off unit on the tractor, or run by battery from a truck.

Purchase and Care of Household Appliances

By Alice M. Lowell

In recent years, American manufacturers have developed and produced a vast array of household equipment for American families. Consumers have purchased these products enthusiastically. The result is that our modern homes are highly mechanized.

Most homes today have such major electrical appliances as refrigerators, vacuum cleaners and washers. Many also have electric ranges, dryers, freezers, food waste disposers and dishwashers. Small appliances most likely to be found in the majority of homes are irons, toasters, mixers and coffeemakers. A variety of other small appliances such as electric skillets, blenders, sandwich-wafflers, rotisseries, electric knives, can openers and hot plates are frequently a part of the inventory in today's mechanized home.

A study done at the University of Arizona in 1962 revealed that Arizona families owned an average of nine small appliances. Investment in this equipment may amount to thousands of dollars and the home manager faces problems of maximizing satisfactions from the investment. Not only must problems of proper selection, care and operation of such appliances be worked out, but other problems to be solved concern house wiring, storage space as well as working space, so that full use of all equipment is possible.

Useful Only If Used

Use of equipment is perhaps the single most important criterion when justifying investment in such goods, yet often appliances do not give full value in terms of use simply because of insufficient electric supply to the house itself or to kitchen and workrooms. Idle equipment means a poor return on invested capital, and is an extravagance most families cannot afford.

Assuming that enough electric power is provided to the house through the service entrance, the home manager assesses the adequacy of wiring within the house. Because of high wattage demands of new appliances, often existing circuits do not provide for successful operation of all equipment desired or presently owned.

3 Types of Circuits

Three types of circuits needed in the home are: 1) General purpose circuits for lighting outlets throughout the house and all convenience outlets except those in the kitchen, dining areas, and laundry; 2) Special purpose circuits for the electric range, electric dryer and electric water heater. 3) Appliance circuits. At least two are needed in the kitchen and one is also desirable in the laundry area.

Two 115 volt, 20 ampere circuits will carry a total of 4600 watts. The 15 ampere - 120 volt circuit provides for a load of only 1800 watts, but many homes are so wired. Individual power circuits are needed for such equipment as the dishwasher, freezer, workshop bench, bathroom heater, attic fan, water pump and furnace blower. It is good practice also to place the automatic washer and refrigerator on individual circuits.

When figuring wattage requirements for small electrical appliances it is surprising to learn how high the requirement is for heating appliances. As a general rule each requires enough wattage to be connected only to an appliance circuit. The electric ratings of heating appliances usually range between 1000 and 1500 watts, although some rate as high as 1650 watts. Automatic irons, coffee makers, toasters and waffle bakers generally require from 1000 to 1200 watts, the rotisserie or electric roaster requires 1650 watts. One circuit may permit simultaneous use of a 1200 watt frying pan and a 1150 watt toaster but a third appliance will blow the fuse. The 15 ampere-120 volt circuit allows for only one high wattage appliance at one time.

Motors Require Less

Small motor-driven appliances require less wattage. Portable mixers require less than 100 watts, blenders 230 to 300 watts. Usually these may be used successfully along with heating appliances on the same circuit.

An automatic control panel that can be placed over the counter and under a cabinet makes it possible to use six appliances at one time in one work area. This panel requires special wiring for the load, and requires the same amperage as an electric range (50 amps). The panel has from four to six circuits, each with its own circuit breaker. It is recommended for the home which stocks many small heating appliances which are used daily.

Outlets for household appliances include special purpose outlets — those not used for random "plugging in" — Typical special purpose outlets are those used for range, clothes dryer, air conditioner, wall clocks, refrigerator and freezer. Duplex outlets are used on appliance and general purpose circuits. The new ones are polarized devices. This means that the outlet has two current contacts as well as a ground contact. Adapters are available to convert standard receptacles from 2-wire to 3-wire, the third being the ground wire.

3-Wire Cord Recommended

The polarized receptacle, having two current-carrying contacts plus a grounding contact, helps to prevent accidental shock and it guards against excessive current leakage due to faulty installation. The three wire power cord on appliances with its 3-prong plug for appliance grounding is to be recommended. The circuit must be grounded to match the appliance plug.

Toasters, broilers and other appliances with open-coil heating elements should not be grounded. Generally, all other electrical devices, including power tools, should be grounded. The use of three-wire power cords on portable electric appliances calls for the installation of three-prong receptacles and the outlet must be specially grounded by the electrician.

Before purchasing new appliances, storage space should be considered. Heavy appliances such as rotisseries and mixers are best stored at the place of use, for if they must be moved each time they are used they will not be used often. The portable mixer may be conveniently stored on the wall near the place where it is used most often. Such an arrange-

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The author is a professor in the School of Home Economics.

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ment necessitates drawer space for beaters and cord close by. Toasters, waffle bakers, coffee makers and blenders require special dimensional shelf space and ample allowances should be made. When estimating storage needs for small electrical appliances be sure to include space needed for storing lids, cords, and attachments.

Things to Consider

When selecting small electrical equipment some general considerations include: Price, reliability of the manufacturer, reliability and availability of servicing, warranties and guarantees, performance of the appliance. An understanding of materials used, as well as an understanding of operating components, helps one to make wise selections. There are many good sources of information about household equipment. These include U. S. government publications, textbooks, reports of consumer testing and rating organizations, journals and magazines, manufacturer's handbooks and service manuals. Readers are invited to obtain from their County Extension Office, or from this College of Agriculture, Publication C-142, "Household Equipment — Its Care and Repair."

Don't overlook the appliance service man as a valuable source of information. He can give information about the appliance being serviced and also pertinent information about other appliances. Ask him questions. Learn from him.

Here at the University of Arizona our home economics course in household equipment emphasizes selection, care and use of small electrical appliances. Students learn about base materials, finishes, construction features and operating components of the appliances presently available. We test many brands and evaluate performance of a variety of small appliances. Students learn how to judge merits of many makes and models of labor-saving equipment. Some appliances rank high after such evaluations. Some do not seem worth the price they cost, the effort they cost to set up, to use, and put away.

Some Good; Some Bad

Some equipment performs important tasks efficiently. Other pieces are scarcely worth their storage space in terms of work performed. Our students learn to choose wisely and to spend money efficiently, the end result being better "buymanship," and more satisfaction.

Recent Journal Articles Listed

EDITOR'S NOTE: In addition to the various "popular" publications of this College of Agriculture — Extension folders, Extension bulletins, 4-H materials, the popular bulletin series, technical bulletins and others — staff members submit a prodigious output of material to the scientific journals in a score or more of fields of scientific inquiry. A listing of recent journal papers is given in each issue of PROGRESSIVE AGRICULTURE IN ARIZONA. Readers who wish copies of certain papers should write directly to the authors. The listing below includes Journal Number, title of the paper, authors, and journal to which the article was submitted.

1182 "The Photolysis of Diazomethane and Ethyl Diazoacetate in the Presence of 4-Octyne"
by Hanns Lind and Archie J. Deutschman, Jr.
Journal of Organic Chemistry

1183 "Nitrogen Fertilizer Timing for Winter Potatoes"
by Paul M. Bessey
American Potato Journal

1184 "Estimation of Leaf Area of Moapa Alfalfa at Various Stages of Growth and Temperature Periods"
by Gayland D. Robison and M. A. Massengale
Crop Science

1185 "Methyl Glucosides II. The Synthesis of Methyl 3-0-Ethyl-2-D-Glucopyranoside"
by J. T. Marvel, S. K. Sen, J. W. Berry and A. J. Deutschman, Jr.
Journal of the American Chemical Society

1186 "Methyl Glucosides III. 1,2 Line Broadening of the C Proton in the NMR Spectra of Methyl 4,6-0-Benzylidene-2-D-3 Glucopyranoside Acetates"
by J. T. Marvel, S. K. Sen, J. W. Berry and A. J. Deutschman, Jr.
Tetrahedron Letters

1187 "Buffering CMV Innoculation of *Chenopodium Amaranticolor*"
by Robert E. Foster
Phytopathology

1188 "Host Nutrition Affects Cucumber Mosaic Virus Infection"
by Robert E. Foster
Phytopathology

1189 "On the Homeologous Chromosome Substitution Hypothesis in *Sorghum Vulgare*"
by W. J. Washington, R. L. Voigt, and J. E. Endrizzi
Journal of Genetics

1190 "Appraising Grower's Role in the Broiler Industry of the Future"
by Hilliard Jackson
Proceedings of the American Farm Bureau Annual Meeting Las Vegas, Nevada, December 5-7, 1966

1191 "A Rust on *Anemopsis Californica*"
by Paul D. Keener and Jack E. Hampton
Madrono

1192 "A Micro-Digestion Procedure for the Determination of Aminoid Nitrogen in Plant Material"
by Hasan K. Qashu
Agronomy Journal

1193 "A New Strain of Tobacco Mosaic Virus from *Lychnis alba* Mill"
by M. Chessin, M. Zaitlin, and R. A. Solberg
Phytopathology

1194 "A Rapid Calendar Date Counter"
by George H. Abel
Agronomy Journal

1195 "Leaf Growth, Leaf Aging, and Leaf Photosynthetic Rates of Cotton Plants"
by H. Muramoto, J. D. Hesketh, and C. D. Elmore
Paper to be presented at Cotton Improvement Conference, Dallas, Texas, and published in proceedings of the Conference

1196 "Some Effects of Plastic Antitranspirants on Plant Growth"
by Steve Fazio
Proceedings of the Seventh National Agricultural Plastics Conference

1197 "Lipids of the Weddell Seal, Leptonychotes Weddelli"
by Gerald Scott
Journal of Mammalogy

1198 "Muskmelon Micrografts"
by Robert E. Foster
Horticultural Research

1199 "Whitefly Abundance and Cotton Leaf Pubescence"
by G. D. Butler and H. Muramoto
Journal of Economic Entomology

1200 "Input-Output" Analysis: The Arizona Model
by William E. Martin and Leonard G. Bower
Arizona Review

1201 "The Live Cycle of *Hypera burnneipennis* (Boh.) in Relation to Temperature
by George D. Butler, Jr. and Philip L. Ritchie, Jr.
Journal of Economic Entomology

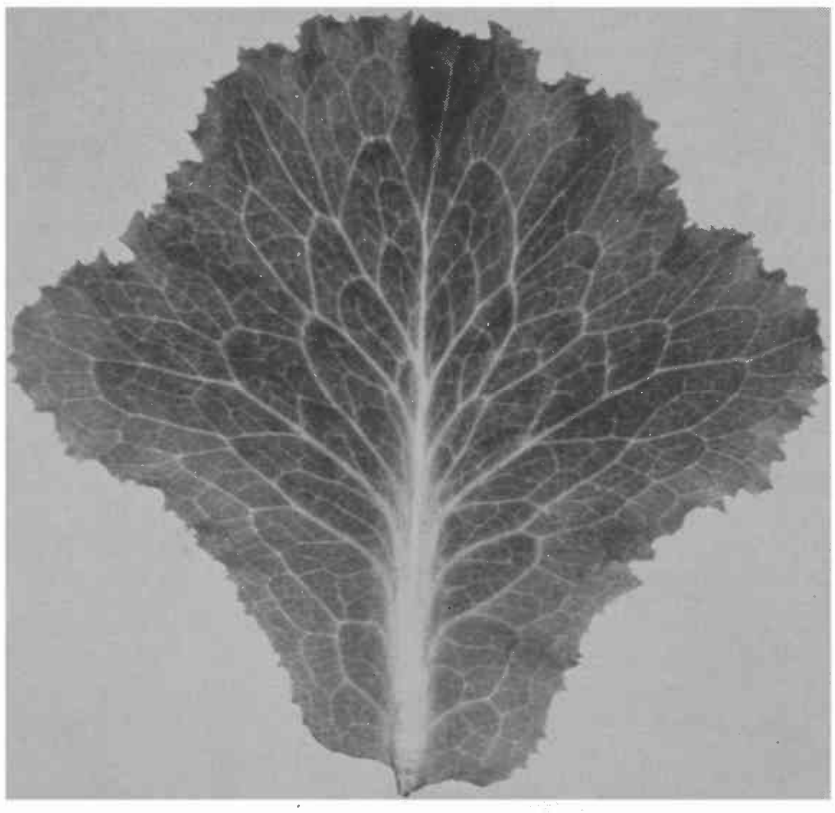
1202 "A Revision of *Acanthinus* (Coleoptera: Anthicidae). VI
by Floyd G. Werner
Annals of the Entomological Society of America

1203 "Registration of Maricopa Wheat"
by A. D. Day, R. K. Thompson, and F. M. Carasso
Crop Science

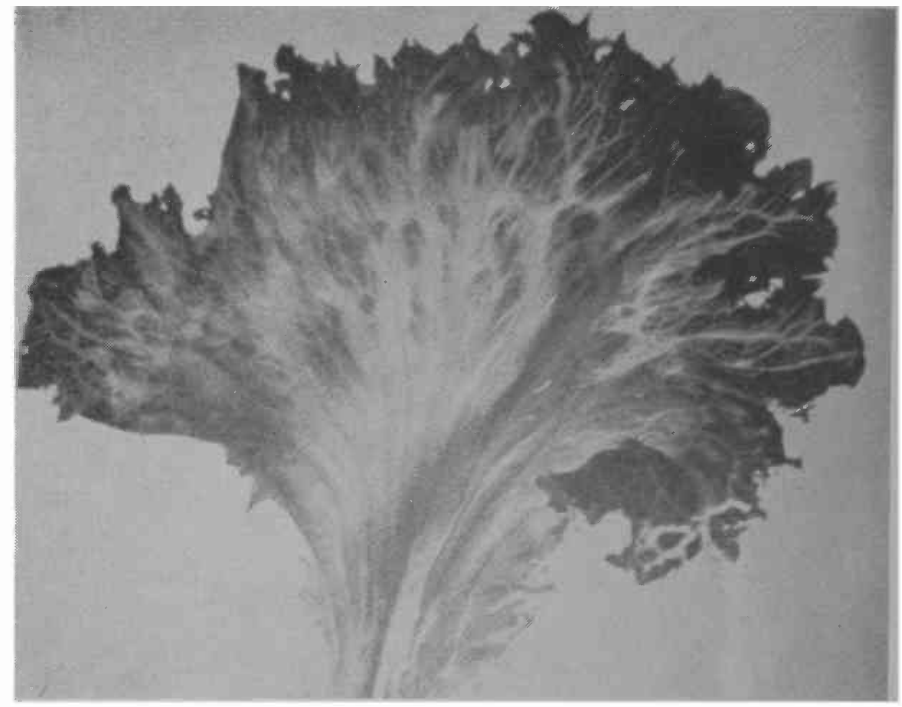
1204 "Oil Composition of Cucurbita"
by W. P. Bemis, J. W. Berry, M. J. Kennedy, D. Woods, M. Moran, and A. J. Deutschman, Jr.
Journal of Am. Oil Chemists' Soc.

VIRUS DISEASES OF LETTUCE IN ARIZONA

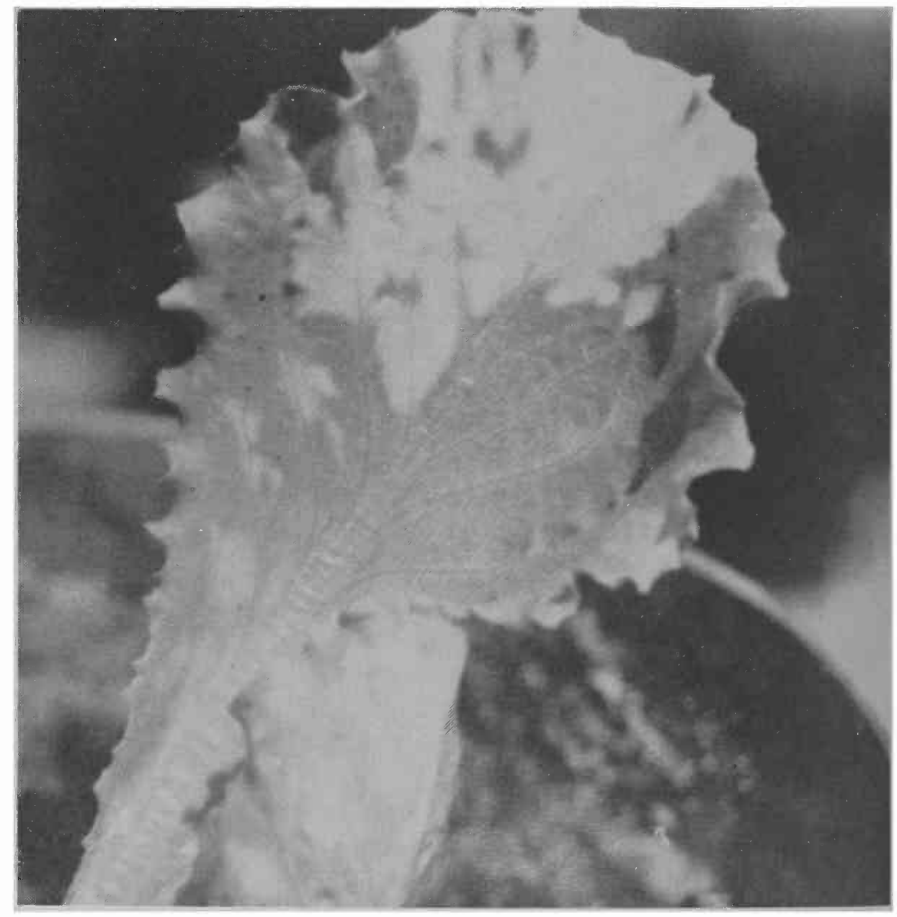
By M. R. Nelson and A. D. Davison



Healthy Lettuce Leaf



Lettuce Leaf With Big Vein



What Pathologists Call "Calico"

As is true of most crops grown in Arizona, lettuce has its share of virus diseases. Probably the best known of these is the seed transmitted lettuce mosaic. However, the long recognized big vein disease is also ever present. Recently, several other virus diseases have been discovered in commercial lettuce fields in Arizona, namely cucumber mosaic and alfalfa mosaic. However, the presence of spotted wilt or "San Pablo blight," long thought to be a disease of Arizona lettuce, has not been confirmed.

Lettuce Diseases Present

Big Vein

Virus: Big vein virus.

This virus disease has long been present in Arizona lettuce fields. The virus causes, as the name suggests, enlarged veins in the leaves of lettuce. In addition, the leaf margins become frilled and distorted, giving fields (or areas in a field) a very different appearance than healthy lettuce fields.

This is a unique virus when compared with others in Arizona lettuce because it is soil-borne. The virus cannot be transmitted from plant to plant by any means other than a very small soil-inhabiting fungus, *Olpidium brassicae*, or by grafting. Since grafting does not occur in the field, transmission to lettuce, insofar as is now known, occurs solely through infection of the lettuce root by this fungus.

As most growers know, this disease occurs year in and year out in roughly the same areas of a given field. Thus it is believed that the virus somehow exists between crops, along with the fungus spores, in soil.

Lettuce Calico

Virus: Alfalfa mosaic virus (AMV).

This aphid-transmitted virus causes mosaic-like calico patterns in many different crop and ornamental plants. "Calico pattern" refers to large or small, irregularly shaped, brilliant yellow areas in the leaves of infected plants. These, with time, bleach to a white, chalky color.

The most important source of AMV for infection of lettuce is probably alfalfa. However, dooryard ornamentals could also serve this purpose where lettuce fields are located near towns or peripheral subdivisions. Al-

(Continued on Next Page)

Dr. Nelson is a professor in the Department of Plant Pathology, while Dr. Davison is Extension Specialist in Plant Pathology.

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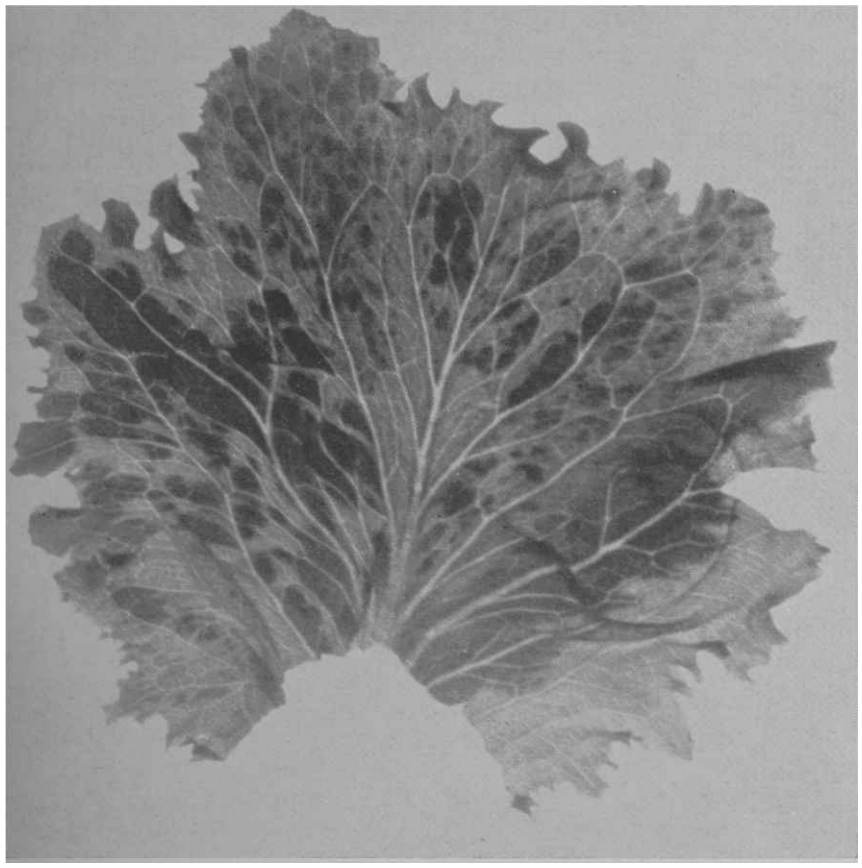
falfa, of course, is the best host for survival of this virus in the desert because it is perennial. Symptoms on alfalfa are present in the fall and spring but scarce during hot summer weather.

Lettuce Mosaic

Virus: Lettuce mosaic virus (LMV).



Lettuce Mosaic (lettuce mosaic virus)

This is one of two very similar mosaic diseases now known to occur in Arizona lettuce. This one, however, has one unique feature when compared with other virus diseases of lettuce — it is seed transmitted. Seed transmission gives a virus disease a tremendous epidemiological advantage over other diseases of similar nature that are not seed transmitted.

This is because the distribution of the virus does not depend upon the vagaries of insect vectors, or the necessity of having some alternate host to maintain the disease "between seasons." However, when seed transmission is the main means of spread, the grower has the excellent possibility of controlling the disease by using "clean seed." Clean seed is obtained from lettuce grown in areas where lettuce mosaic is uncommon. In addition, attempts are made to keep these seed fields as disease free as possible.

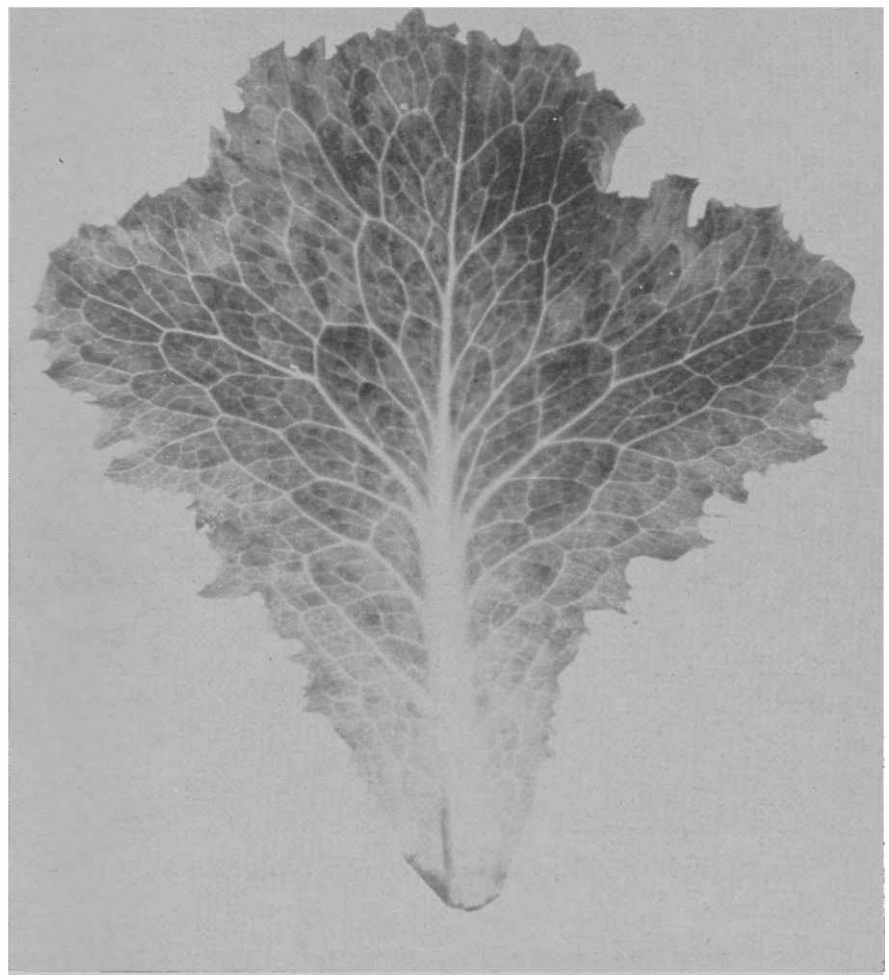
Lettuce seed grown in this manner is tested, or indexed to determine the proportion of seeds infected. If the proportion of seeds infected with mosaic is low (less than .1% or 0 in 30,000) the seed is sold as mosaic tested. Such seed is ordinarily available, and its use is effective in keeping lettuce mosaic in check.

Since lettuce mosaic virus has a wide host range among noncultivated plants, these are believed also to serve as sources of infection from time to time, but their importance is not as great as seed transmission.

Lettuce Mosaic

Virus: Cucumber mosaic virus (CMV).

Cucumber mosaic virus has long been known to infect field lettuce in many parts of the world (New Zealand, Australia, England, West Germany, Belgium,



Lettuce Mosaic (cucumber mosaic virus)

etc.). It wasn't until the fall of 1966, however, that we first detected this virus in Arizona lettuce. Since that time, we have found it consistently in certain areas.

We have suspected that CMV in lettuce probably has the same distribution patterns as CMV in muskmelons (Prog. Agr. Vol. XIX, No. 2, p. 26). Recent work confirms this suspicion. Sources of CMV for both muskmelons and lettuce are dooryard ornamentals. As a result, CMV in both muskmelons and lettuce is restricted to areas around country homes, towns and peripheral subdivisions of cities.

CMV is transmitted by many of the same aphids that transmit LMV but CMV is not seed transmitted. Consequently, LMV remains the biggest threat to the lettuce industry. However, because of grower use of clean seed, the two mosaics are probably currently of more or less equal importance.

The range of symptoms of CMV and LMV on lettuce are, for practical purposes, indistinguishable. They both produce typical mosaic patterns on leaves of infected plants which cannot be differentiated in the field. Because of this, it is quite likely that in the past, CMV infection has, at least occasionally, been diagnosed as LMV. The only way to make a positive identification of either is by indexing plant samples on a series of differential hosts in the greenhouse, or by use of serological techniques.

Lettuce Virus Diseases of Interest But Not Yet Present in Arizona

Spotted Wilt (San Pablo blight)

Virus: Spotted wilt virus.

Recent research has indicated that this disease does not occur in Arizona. It is included in this report, however, because it has long been thought to be a problem in Arizona lettuce. There is no denying the fact that symptoms resembling spotted wilt, as it occurs

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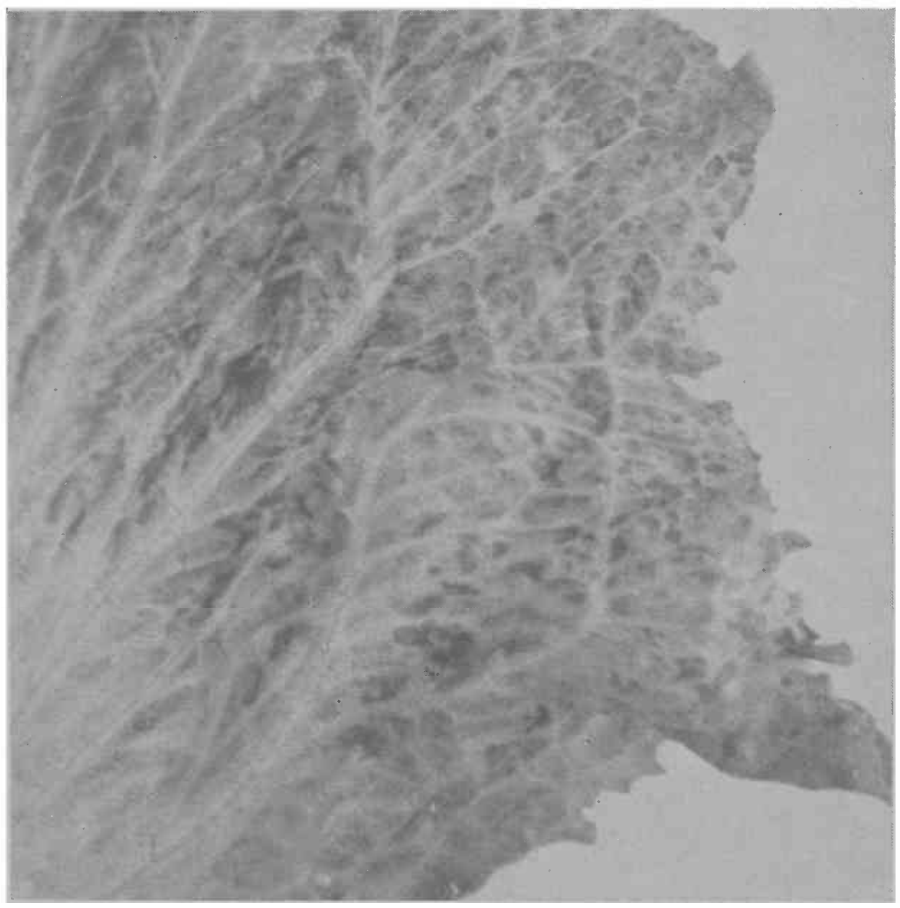
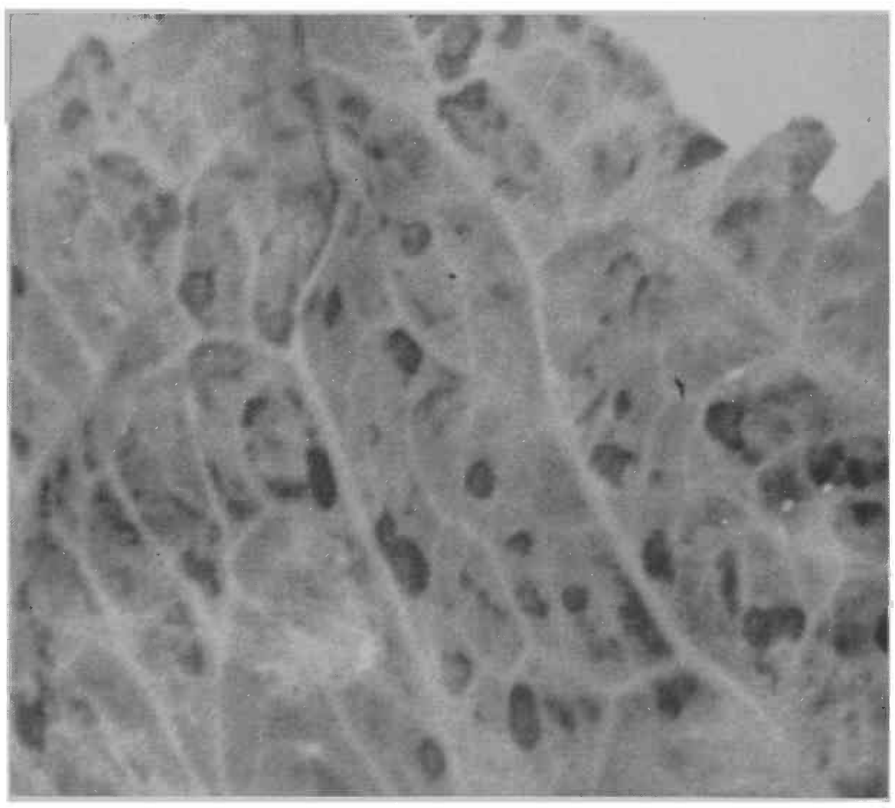


Arizona Necrotic Fleck; Cause Unknown (magnified 1½ times)



Arizona Necrotic Fleck (magnified five times)

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in California, do frequently occur here. However, numerous attempts to demonstrate the presence of the spotted wilt virus in lettuce obtained from fields in central Arizona have ended in failure. This is one fact that leads to the conclusion that this virus simply is not the cause of what has been considered to be "San Pablo blight" in Arizona.

A further reason for such a conclusion is the lack of reports of the occurrence of this disease in other Arizona crops. Spotted wilt virus infects an exceedingly long list of plants — many ornamentals, tomatoes, peppers, eggplant, etc. If the disease were widespread in lettuce as suggested, then certainly at one time or other one or more of these other crops would have been infected. To our knowledge no such reports have been made.

The spotted wilt virus, where present, is transmitted by thrips.

San Pablo blight (necrotic fleck) in Arizona is now considered to be a non-parasitic disease. The distribution patterns of this malady suggest that it is not a virus disease. Further, neither pathogenic fungi nor bacteria have been found associated with these necrotic spots. This condition could be related to the sudden change, during the spring, from cool damp nights to warm dry days. Also, such necrotic flecks may be a result of air pollution, since they are similar to "weather fleck" of tobacco which is caused by high ozone levels. High ozone levels are related to air pollution. Both of these possible explanations are highly speculative, and much more research needs to be done before positive conclusions can be reached.

Lettuce Calico

Virus: Tobacco ringspot (TRSV).

Tobacco ringspot is another virus with an extremely wide host range — melons, lettuce, soybeans, many

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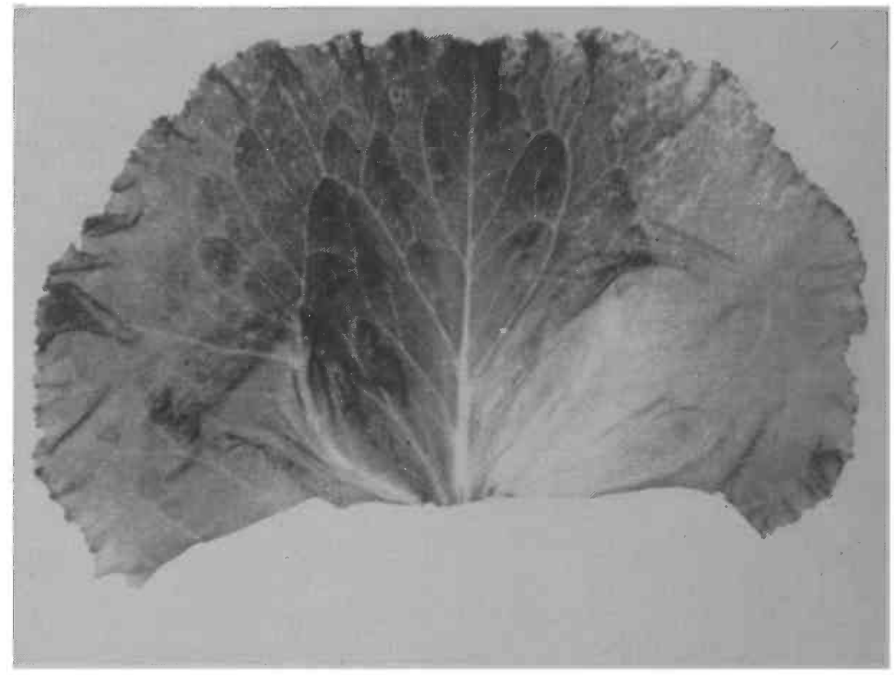
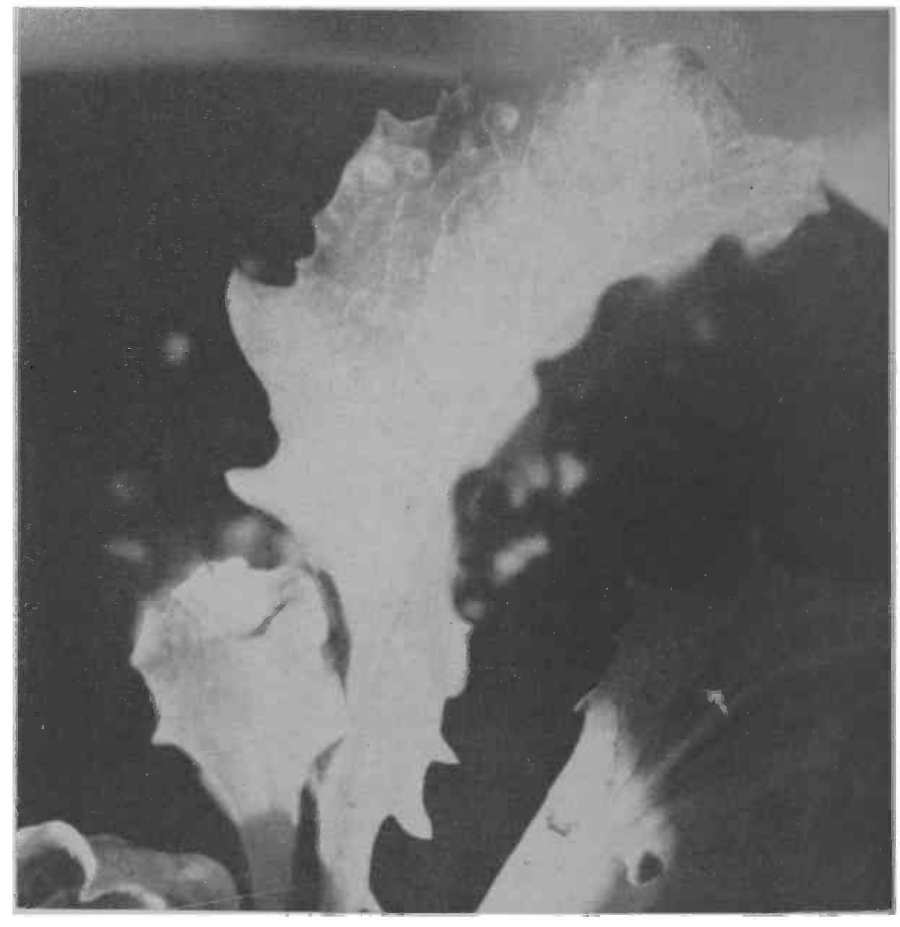


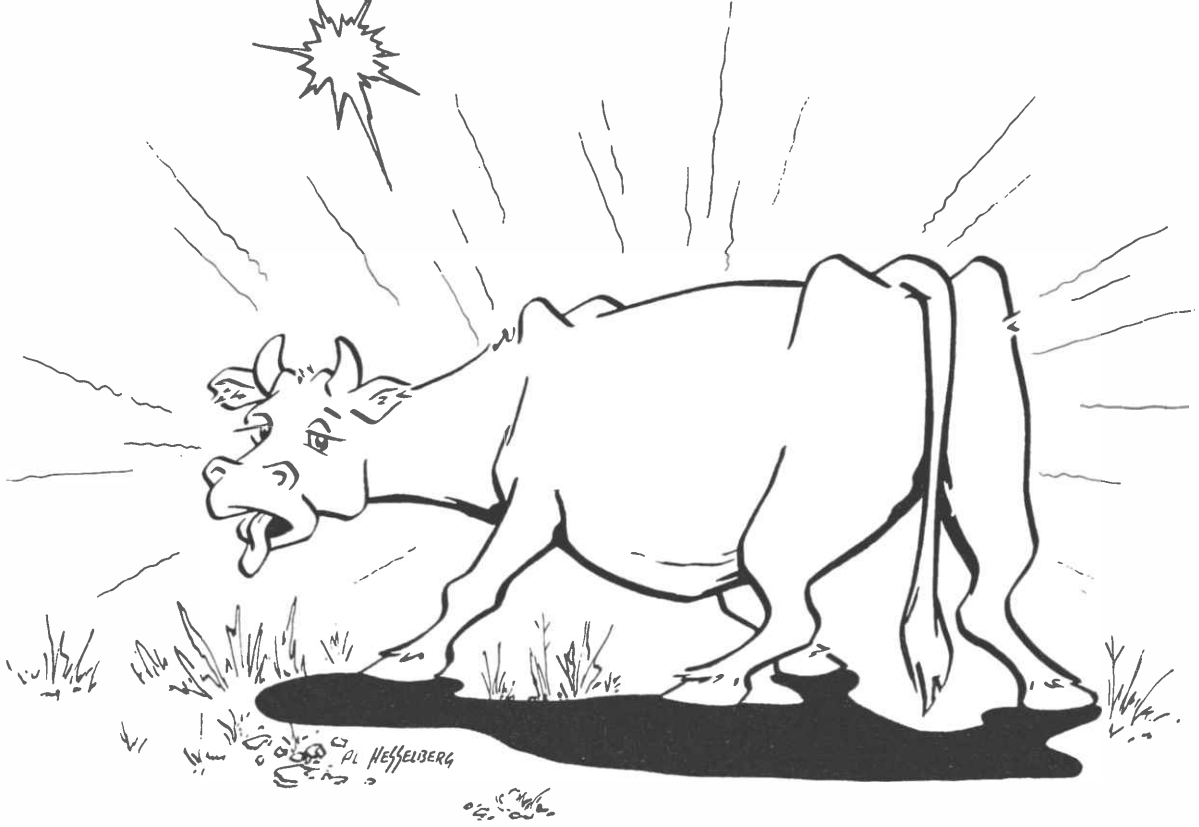
Tobacco Ringspot, With Calico and Yellow Rings on Old Leaf



Tobacco Ringspot; a Young Leaf With Yellow Rings

Animals Have 'Thermometry'

By Raymond E. Watts



One of the reliable factors that physiology presents to the clinician is temperature regulation by the animal body. Evidence provided by animal experimentation reveals the location of thermoregulatory centers in the brain. These regulatory centers are influenced by the temperature of the blood flowing through them and by reflex from the skin.

The external or surface temperature of an animal may differ slightly from the internal temperature due to the influence of environment, external blood circulation and body activity. The surface temperature is more variable and may vary with the site or location on the animal's body. The internal temperature in health is remarkably constant and may remain unchanged even though the environmental temperatures varies from 0° F. to over 100° F.

As each animal has its own thermostat control, there may be slight individual differences within a species, so each animal has its own normal temperature. The temperature regulating centers are not well developed in the very young animal, consequently slight variations are not uncommon in these individuals.

Types of Heat Loss

Normal body heat is produced by the chemical reactions in the various tissues. Heat loss from the animal body depends on physical regulation. Heat is lost mainly by transfer to another object, transmission to another solid, liquid or gas by way of conduction or convection (fans, etc.). There is some body heat lost through water evaporation from the skin, the tongue in some animals and from the lungs through the respiratory tracts. There is also some slight body heat lost in the elimination of wastes excreted. The thickness of hair coats of animals often varies with seasonal change of temperature, which is one of nature's ways of regulating body heat loss or conservation of body heat.

Such endocrine glands as the thyroid and adrenals play an important role in the regulation of body temperature. By their secretions body temperature may be maintained because of their influence on tissue metabolism.

If nature has provided our animals with such fine built-in temperature controls, why should we be so concerned with such things as their internal temperatures? Since man has utilized animals for man's benefit he has taken an increasing interest in the well being of his animals.

When Something Goes Wrong

Early workers learned that when their animals were ailing there was disturbance in the heat regulation. These early workers noted such disturbances by laying their hands on different parts of the animal body — such as the nose, ears, horns, loins, and extremities — and were able to approximately detect hot and cold areas. With the development of the closed glass columned thermometer, it was soon learned that the internal temperature was more reliable, and for accurate reading it should be allowed to remain in place 3 to 5 minutes.

Determination of internal temperature of animals is of great importance in estimating an animal's health. We have learned that some infectious microorganisms are able to gain entrance to the animal tissues. One of the earliest symptoms of many such invasions is a disturbance of the animal body heat regulation. This disturbance causes an elevation of the built-in thermostat or temperature controls in the brain, resulting in an elevated internal body temperature which we call fever.

Generally speaking, the infecting microorganisms produce toxins or poisonous materials which speed up tissue metabolism, so the balance between body heat production and loss is disturbed. Early in a systemic infection the skin is cold and pale because there is a reduced loss of body heat from the body surface. This same chemical reaction produces local shivering which is nature's attempt to step up the surface blood flow.

As the disease progresses, a response is set up in the heat centers which causes the blood vessels at the surface to become dilated, and the blood flow is increased there. With an increased blood flow at the surface there is flushing and a raise in the surface temperature, but because there is a disturbance in the brain center along with a reduced loss of heat from the body surface, more body heat is retained in fevers.

As Temperature Drops

There are some toxins, chemical and plant poisons that so affect the

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Dr. Watts is a professor in the Department of Animal Pathology.

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ornamentals, etc. This virus is believed to be regularly introduced into Arizona by means of seed transmission in a variety of crops. However, it has never become established here, either because of the climate or the absence of proper vectors (unknown).

It is of interest to this report because it does cause a calico symptom vaguely similar to that caused by AMV. The difference is that this calico pattern is much less extensive and not as brilliantly yellow as with AMV infection. Ordinarily, small chlorotic rings are associated with TRSV calico but not with AMV calico.

NITROGEN BOOSTS RANGE PRODUCTION

By Phil R. Ogden, Jack L. Stroehlein and E. M. Schmutz

What effect does nitrogen fertilization of a native range have on livestock production? That was the objective of a cooperative study by Frank Appleton, owner of Elgin Hereford Ranch; Chevron Chemical Company; and the Departments of Agricultural Chemistry and Soils and Watershed Management of the University of Arizona.

Native desert grassland near Elgin, Ariz. was fenced into six 60-acre pastures in late June and early July of 1966. Four pastures were fertilized wth 50 pounds of nitrogen per acre (150 pounds of ammonium nitrate), and two pastures were not fertilized. The graph below shows the pasture plan for the study. Fertilizer was applied by fixed-wing aircraft on July 21, 1966 after the soil was moist from initial rains (1.75 inches prior to fertilization).

The authors are members of the Departments of Watershed Management and Agricultural Chemistry and Soils.

Use Three Groupings

Bill Piper, manager of the Elgin Hereford Ranch, selected 80 heifers which were weighed and assigned to the six pastures as follows:

a) five 2-year-old, bred heifers and 5 yearlings to each of two unfertilized pastures as checks;
b) five 2-year-old, bred heifers and 5 yearlings to each of two fertilized pastures; and
c) ten 2-year-old, bred heifers and 10 yearlings to each of two fertilized pastures.

The replicated pasture treatments provided a comparison of a group of animals on check pastures with an equal number of animals on fertilized pastures and with double the number of animals on fertilized pastures. Data from plot studies in the Elgin area in 1965 had shown that 50 pounds of nitrogen per acre approximately doubled forage yield.

3-Month Pasture Test

Heifers were branded with a dye number, weighed, and placed on the pastures on July 20, 1966. They were reweighed Oct. 20, 1966 and weight gain was used to evaluate animal response to fertilization of the pastures. The bred heifers were removed from the pastures on October 20, 1966 but were replaced with calves. The calves and yearlings grazed the pastures from October 20, 1966 to December 20, 1966 and weight changes were also determined for this period.

Precipitation from July 1 to September 21, 1966 averaged 12.5 inches. Storms were well distributed throughout the growing season.

Both bred and open heifers gained more per individual animal on fertilized pastures compared to nonfertilized pastures when grazed with the same number of heifers. (Figure 2). The average heifer weight gain from fertilized pastures grazed with 10 heifers was 36 pounds more per heifer for the 90 days than for the same number of heifers on nonfertilized pastures. This was a highly significant difference.

Doubling the number of animals grazing fertilized pastures resulted in a similar gain per individual heifer on fertilized pastures compared to nonfertilized pastures (Figure 2). The average gain per acre, however, was greater for 20 heifers on 60 acres of fertilized pasture compared to gain from 10 head on 60 acres of nonfertilized range (Figure 3). The 20 heifers on fertilized pasture gained

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brain centers as to cause a lowered body temperature. This enables us sometimes to diagnose an illness as being infectious or toxic in its nature. At such times, as body metabolism reaches a critical low ebb, the body temperature also becomes what is called subnormal. This is notable preceding death.

When the environmental temperature reaches severe upward limits we sometimes see the effects of heat stress. When this occurs we find the animals in a condition referred to as 'heat stroke'. This condition also causes a disturbance in the brain centers and is reflected by very high body temperatures.

Normal Ranges of Temperature (internal)

Horse	99.5 - 101.3
Colt	99.5 - 102.2
Beef cow	98 - 102.4
Dairy cow	100.4 - 102.8
Sheep	101 - 103.8
Pig	101.6 - 103.6
Dog	100.2 - 103.8
Cat	100.5 - 104.2

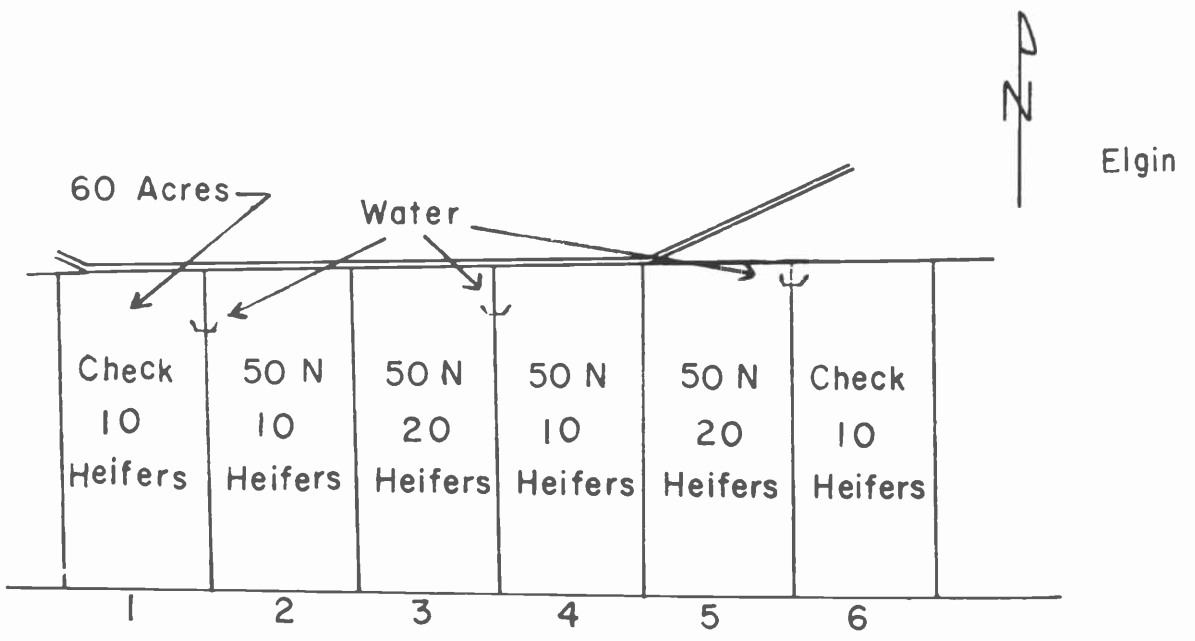
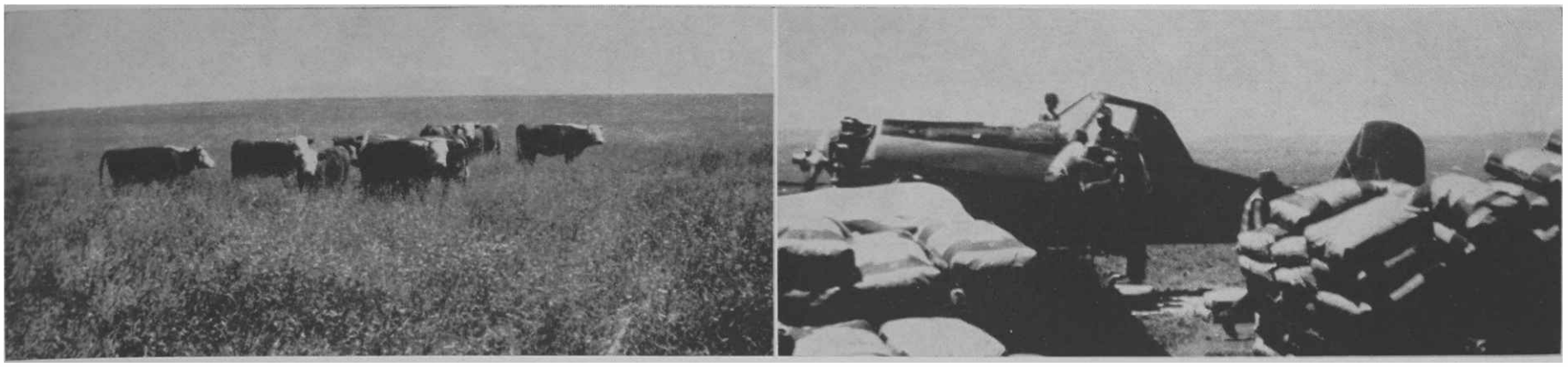


Fig. 1. Pasture plan of range fertilization study near Elgin, Arizona



PUREBRED HEREFORD heifers at Elgin (left) stand belly deep in rank grass of fertilized pasture. Fertilizing (right) was done by airplane spreading of ammonium nitrate.

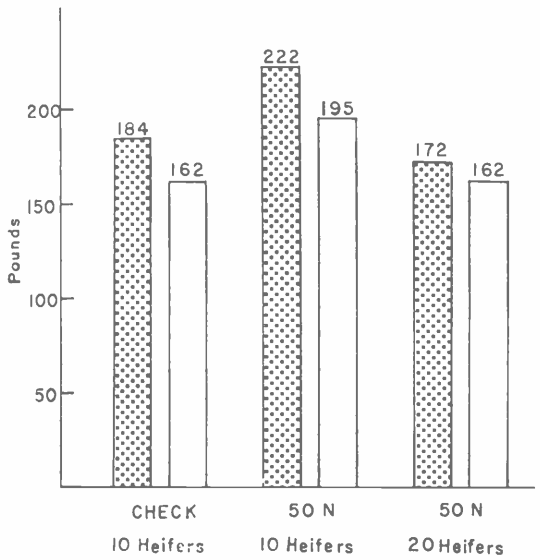


Fig. 2. Gain per heifer on native range near Elgin, Arizona, July 20-Oct. 20, 1966

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56 pounds per acre for the 90 days compared to 29 pounds for 10 heifers on the check pastures.

Fertilizer Effect Tapers Off

The fertilizer treatment in July of 1966 did not improve the performance of individual heifers grazing the pastures when the forage was dry during the October 20, 1966 to December 20, 1966 grazing period. In fact, there was a slight but statistically nonsignificant trend of greater weight loss on fertilized pastures than on checks (Figure 4).

The yearling heifers lost 50 to 62 pounds on the pastures in the 60-day period. The calves showed a slight gain on the check pastures, compared to an averaged loss of 16 pounds on the fertilized pastures grazed with 20 heifers. The livestock had ample forage on all pastures throughout the study period.

Although there were no significant differences in weight changes of individual animals due to fertilizer treatments in the early winter, the fertilized pastures grazed with 20 heifers continued to carry double the number of animals compared to the check pastures. Comparable utilization of blue grama on the check pastures with 10 heifers and fertilized pastures with 20 heifers illustrates that fertilization did double the carrying capacity of the pastures.

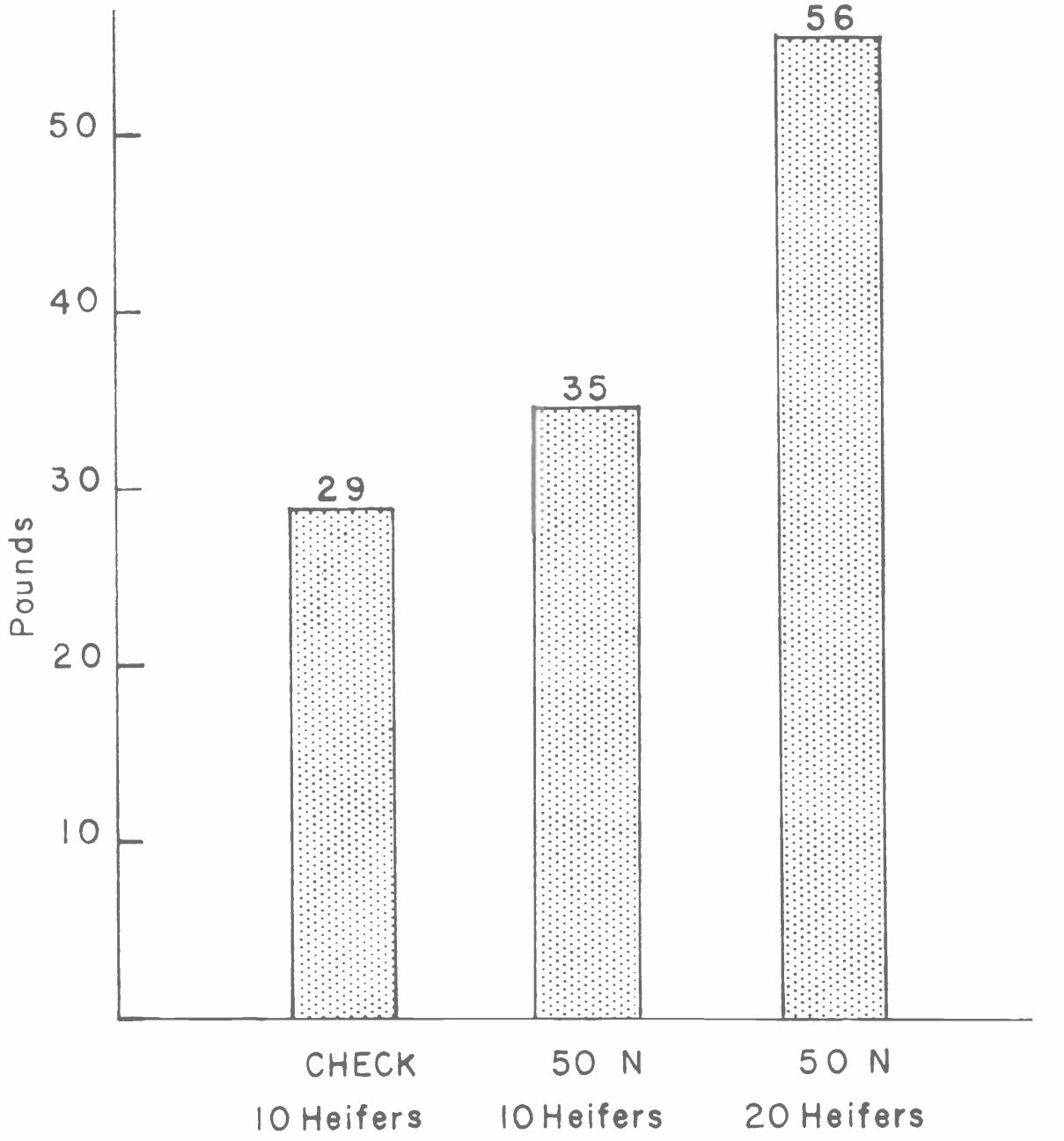

Fig. 3. Gain per acre by Hereford heifers grazing native range near Elgin, Arizona, July 20-Oct. 20, 1966

Utilization of blue grama on the major soil type of the pastures after completion of the grazing in December averaged 48% for the check pastures, 43% for the fertilized pastures grazed with 20 heifers, and 25% for the fertilized pastures grazed with 10 heifers.

What Was Learned

Individual heifers gained slightly more on fertilized pastures than heifers on check pastures when grazed

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Reclaiming Sewage Effluent

By L. G. Wilson and G. S. Lehman

To the layman, sewage effluent represents a necessary but aesthetically undesirable byproduct of community living. To the water conservationist, on the other hand, sewage effluent constitutes a valuable source for a water conservation and re-use program.

Of particular importance for this purpose are the relatively large quantities available in metropolitan areas on a continual basis. In Arizona, for example, sewage flows equal or exceed 50 percent of the total water requirements of the municipalities in the state. By 1975, according to data in an Arizona Town Hall on Arizona's water supply, the total sewage flow from the greater Phoenix area should be 423 ac ft/day (acre feet per day); and for the Tucson area, 111 ac ft/day.

At present a large portion of sewage effluent from treatment plants is being used for irrigation of non-edible crops (so-called sewage farming). Since effluent normally contains an abundance of the nutrients required for crop growth, the farmer reaps an additional benefit by utilizing this supply. Other re-use possibilities also exist, such as for industry, recreation, and for irrigation of edible crop varieties.

The authors are Associate Hydrologist and Graduate Associate in Research in the Water Resources Research Center.

To Upgrade Quality

One drawback to the use of sewage effluent for such purposes is the need to upgrade the quality to levels commensurate with public health safety standards. Two possible methods for "tertiary" treatment of sewage effluent prior to re-use are grass filtration and soil filtration.

Grass filters consist of grassed areas through which sewage effluent is passed. Apparently treatment is effected by the following mechanisms: (a) removal of settleable materials, by the filtering action of grass, and (b) reduction of organic pollution by oxygen at the water surface, and by a biologically active film on the grass surface.

Soil filtration, one of the oldest water treatment methods, consists of percolating sewage effluent through soil material either to a subsurface collector or directly to ground water. With proper management, the soil serves as an effective filter for both solid material and microorganisms.

Grass Filtration Studies

This paper presents data on preliminary studies, conducted cooperatively by the Water Resources Research Center, and the Sanitary District No. 1 of Pima County. Main purpose of these studies was to determine the effectiveness and durability of grass filters during tertiary treatment of sewage effluent under Arizona conditions. Auxiliary studies were made to determine intake rate and depth of penetration of percolating effluent to provide data for future soil filtration studies.

Three plots, each 25 x 1000 feet (0.3% slope) were constructed in 1965 near the outfall from the Ina Road Oxidation Pond operated by the Sanitary District. Each plot was seeded to common Bermudagrass. The outer checks served as guard strips, restricting lateral subsurface flow from the central test strip. An asbestos cement liner was installed in the head ditch to minimize leakage.

Effluent was by-passed to the head ditch through a four-inch pipeline. An earthen ditch was used to conduct tail water to the Santa Cruz River for disposal. Three-inch Parshall flumes were located in the head ditch and tail water ditch for measurement of inflow and outflow rates. Two 100-foot access wells, for use with a recording moisture logger, were installed at 200 feet and 800 feet from the head end of the strip.

Three Tests Used

Three trials were conducted on the test strip in 1966. The guard strips were well irrigated before each test in an effort to minimize lateral subsurface flow from the central strip during testing. For these trials all the water available at the by-pass line was applied to the strip. This was done so that we could observe treatment during maximum loading conditions. The principal analytical method for characterizing treatment during the first two trials was the B.O.D. test, conducted on inflow and outflow samples. (B.O.D. values provide a measure of the biologically decomposable material in a stream). In the third trial the Chemical Oxygen Demand (C.O.D.) test was used. (This

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with comparable numbers of livestock during the summer grazing period.

When increased numbers of animals were placed on the pastures to utilize additional forage obtained from fertilization, individual animal gains were similar to those on check pastures, but the gain per acre was approximately doubled.

Heifers lost weight on dry grass during the October 20 to December 20, 1966 grazing period and fertilization in July did not reduce this loss.

The full story cannot be determined from data from a single year. This study will continue next year to determine carryover effects of the 1966 fertilization.

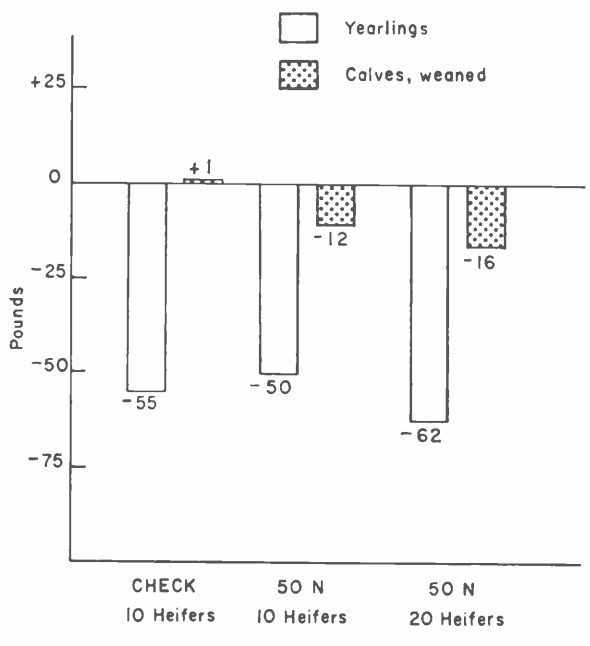

Fig. 4. Weight change per heifer on native range near Elgin, Arizona, Oct. 20-Dec. 20, 1966

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test measures the chemically oxidizable material in an effluent sample.)

Visual observations were made on changes in suspended solids concentration during grass filtration, and on the ability of the Bermudagrass to withstand prolonged flooding. Inflow and outflow rates were determined from Parshall flume data; results were used to estimate intake rates. Detention times (that is, time of residence of the effluent on the plot) were estimated for each trial from rate of advance data at the beginning of flooding. Subsurface moisture changes were monitored in the access wells using a recording moisture logger .

Algae Affect Results

For the first trial grass height averaged about four inches. Because of the shortness of the grass and the high hydraulic loading, 1.5 ac ft/ac/day, the grass was completely covered at several locations. Detention time was about 8½ hours. The total volume infiltrated during the nine days of testing was 3.8 ac ft, and average infiltration rate was 0.80 ac ft/ac/day. No definite conclusion could be made on treatment effectiveness from B.O.D. data since algae, entrained in samples, appeared to affect results. Visual observations on suspended solid concentration in inflow and outflow effluent showed that coarse particles were removed during filtration. In spite of prolonged inundation the grass recovered rapidly after water was turned off the plot.

Moisture logs obtained in an access tube on August 15, 24, 25, and 28, are shown in Figure 1. The log for August 15, illustrates the moisture profile the day before the test was started. Apparently pre-irrigation on the plot caused an increase in moisture content from about 25 to 35 feet below ground surface, and a rise in the water table level to about 45 feet.

The log for August 24, the last day of the test, shows the effects of flooding on the moisture content in the surface: a pronounced rise being evident from 0 to 10 feet below ground surface. The moisture bulge from 25 to 35 feet remained as in the earlier log, but a moisture increase was apparent in materials from 36 to 44 feet. This increase implies that accretion to ground water occurred during the trial.

Logs for August 25 and 28 were almost identical to that of August 24, except for a slight reduction in moisture content in the upper 10 feet, and continued increase in the region from 36 to 44 feet.

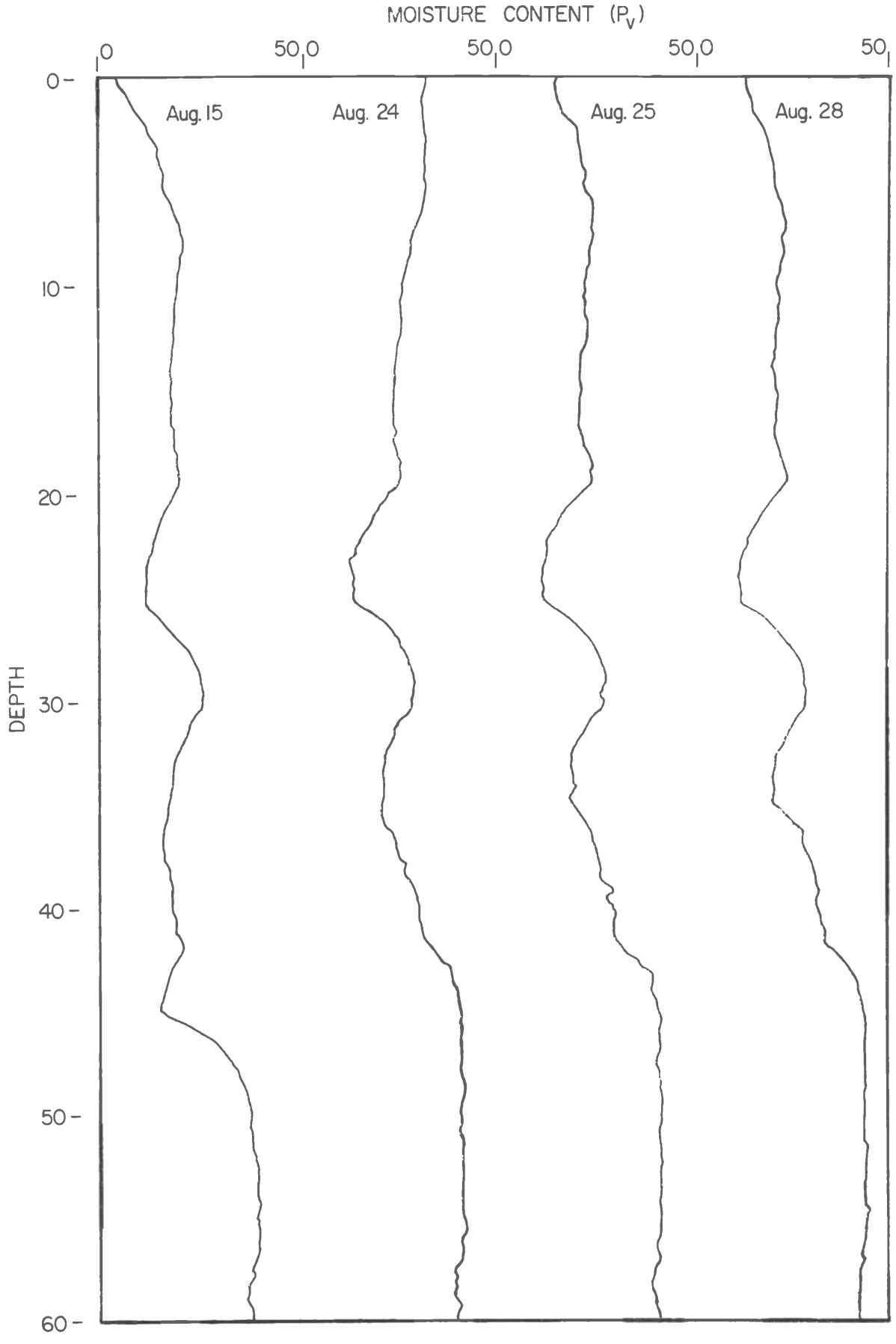

FIGURE 1 — Moisture Logs at Grass Filtration Plot Aug. 15-28, 1966.

Second Trial—Sept. 17-24, 1966

During the second trial grass height was about 14 inches and coverage was dense. Submergence was minimal and the test strip functioned more effectively as a filter. The average hydraulic loading was 1.4 ac ft/ac/day and detention time was again about 8½ hours. The total volume infiltrated during the eight-day trial was 2.6 ac ft and average intake rate was about 0.7 ac ft/ac/day. B.O.D. values, again, appeared to be unreliable. Coarse materials in the incoming effluent were reduced during filtration. Moisture logs were similar to those described above. The grass was not affected by flooding.

Third Trial—Oct. 1-18, 1966

It was evident from the two earlier trials that results of B.O.D. tests are affected by algal activity in the samples. During the third trial, therefore, we decided to use the C.O.D. test to characterize treatment. (C.O.D. is affected by number of alga but not algal activity). Duration of this trial

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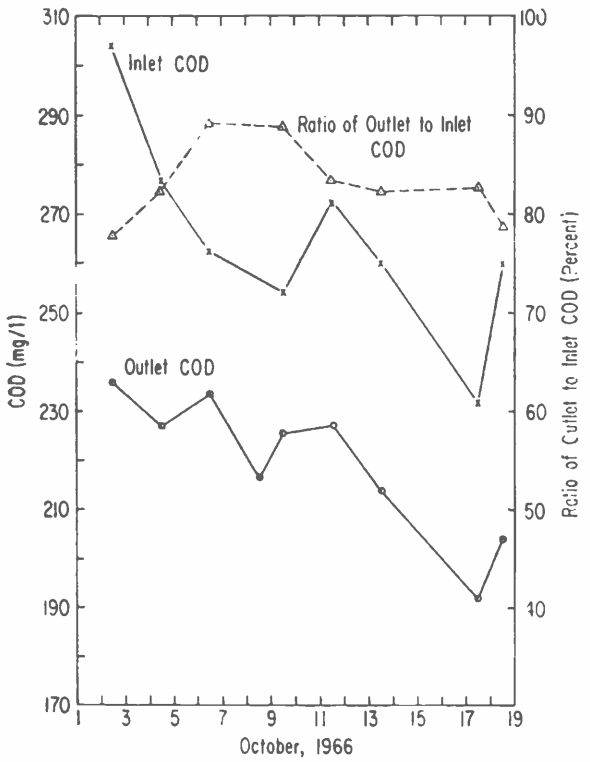

FIGURE 2 — Inlet and Outlet COD Values (mg/1) and Ratio Outlet to Inlet COD (percent) During Third Trial, Oct. 1-18, 1966.

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was longer than for the other two, so that we could determine if treatment improves with time.

Grass height was again about 14 inches and coverage was excellent. In spite of an increase in hydraulic loading to 1.7 ac ft/ac/day, submergence was not observed. Maximum detention time was about eight hours. Total volume infiltrated during the 17-day trial was almost 9 ac ft. Average infiltration rate was about 0.9 ac ft/day. Suspended solids were of colloidal dimensions and were not markedly reduced in concentration during flooding.

Outflow Values Consistent

Results of C.O.D. tests on inlet and outlet samples, together with the percentage of outflow to inflow samples, are shown in Figure 2. The data indicate that although inlet C.O.D. fluctuated during the test, outflow C.O.D. values were consistently lower. After an initial drop in percentage of outflow to inflow C.O.D., to 77.6 percent on Oct. 2, the percentage increased to a maximum value of 89.0 on Oct. 6. Thereafter, the percentage gradually decreased to a value of 78.7 on Oct. 18. It appears that treatment improves with time when inundation is avoided and the unit operates as a true grass filter.

Subsurface moisture changes during the third trial were about the same as those reported for the first trial. The grass showed no ill-effect from the prolonged flooding.

Cite Five Conclusions

On the basis of results from the three grass filtration trials, and particularly the third trial, we conclude:

(1) Only partial treatment was produced during the trials of 1966 because of the excessive hydraulic loadings and short detention times. The results of the third trial were encouraging enough, however, for us to anticipate producing a desirable effluent during future studies using lighter loadings.

(2) Grass height and density should be great enough to ensure operation of the grass plots as true filters.

(3) Water percolating downward during flooding eventually reaches the water table. Apparently the subsurface materials will serve as a soil filter. During impending studies water samples will be obtained in two wells, recently installed to 30 feet and 50 feet below ground surface, to determine changes in quality during soil filtration.

(4) C.O.D. is a more reliable method for characterizing treatment than B.O.D. in samples containing high algal concentrations.

(5) Bermudagrass tolerated prolonged flooding with sewage effluent.

PROGRESSIVE AGRICULTURE IN ARIZONA

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Harold E. Myers Dean