New Mexico's

# research progress

**Agriculture • Home Economics**

**1960-61**

72nd annual report

**Agricultural Experiment Station**

**NEW MEXICO STATE UNIVERSITY**
UNIVERSITY PARK

January 1, 1962

To His Excellency, Edwin L. Mechem
Governor of New Mexico
Santa Fe, New Mexico

Dear Governor Mechem:

We are pleased to submit the seventy-second annual report of the Agricultural Experiment Station of New Mexico State University.

This report is required under the Act of Congress approved March 2, 1887, but we also welcome the opportunity to present to you and other interested citizens of the State a summary of the research which has been accomplished in the fiscal year ending June 30, 1961.

The Experiment Station has made many basic contributions to our storehouse of agriculture and home economics knowledge. This knowledge, transformed into technological competence, greatly benefits the agricultural industry of New Mexico and the nation. We can well be proud of our State's agricultural and home economics research contributions.

We hope that the research accomplishments reported here will provide you and the citizens of New Mexico with the information to recognize fully the far-reaching influence and importance of the Agricultural Experiment Station.

Respectfully submitted,

Philip J. Leyendecker
Director

Albert S. Curry
Associate Director

# AGRICULTURAL ECONOMICS

## Cattle

MARKETING This study is designed to analyze various methods of marketing New Mexico cattle, and to develop cost and return guides to indicate the most profitable outlets for New Mexico cattle.

Since 1930, the terminal market has decreased in importance as an outlet for New Mexico cattle and calves while the importance of direct sales and auction markets has increased. From 1930 through 1936, about 32 percent of the cattle and calves were sold at terminal markets, and from 1937 through 1946, about 22 percent. In the next 10 years, this percentage was about 15, and in 1960, only 12 percent were shipped to terminal markets. In 1955, 32.5 percent of the cattle and calves sold in the United States went through terminal markets, but only 15.7 percent of those sold in New Mexico did so.

New Mexico cattlemen have several alternative market outlets for their feeder-stocker and slaughter cattle and calves. They may sell the feeder-stocker animals at the ranch to feeders and order buyers, or they may move the animals to auction markets or terminal markets. The slaughter cattle may be sold at terminal markets, auctions, direct to packers, or at the feedlots. They may also be sold on carcass grade and yield, or on consignment to packers.

TRANSPORTATION In 1959, cash receipts from the sale of cattle and calves amounted to about 118 million dollars. This accounts for 45 to 50 percent of all the cash receipts for farming and ranching in most years.

New Mexico is primarily a producer of stocker-feeder type cattle and many of these are shipped to other states to be finished before slaughter. The number of cattle shipped out of the state varies considerably from year to year. The 1951-60 average was approximately 573,000 head annually.

In 1958, New Mexico cattle were shipped to 29 different states. The table shows that the movement eastward accounted for two-thirds of the shipments, while 19 percent went north and 15 percent west.

Even though New Mexico cattle go to a large number of states, seven receive about 90 percent of the cattle. Texas receives about one-third of New Mexico cattle shipments and Colorado about one-fifth.

**States receiving the highest percentages of all New Mexico cattle shipped in 1958, and percentages received by these states in 1950 and 1959**

| State | Out-of-state shipments received in | | |
|---|---|---|---|
| | 1958[1] | 1950[2] | 1959[2] |
| | *Percent* | *Percent* | *Percent* |
| Texas | 29.87 | 38.63 | 32.25 |
| Colorado | 18.05 | 14.97 | 19.83 |
| Kansas | 14.68 | 14.48 | 11.00 |
| California | 9.78 | 8.94 | 8.83 |
| Illinois | 6.25 | 2.26 | 5.88 |
| Arizona | 5.00 | 4.87 | 6.34 |
| Oklahoma | 4.82 | 5.93 | 3.98 |
| Total | 88.45 | 90.08 | 88.11 |

1. Compiled from data obtained from the New Mexico Cattle Sanitary Board, Albuquerque, New Mexico.
2. Compiled from information available in monthly releases from the Office of the Agricultural State Statistician, "New Mexico Cattle Shipments," AMS, USDA, Las Cruces, New Mexico, December 1958, and from data obtained from the New Mexico Cattle Sanitary Board, Albuquerque, N. M.

Even with improved highways and trucking facilities, the railroads still play an important role in moving New Mexico cattle. In 1950, about 43 percent of the cattle were shipped out by rail and 57 percent by truck. The percentage moving out by rail dropped from 45 to 33 percent from 1958 to 1959, but increased to 37 percent in 1960.

**Cattle shipped from New Mexico by rail and truck, by specified years**

| Year | Rail | | Truck | | Total | |
|---|---|---|---|---|---|---|
| | *No.* | *%* | *No.* | *%* | *No.* | *%* |
| 1950 | 248,041 | 43 | 318,089 | 57 | 566,130 | 100 |
| 1954 | 208,435 | 40 | 312,653 | 60 | 521,088 | 100 |
| 1958 | 240,272 | 45 | 293,665 | 55 | 533,937 | 100 |
| 1959 | 194,786 | 33 | 391,532 | 67 | 586,318 | 100 |
| 1960 | 251,514 | 37 | 428,673 | 63 | 680,187 | 100 |

Source: Cattle Sanitary Board of New Mexico, Albuquerque, New Mexico

The distance largely determines whether the cattle are moved by truck or rail. In 1958, only 12 percent of the cattle going to Texas and 25 percent going to Colorado were shipped by rail. For the more distant states—Iowa, Illinois, Missouri, and Nebraska—more than 90 percent were moved by rail.

## Cotton

FARMING ADJUSTMENTS Cotton is New Mexico's most important cash crop. In 1959, it accounted for almost $75 million, or about 30 percent of the total farm receipts. In southern New Mexico, the crop occupies about 40 percent of the irrigated land. Cotton was grown on about 189 thousand acres in 1959.

Changes in government allotment programs, technology, farm labor policy, and prices paid and received have caused major farm adjustment problems. These changes do not affect all cotton farmers in the same way. Farm size, soil, water, climate, tenure arrangements, and market opportunities are important considerations in New Mexico. Tabulations made from Agricultural Stabilization and Conservation (ASC), Soil Conservation Service (SCS), and Agricultural Census data in respect to these items in southern New Mexico cotton areas show the following:

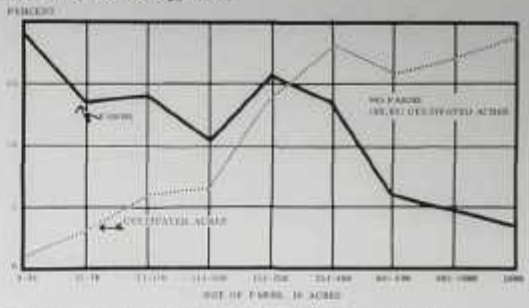
1. Farms are becoming larger and fewer as the table shows.

2. Small farms make up a large percentage of the total farms but account for only a small percentage of the total cultivated land. A typical relationship is shown in the chart.

3. Soils vary within each producing area and between areas. In the Pecos Valley 88 thousand out of 179 thousand acres are considered SCS Class I soil. Another 48 thousand acres are highly productive. In Roosevelt and Lea counties there are no Class I soils and Class II soils account for only about one-third of the total irrigated acres.

4. Most of the irrigation is by pump from underground basins. The water tables of these basins are declining around three feet per year depending upon

**Distribution of farms and cultivated acres, by size of farm, Pecos Valley, 1961**



irrigation concentration and recharge. Surface water used on about 110 thousand acres is highly variable.

5. Climate determines the boundaries of cotton production. Pima cotton is grown in Hidalgo, Luna, and Dona Ana counties but does not do well in more northern areas. Although New Mexico's 1517 varieties predominate in most areas, the shorter staple, earlier maturing varieties are grown in Roosevelt, Curry, and Quay counties.

6. Farm tenancy within the Pecos Valley, which is representative for the New Mexico cotton area, runs 28 percent for full renters, 16 percent for owner-renters, and 56 percent for full owners.

7. Illustrative of the technological changes taking place are the adoption of machine cotton pickers and the use of commercial fertilizer. In 1960, 61 percent of New Mexico's cotton was machine harvested compared to 15 percent in 1957. In 1959, 21,232 tons of commercial fertilizer was applied to cotton land compared to 14,430 tons in 1954. Total acres of cotton was less in 1959 than in 1954.

A study has been initiated to assist farmers in adjusting to these changes and to be used as a tool for effective policy legislation. Recommended input levels, optimum crop and livestock combinations, farm size, and the effects of various price changes will be studied.

**Change in number and size of farms, 1950-59**[1]

| Classification | 1954 Definition | | | 1959 Definition |
|---|---|---|---|---|
| | 1950 | 1954 | 1959 | 1959 |
| Number of farms: | | | | |
| United States, all farms | 5,382,000 | 4,782,000 | 3,936,000 | 3,704,000 |
| New Mexico, all farms | 23,599 | 21,070 | 17,000 | 15,919 |
| New Mexico, commercial | 14,056 | 12,008 | ..... | 9,799 |
| New Mexico, cotton[2] | 3,454 | 3,351 | 2,976 | 2,976 |
| Average size of New Mexico farms (acres): | | | | |
| All farms | 2,014 | 2,347 | 2,725 | 2,908 |
| All commercial farms | 2,797 | 3,434 | ..... | 3,935 |
| Cotton farms, irrigated land[3] | 117 | 124 | ..... | 157 |
| Value of crops harvested on New Mexico farms (dollars): | | | | |
| Average of all farms reporting cropland harvested | 4,807 | 6,619 | ..... | 9,525 |

1/ U. S. Census of Agriculture
2/ Includes all farms reporting cotton
3/ These figures are not fully comparable since the data for 1950 and 1954 include all farms and for 1959 only commercial farms

GINNING AND MARKETING The amount of New Mexico cotton harvested by machine has increased from one percent to 61 percent in the past 10 years. Along with this rapid shift from hand to machine harvesting have come changes in ginning and marketing practices.

The differences in the condition of hand and machine harvested cotton forced ginners to invest in new equipment, such as driers, cotton conditioners, or moisture controllers. They also invested in more cleaners, either the overhead type, the after-cleaning type, or both.

Since, in some cases, the changes affect the spinning quality of the lint, cotton merchants and cotton mills have been adjusting their trade practices to compensate for changes in cotton quality. At first, the trade adopted tests to measure fiber characteristics such as strength, fineness, and maturity in addition to the grade and staple determined visually by cotton classers. Fiber characteristics are sometimes changed by early defoliation, which is done so that machine harvesting can begin before frost. Next, the trade has started several types of direct buying to specify the desired method of harvesting, ginning, and marketing. To date, there have been only a few cases of direct buying in New Mexico. Consequently it is too early to tell how this change will affect the prices received by growers for their cotton.

New Mexico ginners were interviewed for suggestions on improving the marketing of New Mexico cotton. About 25 percent said that the greatest problem was over-sampling and that it caused the greatest damage to cotton. Fourteen percent of the ginners suggested automatic sampling at the gin to eliminate cutting the bale and subsequent damage, if the trade would accept the sample. Three gin batteries in New Mexico are now operating automatic samplers. The last of these was installed in the summer of 1961.

Four gin operators in the state have installed standard density presses. They receive an extra $1.25 per bale as compression fee. Research is continuing to determine the economic feasibility of standard density press installations and the minimum volume necessary for a gin to break even.

## Dairy Farming

Reasons for success or failure in the dairy business were studied in a farm management analysis of 68 dairy farms located in the Rio Grande and Estancia valleys. Incomes were found to vary widely due to the complex of management factors affecting the success of a dairyman. Average labor income, the operator's return for his own labor and management, was $4,031 per farm. One farm in three returned nothing for the operator's labor or management and, in some instances, for his capital investment.

Herd sizes ranged from 15 to 500 or more cows. The most common herd size was about 40 cows. As herd size increased, labor income also tended to increase.

To be profitable, a dairy farm which produces most of its feed must be at least a two-man business with a minimum of about 25 cows per man. Each cow must produce more than 8,500 pounds of milk per year. If all of the feed is purchased, the herd must contain at least 80 cows.

Feed consumption per cow averaged 3,097 pounds of grain and concentrate, 5.2 tons of hay, and 3.6 tons of silage. Feed costs amounted to $273 per cow, or about 50 percent of the value of the milk sold per cow.

Feed costs and level of milk production were found to be key factors affecting financial success. High hay prices, low production, and heavy grain and concentrate feeding were found on the farms with low labor incomes.

## Farm Labor

The cost of hired farm labor consists of the sum of cash wages paid and the value of perquisites given workers. Such perquisites as transportation, housing, insurance, food, and utilities constitute both a cost to the farmer and a source of income to the worker. The cost of perquisites is being studied in six counties of New Mexico.

Federal legislation directed toward the farm wage structure prompts farmers to determine the total labor costs associated with farm production.

In a survey of 120 farms in southern New Mexico,

**Quantities and cost of concentrates, roughage, and labor used in milk production on 68 dairy farms, Rio Grande and Estancia valleys, 1957**

| Item | Average Amount Used | | Average Cost, in dollars | | |
|---|---|---|---|---|---|
| | Per Cow | Per 100 Pounds Milk Sold | Per Cow | Per 100 Pounds Milk Sold | Per Cow Per Day |
| Concentrates[1] | 3,097 lbs. | 34.56 lbs. | 92.88 | 1.04 | .255 |
| Dry Roughage | 5.22 tons | 116.44 lbs. | 141.77 | 1.58 | .388 |
| Silage | 3.60 tons | 80.25 lbs. | 36.93 | .41 | .101 |
| Pasture | | | 1.10 | .01 | .003 |
| Total feed cost | | | 272.68 | 3.04 | .747 |
| Man labor[2] | 89.96 hrs. | 1.00 hr. | 113.23 | 1.26 | .310 |
| Total—labor & feed cost | | | 385.91 | 4.30 | 1.057 |

1. The term concentrates is used to denote both grain and concentrates fed.
2. This is chore labor on cows and does not include care of young stock.

detailed information was collected on amounts and costs of housing, utilities, furniture, equipment, groceries, insurance, transportation, incentive payments, and cash wages for hired labor in 1960. Information on all labor activities and on all workers hired on the survey farms was taken.

When analyzed, this information will be of use to farmers, farm organizations, legislators, and other groups interested in evaluating farm wage problems. Only limited information is now available on the value of perquisites. Enumerating such information is extremely complex, but the present study may also help in designing further research on this problem.

Two other farm labor research projects are in progress. One concerns labor mobility in a northern New Mexico community. The other is a study of labor costs in producing potatoes, tomatoes, and sweetpotatoes.

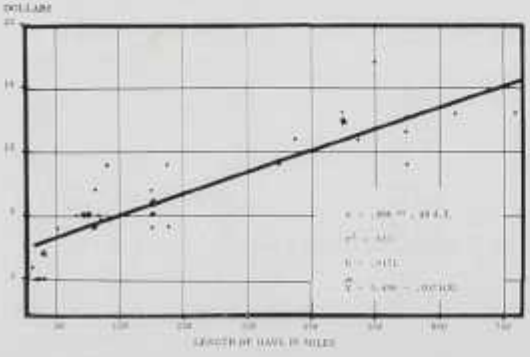
Results of farm labor research were used in 1961 by New Mexico farmers to contest the validity of a farm wage survey conducted by the U.S. Department of Labor.

## Hay Marketing

Twenty hay producers in Dona Ana County were sent hay market newsletters during 1960, and their marketing practices were compared with those of 20 producers who did not receive the letter. On the average, the producers who received the letter had a greater increase in price from 1959 to 1960. In general, producers receiving the letter sold their hay at harvest time, but the control group delayed selling hay for about a month after harvest. Prices received by producers who received the newsletter varied less than prices received by the control group. Eighty-six percent of those receiving the letter were satisfied with the available market news, but only 19 percent of those not receiving the letter were satisfied.

Hay transportation practices were also studied. Nineteen truckers supplied 1960 charges on 59 individual hay hauls. These data included the contract charge for hauling hay, including loading, type of truck used, size of load, origin, destination, and distance hauled. The hay hauling charge per ton varied from about $5.75 per ton for a 10-mile haul, to about $18 per ton for a 750-mile haul (see figure).

**Charges per ton for hauling alfalfa hay, 1958**



Charges per mile varied widely, depending on the number of miles hauled. On the average, truckers charged 55 cents per mile for each ton of hay when it was moved only three miles. When hay was moved about 700 miles, this per ton charge was only about three cents per mile.

Highest prices were received by producers of alfalfa hay in the west-central area of New Mexico and lowest prices were received in the Lincoln-Otero county area. The major hay surplus producing areas were in Chaves and Eddy counties. The main hay deficit areas were in Bernalillo, Curry, Roosevelt, and Union counties. In most cases, distances between surplus and deficit areas were 300 miles or less.

Field work on a final phase of the project was also completed during 1961. Personal interviews were made in the 36 feed manufacturing, 42 custom mixing or grinding, and 21 pelleting firms in operation in New Mexico both in 1956 and 1961.

## Lumber Marketing

Woodland Owners About 10 percent of New Mexico's 2,000 woodland owners were interviewed during the summer of 1961 as a part of a study of their marketing practices. The 181 persons interviewed own 855,000 acres of forest lands. In the past five years, 44 percent of these owners sold some type of forest product.

Seventy-five percent of the forest lands was purchased by the owners, 21 percent was inherited, one percent was homesteaded, and one percent was received as gifts.

Of the owners who boueht their forest land, 64 percent indicated that they did so primarily to use the land for farming or grazing. Only 23 percent of the owners indicated as primary reasons for buying the lands timber or forest production as well as farming and grazing. Thirteen percent bought the lands because they anticipated rises in values of either land or timber.

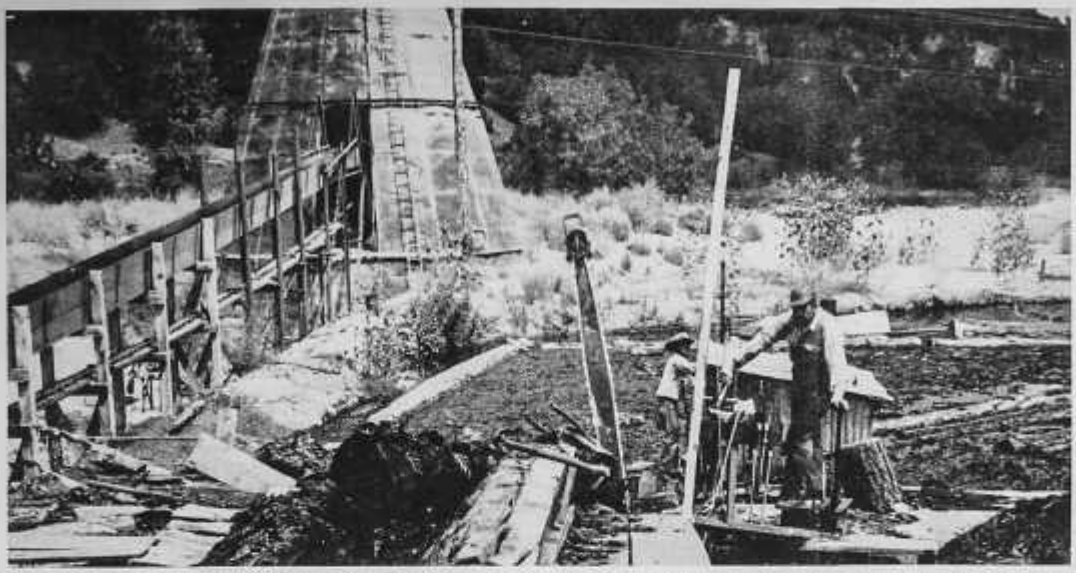
Only about a fourth of the owners manage their lands to produce timber. Almost three-quarters of them use forest lands for grazing, or a combination of grazing and erosion control. Nonetheless, in 1959, over one-third of the state's estimated 184 million board feet were cut from privately-owned forests.

Sawmills Seventy sawmill operators in New Mexico were interviewed in 1960 regarding their log-purchasing practices, sawmill facilities, product-selling practices, and prices and costs since the 1940's.

The industry is concentrated in northcentral New Mexico. Most mills sawing one million board feet or less per year are privately owned. Those mills sawing over five million board feet are mainly corporations.

Lands controlled by the U.S. Forest Service supplied slightly over half of the logs used by sawmills in New Mexico in 1959. Large private holdings of timber (5,000 acres or over) were the second most important source.

Of all the products sold from the sawmills, 84 percent was lumber, 11 percent was studs, and the re-



**The sawmill industry, important in New Mexico's economy, is being analyzed to provide a better understanding of the problems.**

maining 19 percent was made up of cants, ties, and miscellaneous materials.

Almost all operators of small mills sold their products on the basis of mill run. About three-fourths of the operators of large mills sold their products by grade.

In 1959, sales made directly to consumers were of relatively minor importance except from the small mills. The largest volume of timber products was sold to retailers. About one third of all the sawmill products was sold to larger mills for further processing.

For all sawmills, more than half the total expense was logging costs. For large mills, over half the total expense was manufacturing costs. Stumpage costs were a relatively small proportion of the total costs for mills of both sizes.

The New Mexico wholesale lumber price index is closely related to the United States wholesale lumber price index. Demand factors affecting the United States index apparently affect the New Mexico index. About 90 percent of the annual variation in the wholesale price for rough green lumber in New Mexico was associated with the combined variations in sawmill logging and operating costs, timber cut on national forests in New Mexico, stumpage prices, the building permit index, the wage employment index, and concrete block prices. Sawmill costs alone accounted for 70 percent of the variation.

Operators believe their major log procurement problems are weather, roads, and labor. Their major marketing problems are a lack of demand for their products and low prices.

## Machinery Costs

A study of the costs of machinery used in seedbed preparation on 49 New Mexico farms shows equipment depreciation to be the largest of all cost items. The effects of machine size and amount of machine use are being analyzed to determine where savings can

**Cost of operating tractors in seedbed preparation, 49 farms, New Mexico, 1960**

| Hours of use | Less than 30 h.p. | | 30-39 h.p. | | 40-49 h.p. | | 50 h.p. and more† | |
|---|---|---|---|---|---|---|---|---|
| | Average Use | Cost per Hour | Average Use | Cost per Hour | Average Use | Cost per Hour | Average Use | Cost per Hour |
| | *hours* | *dollars* | *hours* | *dollars* | *hours* | *dollars* | *hours* | *dollars* |
| Less than 300 | 178 | 1.57 | 117 | 3.75 | 150 | 4.43 | — | — |
| 300 to 599 | 378 | 1.43 | 429 | 1.57 | 432 | 1.73 | 500 | 1.67* |
| 600 or more | 923 | .95 | 1089 | 1.16 | 1011 | 1.27 | na | na |
| 600-799 | na | na | na | na | na | na | 620 | 1.71 |
| 800 or more | na | na | na | na | na | na | 1225 | 1.16 |

† The grouping was changed for the 50 h.p. tractors; na means not applicable.
* Three observations only

be made. Tractor size and amount of use per year significantly affect the cost per hour of use.

Cost information on the companion equipment used in seedbed preparation is also being analyzed. As with tractors, the hours of use per year influences the economy of machine use. Comparisons will be made between costs of ownership, renting, custom hire, and other alternatives to ownership.

## Pumping Irrigation Water

The objectives of this project are to determine the cost of pumping irrigation water in the various areas of New Mexico and to analyze the variations in pumping costs.

Forty-seven farmers in the Pecos Valley were interviewed in 1961. They were selected by geographical location and by the type of fuel they used. The majority of the pumping plants, 87 percent, used electricity as source of fuel, 11 percent used natural gas, and two percent, butane. Farmers in the Carlsbad area pumped water as supplemental irrigation. In this area, one pumping plant irrigated an average of 138 acres. In the Artesia area, farmers irrigated an average of 92 acres per pump. An average of 124 acres was irrigated per pump in the Roswell area.

There appears to be a wide range in the number of gallons pumped per minute. Farmers in the Carlsbad area reported an average of 1850 g.p.m., with a range between 500 and 3200 g.p.m. Wells in the Artesia area produced approximately 912 g.p.m. with a range between 550 and 1565 g.p.m. The output per well in the Roswell area was slightly higher with an average of 1022 g.p.m. and a range between 600 and 1400 g.p.m.

Two types of costs affect the total cost of pumping irrigation water. Fixed costs include depreciation, taxes, insurance, and sometimes a stand-by charge collected by the utility company. Variable costs include fuel, oil, lubrication, maintenance, and repairs. It appears that electric motors require less repair and maintenance than the combustion engines, but electricity seems to be more expensive than natural gas or butane.

## Sheep

Lambing on Crested Wheatgrass The effects of lambing on crested wheatgrass pastures were measured over a three-year period in northern New Mexico. Crested wheatgrass pastures produced four to five times more herbage than native range. In the extremely dry spring of 1959, crested wheatgrass production was more than 400 percent that of adjacent native ranges.

The January-through-May precipitation accounted for 99 percent of the variation in air-dry crested wheatgrass production for the period 1957 through 1960. Crested wheatgrass production increased at the average rate of about 200 pounds of air-dry plant material per additional inch of precipitation.

Lamb crops were 4.5 to 7.1 percent larger when

**Lambs born on the crested wheatgrass pastures were weighed within one day after birth.**

ewes lambed on crested wheatgrass. The highest percentages were attained by ewes grazing crested wheatgrass at the 53 and 72 percent levels of current annual growth.

The costs of reseeding rangelands in northern New Mexico in 1959 was $6.13 per acre, or 2 percent less than in 1956.

After all costs were paid, including interest on investment, the operator who pastured ewes on crested wheatgrass for lambing received for his labor and management 19 to 27 percent more than that received when ewes were lambed on native range (see table).

The highest profit from lambing on crested wheatgrass in northern New Mexico lies between the 53 and 72 percent utilization level. The estimated maximum return is achieved at about the 66 percent utilization level.

An analysis was made of sheep enterprises in northern New Mexico as part of the study. Results of the analysis were released during the year.

Wool Production The West and Southwest are vitally interested in government wool programs, because they produce large amounts of wool. The 11 western states and Texas produce about 70 percent of all United States wool.

**Costs and returns of lambing on native and crested wheatgrass pastures, northern New Mexico, 1957-59**

| Item | Native Range | Crested Wheatgrass 39% Use | 53% Use | 72% Use | 84% Use |
|---|---|---|---|---|---|
| | *Dol.* | *Dol.* | *Dol.* | *Dol.* | *Dol.* |
| Total cash income | 9,963 | 10,483 | 10,496 | 10,491 | 10,424 |
| Total cash expense | 6,299 | 6,154 | 6,079 | 6,127 | 6,158 |
| Net cash income | 3,664 | 4,329 | 4,417 | 4,364 | 4,266 |
| Noncash items | —1,394 | —1,567 | —1,539 | —1,559 | —1,556 |
| Net returns to operator | 2,270 | 2,762 | 2,878 | 2,805 | 2,710 |
| Net returns above native | ——— | 492 | 608 | 535 | 440 |
| Years required to pay investment in crested wheatgrass | ——— | 7 yrs. | 4 yrs. | 4 yrs. | 4 yrs. |

Since 1938, there have been several different wool programs. Most were attempts to increase wool production. In 1938-39, price supports were permissive, and loans were used. For 1940, 1941, and 1942, no support program was in effect. Support was permissive from 1943-46. In 1947, support was permissive until April 15. No program was in effect from April 15 to August 15, but support was mandatory after this date. Since 1948, support has been mandatory. During 1943-51, the price of wool was supported by purchases; during 1952-54, by loans and purchases; and since 1955, by incentive payments.

A study has been initiated to help determine the effects of the various programs on wool producers' income and to determine the trend in production under the various programs.

## Tax Revenues

The objective of this project is to analyze the sources and uses of New Mexico's tax revenues.

Private and corporate property assessment in five of New Mexico's 32 counties accounts for 54 percent of the total assessed valuation of the state. The assessment in 35 percent of all counties constituted 76 percent of the total assessed valuation of the state. The county, the school district, and the state levy property taxes. The school district and the county depend entirely on the property taxes as their source of revenues.

Per capita personal income is another measure which describes the tax base. In New Mexico, the 1958 per capita personal income amounted to $1,838, which ranked New Mexico as 29th in the nation. Wyoming reported a per capita personal income of $2,088, which was the highest among the mountain states. The per capita personal income of Arizona was $94 higher than that of New Mexico.

A comparison of personal income is incomplete, however, without consideration of the amount of taxes paid. In 1958, the per capita taxes amounted to $124 in New Mexico. This was the second highest amount in the nation. Per capita taxes amounted to $115 in Wyoming, $109 in Oklahoma, $100 in Colorado, $96 in Arizona, and $92 in Utah.

New Mexico derives its revenues from three major sources: taxes, intergovernmental revenue, and charges, fees and miscellaneous revenue. Taxes accounted for 47 percent of the total revenue in 1959, intergovernmental revenue for 31 percent, charges and miscellaneous revenues for 18 percent. Also reported as revenue is insurance trust revenue which accounted for four percent of the total revenue. Intergovernmental revenue is transfer payments from other units of the government. Practically all of these transfer payments came from the federal government.

Fifty-five percent of revenues from the federal government were earmarked for highway purposes, and 21 percent for public welfare programs. Other functions for which transfer payments were received included education 9 percent, agriculture 1 percent, employment service 2 percent, health and hospitals 2 percent, and miscellaneous 10 percent.

Forty-seven percent of New Mexico's aggregate revenue was derived from taxes. Major tax revenues and their uses in 1959 were:

*Sales Tax* is the largest single tax source of New Mexico. The revenue from this tax amounted to $42.2 million, or 37 percent of the total tax revenues. Approximately 85 percent of this tax revenue was earmarked for the Public School Equalization Fund.

*Gasoline Tax (Motor Fuel Tax)* is the second most important source of tax revenue in New Mexico. It brought $23.3 million, or 21 percent, of total tax revenues. Eighty-five percent of the revenue was transferred to the State Road Fund.

*Motor Vehicle Tax* accounted for $11.6 million, or about 10 percent, of the total tax revenue. Ninety-one percent of these tax revenues are transferred to the State and County Road Fund.

*Severance Tax* produced $8.9 million, or 8 percent of the total tax revenue. Approximately 80 percent of this is transferred to the State General Fund.

*Income Tax* yielded $6.8 million, 6 percent of the total revenue. Seventy percent of the income tax revenue was earmarked for the Public School Equalization Fund.

*Earnings on Property and Investment* are derived from royalties from state-owned land, and interests from investments of the Permanent Fund. It should be noted that these revenues are the second largest single source of revenue, only exceeded by the revenue from the sales tax.

# AGRICULTURAL ENGINEERING

## Cotton Mechanization

Cotton mechanization studies during 1960 included tests of planting dates and equipment, weed control methods, and harvesting methods.

PLANTING DATES AND EQUIPMENT Excellent stands were obtained from four plantings made on the following dates: April 1, April 15, April 30, and May 13. In all cases, the plots planted by the capped method emerged better than those without caps. There were no significant differences in emergence between planting dates for the 1960 season. Yields from cotton planted on May 13 were significantly lower than from the April plantings. Planting date had no effect on the fiber properties of the cotton. Planting equipment tests included modified and standard openers, seed press wheels, rubber and steel surface press wheels, and capping attachments. The capping method produced the best stand, but it was not significantly better than stands planted by other methods. Harrowing other treatments did not significantly improve the stands.

**Improvement of farm machinery is one object of agricultural engineering research at NMSU.**

In a test of seed treatments, irradiation and radio frequency electric field heating both decreased field emergence significantly. There were no significant differences in laboratory germination between the treated and untreated samples.

WEED CONTROL TESTS Weed control tests included six combinations of cultivating, hand hoeing, chemical control, and flame cultivation. These various methods caused no significant differences in yield or fiber properties.

HARVESTING METHODS Defoliated and non-defoliated cotton plots were machine harvested and hand harvested. Two different defoliants, DEF (S, S, S-Tributylphosphorotrithioate) and magnesium chloride, were used. Both chemicals were applied early in the morning and late in the afternoon. No differences were found in the efficiency of the defoliants. Seed-cotton loss was smallest when the cotton was hand-picked late in the season and then machine harvested, but this smallest loss was not significantly less than those from other hand-harvested plots or from plots harvested by machine early in the season. Defoliation had no significant effect on cotton loss incurred by the machine. Moisture content was not significantly affected by either defoliant. There was a tendency toward lower moisture content in cotton on defoliated plots, but the trend was not significant, especially late in the season. Seed cotton trash content was not affected by any of the defoliation methods. The least seed-cotton trash was obtained when samples were hand picked early in the season. When the cotton was hand picked late in the season, it was not significantly cleaner than that picked by machine. Lint trash content increased in samples picked later in the season. Before frost, hand-picked samples had lower lint trash contents. After frost, lint trash in hand and machine harvested samples were practically equal. Micronaire measurements did not appear to be affected by defoliation or hand picking. The grade of cotton from hand harvested plots picked early in the season was significantly higher than that from machine harvested plots. The grade difference was not significant in plots harvested after frost.

# AGRONOMY

## Alfalfa

ALFALFA BREEDING — A total of 250 progenies were screened for resistance to the spotted alfalfa aphid. Of this number, 47 percent were classified as resistant. This figure compares with 32 percent for 1959 and 14 percent for 1958. This indicates that the quantity of aphid-resistant breeding material is increasing.

In the disease nursery, all of the top entries were of New Mexico origin. The best lines came from the Zia variety. Zia was the most resistant variety in the test, but it was exceeded or equaled by three new experimental synthetics, N.M. 21-1, 22-1, and 23-1. Cody and Epley were highly susceptible.

Studies of inbreeding behavior, self fertility, and hybrid performance were initiated in 1959. For the experiments, eight clones were selected. One was classified as highly self fertile, three were medium, three were low in self fertility and one was self tripping and highly self fertile. With advanced generations of selfing there was segregation for high and low self fertility within each family, but the self tripping plant remained highly self fertile in the $S_1$. Seed yield was severely depressed by inbreeding. The average depression was 29 percent for the $S_1$ and 52 percent for the $S_2$, compared with the open pollinated progeny. There were two depression patterns—a straight-line one and a delayed depression in which inbreeding was not evident immediately but was severe in the $S_2$. Inbreeding affected forage yield similarly except that the depression was not as drastic. One generation of open pollination restored approximately 70 percent of the vigor lost by inbreeding. A new project has been initiated to study the feasibility of utilizing hybrids and hybrid vigor in the production of new alfalfa varieties.

ALFALFA STRAIN AND VARIETY TESTS — Four yield tests of 49, 64, 60, and 49 entries were conducted. Zia was the highest yielding commercial variety. However, two experimental synthetics, N.M. 22 and N.M. 21, yielded slightly more. One experimental line, 55-77-0, exceeded the yield of Zia by 21 percent on a three-year average. Lahontan yielded the same as N.M. 11-1 but about 20 percent less than Zia. Cody was lower in yield than 11-1 or New Mexico Common. Buffalo and Ranger yielded approximately 20 percent less than 11-1. Two single cross hybrids exceeded the yield of Zia by about 10 percent.

ALFALFA SEED PRODUCTION — Planting methods and other management practices are being compared for their effects on alfalfa seed production. The data in the table represent the results from comparisons on fall seeded alfalfa.

Alfalfa planted in 24-inch rows at a rate of one-half pound of seed per acre produced the highest yield of seed. In all planting methods, seed yield decreased as the rate of planting was increased.

Two pre-emergence and three post-emergence weed control chemicals were evaluated for their effects on alfalfa seed production. Neburon, a pre-emergence chemical, controlled 97 percent of the weeds. This treatment also yielded approximately 25 percent more seed than the check. Eptam, another

**Alfalfa seed yields by planting method and seeding rate**

| Planting Method | Seeding Rate lbs./A | | Yield lbs./A |
|---|---|---|---|
| 24 inch rows | ½ | | 290.28 |
| | 1 | | 191.73 |
| | 2 | | 279.07 |
| | 4 | | 219.11 |
| | 8 | | 157.52 |
| | | Average | 227.78 |
| 40 inch rows | ½ | | 246.56 |
| | 1 | | 183.78 |
| | 2 | | 203.59 |
| | 4 | | 141.23 |
| | 8 | | 132.81 |
| | | Average | 181.59 |
| Broadcast | 4 | | 188.73 |
| | 8 | | 177.39 |
| | 15 | | 128.72 |
| | 30 | | 121.84 |
| | | Average | 154.17 |

pre-emergence chemical, with 64 percent weed control, produced the second highest yield of seed. Some control of the summer grasses was achieved with Dalaphon, but it decreased the seed yield below that of the check. From these studies it was apparent that the critical stage for controlling weeds is in the seedling stage and that a good pre-emergence chemical could increase yields significantly. Diuron gave good control of the alfalfa seedlings without injuring the established alfalfa.

Three desiccants were evaluated for rapidity of drying, seed yield, and shattering. Penta-chlorophenol and Dinitro produced the most rapid drying, resulting in completely dry plants and pods four to five days after spraying. Endothol was slower and required seven to ten days for complete drying. There were no differences in seed yields or shattering between the chemicals or as compared to the check.

## Cotton

COTTON BREEDING FOR DISEASE RESISTANCE Several new experimental strains which combined a rather high level of resistance to races 1 and 2 of the bacterial blight producing organism (Xanthomonas malvacearum), a comparatively high level of tolerance to verticillium wilt, and excellent spinning performance were included in yield tests at four locations in the state. Some of the strains, in preliminary yield tests, showed promise of a yield potential near that of 1517D under disease-free conditions. Further intensive yield testing will determine the reliability of the yield potential of the experimental strains.

From the verticillium wilt breeding pool, one experimental strain, 5548, in preliminary yield tests, appeared to have fiber quality equal to 1517D and to approach it in yield on disease-free soil. On severely wilt-infested soil, strain 5548 yielded much more than 1517D.

Several other strains were continued in the testing program because, although they did not equal 1517D in one or more fiber properties or in spinning performance, they produced greater yields than 1517D on both wilt-infested and wilt-free soils.

COTTON BREEDING FOR SALT TOLERANCE Because of the prevalence of alkali soils in New Mexico, a search is being made for a salt-tolerant variety of cotton. In a previous experiment two varieties, Stoneville 3202 and 1517D, exhibited the greatest tolerance when allowed to germinate in a solution of salts normally found in an alkali soil.

One thousand seed of each variety were germinated on blotter paper in a 0.35N mixed salt solution. The percentages of germination for Stoneville 3202 and 1517D were 27 percent and 29 percent, respectively. The seed which sprouted were designated as highly salt-tolerant and planted in paper cups. The remaining ungerminated seed were washed in distilled water and germinated again. The seed which sprouted in this group were designated as low in salt-tolerance and planted like the highly salt-tolerant seed. The paper cups were left in the greenhouse until the seedlings emerged and then were transplanted into the field.

The selections for high and low salt tolerance did not differ significantly in yield, fineness, elongation, strength, upperhalf mean length, mean length, uniformity ratio, or lint percentage.

The seed from the test were saved. A sample of seed from each treatment and each variety was germinated in a 0.35N mixed salt solution, but the results revealed no significant gain in salt tolerance.

COTTON GENETICS Three New Mexico lines of cotton and two other varieties, Mebane B-1 and Gregg, are resistant to races 1 and 2 of the bacterial blight organism, but the genetic basis of their resistance is not clearly understood. Investigations were initiated this year to determine the genetic basis of this resistance for possible use in the production of blight-resistant cottons. The lines and varieties were selfed and crossed to a fully susceptible line. The selfed seed, the $F_1$ hybrid, and the $F_2$ (first segregating generation) will be grown and evaluated during the 1962 growing season.

**Production efficiency and high quality fiber are goals in the cotton breeding work.**

## Other Field Crops

BEAN BREEDING Exceptionally good yields and highly significant yield differences were obtained in all the 1960 dry bean tests near Deming. Strain 57-386 was the highest yielding pinto in each of the Deming tests and in the test near Espanola. It was also the top yielder during the previous two years at Deming. Because of its moderate rust resistance and its outstanding yield, its seed is being increased for release as a new variety for the Deming area. In the tables the new strain is compared with the two standard varieties, U.I. 111 and N.M. 295.

A total of 1941 breeding plots and 630 yield plots were grown in 1960, with more than a third of an acre for seed increase. The breeding plots consisted of $F_2$ to $F_{11}$ progeny rows, $X_1$ to $X_3$ irradiated U.I. 111 progenies, and miscellaneous materials. Seventy-eight row selections and 2358 plant selections were obtained from these various materials. No rust was present, but virus diseases were more prevalent than in any of the previous seven years. The yield plots near Deming included a cooperative regional trial with 25 entries, an advanced strain test with 30 entries, and a preliminary strain test with 25 entries. A variety and strain test with 25 entries was grown near Espanola. All yield plots were evaluated for stand, days to maturity, growth habit, seed appearance, percentage of water absorption, grams per hundred beans, insects, common blight, curly top, mosaic, and yield.

During the 1959-60 winter, 93 crosses were obtained, 217 $F_1$ cultures were increased, 568 progenies were inoculated and evaluated for rust resistance and 100 other progenies were screened for blight tolerance. One hundred and eighteen of the lines were found to be resistant or very resistant to rust. Twenty-one blight inoculated lines were selected and grown to maturity.

PLANT INTRODUCTIONS In the search for exotic plants of possible value in New Mexico, accessions belonging to more than 18 genera were obtained during 1960 from the four regional plant introduction stations. They were planted in observation rows on May 16, and the following accessions appeared worthy of note:

*Hedysarum spp.*: PI 168954 appeared healthy, very vigorous, and dark green. PI 259863 was not as good looking. PI 240659 and PI 249691, although not as vigorous, seemed to have forage value.

*Desmodium spp.*: Four of the 20 accessions had a heavy seed set but no apparent agronomic value.

*Clitoria ternatea*: PI 164250, PI 209315, and PI 227163 might have some ornamental value.

*Cassia spp.*: PI 214042 and PI 204366 were about nine feet tall, very well-podded, and early. They should be tested for chemical properties and yield.

*Crotalaria spp.*: Eight of the 30 accessions planted appeared to have possible forage or green manure value. They were vigorous and some were heavily podded.

*Hibiscus cannabinus*: PI 248895, PI 248897, PI 250087, PI 250362, and PI 250363 were early and produced a large amount of seed. They might have some value for seed production in our area if the seed were high in oil or some other valuable chemical and if economic methods of harvesting the seed were available.

**Yield, in pounds per acre, of strain 57-386 and two standard pinto varieties, Deming**

| Variety or Strain | Regional Uniform Nursery 1958 (1) | Advanced Strain Test 1959 (2) | Preliminary Strain Test 1960 (3) | Advanced Strain Test 1960 | Regional Uniform Nursery 1960 | Average |
|---|---|---|---|---|---|---|
| 57-386 | 2083 | 2950 | 3291 | 3394 | 3213 | 2987 |
| U. I. 111 | 1889 | 2565 | 2552 | 2858 | 2442 | 2461 |
| N.M. 295 | 719 | 2233 | 2998 | 3179 | 3040 | 2434 |
| Test Mean | 1272 | 2283 | 2651 | 2826 | 2519 | |
| L.S.D. (5%) | 212 | 268 | 376 | 369 | 326 | 142 |
| C.V. (1%) | 14 | 11 | 12 | 11 | 11 | |
| Replications | 6 | 6 | 6 | 6 | 6 | |

(1) A severe rust epidemic was present
(2) A moderate to severe rust epidemic was present
(3) Very favorable growing conditions prevailed in 1960

**Other agronomic characteristics of strain 57-386 and two standard pinto varieties**

| Character | 57-386 | U.I. 111 | N.M. 295 |
|---|---|---|---|
| Days to maturity | 88 | 80 | 88 |
| Growth habit (1=erect; 4=very viny) | 3.3 | 2.2 | 4.0 |
| Seed appearance 1=very good; 5=very poor) | 1.5 | 1.8 | 2.4 |
| Grams per hundred beans (size) | 33.0 | 36.7 | 28.2 |
| Degree of water absorption[1] | 17.5 | 22.5 | 14.9 |
| Rust resistance[2] | M+ | VS | VS |
| Field stand percentage | 95 | 90 | 93 |

(1) The higher the degree, the greater the ease of cooking
(2) M+ = better than intermediate in rust resistance
VS = very susceptible

Twenty of the accessions planted in 1959 and evaluated for second year growth during 1960 were found to have some value for forage.

SUGAR-BEET STRAINS AND VARIETIES In 1960, eight varieties of sugar beets, supplied by the Sugar Beet Section, Agricultural Research Service, U.S. Department of Agriculture, were compared for disease resistance. Six replications of each variety were planted on March 5 and April 5. Twenty-seven strains were also planted in single plot, four-row tests on April 5. Most of these plantings represented breeder's seed.

The 1960 season was good for sugar beets. Almost no curly top was found in the replicated varieties. It was, however, very destructive in the observational plots which were about 300 yards away. Leaf spot (*Cercospora*) was noticeable in the variety test, but was not conspicuous at harvest time, December 1.

The March 5 planting yields ranged from 24.2 to 32.4 tons per acre and the April 5 yields ranged from 22.6 to 30.1 tons. Average weight per root varied from 1.9 to 2.5 pounds. Roots from the March planting averaged 14 percent heavier. The April planting stands were slightly better. Usually April is a little late for optimum yields.

In 1961, 135 mother roots from the observational test were left in the field for seed production. These selections were based on curly top resistance and monogerm character. Approximately 20 pounds of breeder's seed were harvested for the sugar-beet breeders of the USDA.

In 1961, a test of 10 varieties, replicated six times, and an unreplicated observational test of 23 strains and varieties were planted March 17.

## Other Forage Crops

SUDANGRASS VARIETY TEST Twelve varieties of Sudangrass were compared for adaptability in southern New Mexico. Four of the varieties—Grazer, DeKalb SX-11, Lindsey 77F, and Germain's—are hybrids. Wheeler, Piper, and California 23 are selections from Common Sudangrass and have dry stalks. Greenleaf, SA 372 S-1, and Commercial Sweet, which have sweet, juicy stalks, are crosses of Sudangrass and sorgo. Sorghum Almum is a cross of Johnsongrass and sorghum. Sorgrass is a cross of Sudangrass and Johnsongrass.

SA 372 S-1 has consistently produced high yields. Grazer, DeKalb SX-11, and Germain's yielded the most green forage per acre, but they produced the lowest dry weight percentage. However, the dry weight percentage depends partly on the stage of growth at harvest.

The protein percentage differed widely between varieties. This was affected by both variety and stage of growth at harvest.

The following tables present the results of this test.

**Dry weight yield, in tons per acre, of Sudangrass varieties, and the dry-weight percentages of each variety**

| Variety | 1st Cutting | | 2nd Cutting | | 3rd Cutting | | Total Yield |
|---|---|---|---|---|---|---|---|
| | T./A. | % | T./A. | % | T./A. | % | |
| SA 372 S-1 | 1.38 | 12.4 | 3.81 | 20.7 | 1.71 | 16.8 | 6.90 |
| Calif. 23 | 1.31 | 13.3 | 3.87 | 22.8* | 1.72 | 18.2 | 6.68 |
| Wheeler | 1.40 | 15.4* | 3.30 | 26.7* | 1.81 | 18.7 | 6.51 |
| Commercial Sweet | 1.32 | 13.2 | 3.03 | 15.9 | 1.57 | 16.3 | 5.92 |
| Common | 1.25 | 14.9 | 3.16 | 24.7* | 1.35 | 16.9 | 5.76 |
| Grazer** | 1.71 | 11.6 | 3.06 | 15.9 | 1.91 | 15.2 | 5.68 |
| DeKalb SX-11** | 1.70 | 11.9 | 2.29 | 15.2 | 1.52 | 16.0 | 5.51 |
| Greenleaf | 1.16 | 12.7 | 3.10 | 16.5 | 1.25 | 18.0 | 5.51 |
| Germain Hybrid** | 1.69 | 11.3 | 3.15 | 14.6 | 0.64 | 15.5 | 5.48 |
| Sorghum Almum† | 1.47 | 11.9 | 3.03 | 21.6 | 0.61 | 17.3 | 5.11 |
| Piper | 1.30 | 13.9 | 3.23 | 22.8 | 0.52 | 15.6 | 5.05 |
| Sorgrass | 1.34 | 12.0 | 2.53 | 18.8 | 0.81 | 16.6 | 4.68 |

* Partially headed at harvest time.
** Excellent seedling vigor (hybrids).
† Perennial.

**Protein percentages, by variety of Sudangrass, first two cuttings**

| Variety | 1st Cutting | 2nd Cutting | Average | Rating |
|---|---|---|---|---|
| SA 372 S-1 | 15.05 | 6.83 | 10.94 | 5 |
| Calif. 23 | 14.39 | 8.07 | 11.23 | 3 |
| Wheeler | 14.10 | 6.54 | 10.32 | 9 |
| Commercial Sweet | 14.54 | 7.42 | 10.98 | 4 |
| Common | 12.82 | 6.98 | 9.90 | 12 |
| Grazer | 13.47 | 6.67 | 10.07 | 11 |
| DeKalb SX-11 | 13.55 | 8.15 | 10.85 | 7 |
| Greenleaf | 16.36 | 8.08 | 12.22 | 1 |
| Germain Hybrid | 15.40 | 8.36 | 11.88 | 2 |
| Sorghum Almum | 14.27 | 7.21 | 10.74 | 8 |
| Piper | 14.01 | 6.24 | 10.12 | 10 |
| Sorgrass | 14.94 | 6.95 | 10.94 | 5 |

OBSERVATIONAL NURSERY The observational nursery consists primarily of cool season grasses with a few legumes.

The orchardgrass varieties, Pennsylvania Early Synthetic, Pennsylvania Medium Synthetic, Kentucky Synthetic, and Iowa #1, and Iowa #6, are best adapted to southern New Mexico. Several fescue strains appeared to be superior to Alta. These strains—P. T. 195477, P. I. 229500, P. I. 235018, and P. T. 234717—will require further testing before recommendations can be made.

Upland Reed Canarygrass has consistently shown promise for forage use in southern New Mexico. It withstands summer temperatures much better than other canarygrasses in the nursery.

Four strains of birdsfoot trefoil, one white clover, and one strawberry clover were transferred to plots for further testing. The strawberry clover appears to be well suited for turf, and the others are forage plants.

FORAGE BERMUDAGRASS VARIETY TEST Because of the interest in Bermudagrass varieties for forage, six varieties—NK 37, Coastal, Midland, Suwannee, Common, and a New Mexico selection—were planted for comparison. No data have been obtained because the stands were poor.

## Fertilizer Use

COTTON Effect of timing fertilizer applications on cotton was determined by applying 160 pounds of nitrogen as ammonium sulfate and 80 pounds of phosphate as 0-20-0 fertilizer per acre. One application was made of all of the fertilizer at planting time, June 14, for comparison with split applications, in which one-half of both fertilizers was applied June 14 and half, August 1. The soil was a Gila silty clay loam.

The fertilizer increased average yields on all plots by 400 pounds of lint cotton per acre. Of this increase, the split applications were responsible for 100 pounds increase of lint cotton per acre. The split application of both nitrogen and phosphate was most effective in obtaining this result. The most favorable application seemed to result from sidedressing half of the available nitrogen and phosphorus at planting time, and the other half between June 15 and August 15.

Fiber analyses showed that quality was best maintained by the split applications of both fertilizers. The percentage of cotton harvested at the first picking was also affected by the fertilizer application. The fertilizers promoted vegetative growth and reduced the yield from the first picking by 14 percent. However, the split application caused only a four percent reduction while increasing the yield and maintaining the quality of the fiber.

FORAGE SORGHUM Sumac 1712 was grown on Gila clay loam. The rates of fertilizers used were 0, 80, 160, and 240 pounds per acre of nitrogen in the form of urea, and 0, 40, and 80 pounds of available phosphate and available potash, in the forms of single superphosphate and muriate of potash, respectively. Planting date was May 20. Half of the nitrogen and all of the phosphate and potash were sidedressed on June 11. The other half of the nitrogen was applied on July 20.

The results, reported in the table, show nitrogen to be the major factor responsible for increased yields of silage. Small increases, not statistically significant, were obtained from phosphate and potash. The highest yielding treatment (48.4 tons of silage per acre) was 160-80-80 pounds of N, $P_2O_5$, and $K_2O$, respectively. This indicates that for continued high yields of forage from fields of this type, consideration must be given to possible limitations of phosphate and potash.

The amount of protein increased with increments of nitrogen fertilizer. Total digestible nutrients were slightly affected by fertilizer treatment. The effect upon T.D.N. was determined for only a few treatments and a fluctuation of three percent was found. The best T.D.N. value was 49.35 with the 160-80-0 treatment and the poorest was 46.44 with 240-80-0 treatment. The result of the unfertilized treatment was a value of 48.81. The unbalance of nitrogen and phosphorus in the 240-80-0 treatment seemed to affect the lignin formation in the maturing plants. The process of lignin formation during late soft dough and early hard dough stages of maturity is probably a major factor in the values received.

SUDANGRASS Common Sweet Sudangrass was planted May 20 on Gila clay loam and harvested on July 18, August 30, and October 20. Fertilizers were applied in the forms of urea, single superphosphate, and muriate of potash. Nitrogen was applied at the rates of 0, 100, 200, and 300 pounds per acre. One-half was sidedressed June 11, one-fourth July 20, and one-fourth September 1. The rates of phosphorus were 0, 50, and 100 pounds of available phosphate per acre. Potassium rates were 0 and 50 pounds of

**Silage yields, in tons per acre, of Sumac 1712, by rates of nitrogen, phosphate, and potash applications**

| Pounds of N per acre[1] | Pounds of $P_2O_5$ per acre[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | 40 | | | 80 | | |
| | Pounds of $K_2O$ per acre[1] | | | | | | | | |
| | 0 | 40 | 80 | 0 | 40 | 80 | 0 | 40 | 80 |
| 0 | 33.8* | 36.5 | 42.0 | 39.5 | 37.7 | 39.9 | 42.3 | 38.6 | 44.7 |
| 80 | 41.9 | 39.4 | 41.0 | 42.7 | 42.4 | 44.8 | 40.0 | 42.0 | 39.5 |
| 160 | 44.9 | 43.7 | 45.0 | 44.4 | 47.3 | 41.4 | 43.8 | 45.8 | 48.4 |
| 240 | 47.7 | 44.8 | 44.4 | 40.5 | 45.2 | 46.4 | 42.0 | 44.0 | 47.5 |

[1]N applied as urea, $P_2O_5$ as 0-20-0, and $K_2O$ as Muriate of Potash
*Moisture content averages 75 per cent

**Fertilizer applications created visible differences in the color of Sudangrass in experimental plots.**

available potash per acre. All of the phosphorus and potassium was sidedressed on June 11.

The results, reported in the table, show nitrogen to be mainly responsible for increasing the yields of silage. For the first cutting, only nitrogen changed the yield significantly. In the subsequent two cuttings, best yields were obtained from plots fertilized with 200-50-0. Small increases from fertilizing with potassium indicate the possible need for this fertilizer when high yields are continually removed from the land.

As with the Sumac 1712, there was an increase in protein content with increments of nitrogen fertilizer. Total digestible nutrients were also affected by fertilizer treatments. Cutting had more effect than the fertilizer treatment on the T.D.N. This was probably the result of lignin formation, which is inversely related to T.D.N. The most mature first and second cuttings had T.D.N. values of approximately 59.06 compared with 64.38 for the more immature third cutting. The fertilizer treatment 200-50-0 was most consistently high for the three cuttings in T.D.N. value and yield.

**Silage yields in tons per acre, of Common Sweet Sudangrass, by rates of nitrogen, phosphate, and potash applications**

| Harvest Date | Pounds of N per acre | Pounds of $P_2O_5$ per acre | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | | 50 | | 100 | |
| | | Pounds of $K_2O$ per acre | | | | | |
| | | 0 | 50 | 0 | 50 | 0 | 50 |
| July 18 | 0 | 14.6* | 17.2 | 16.4 | 17.6 | 15.7 | 17.7 |
| | 100 | 19.7 | 17.8 | 17.9 | 20.2 | 19.8 | 19.7 |
| | 200 | 20.4 | 20.2 | 20.4 | 20.5 | 19.5 | 17.4 |
| | 300 | 17.6 | 18.9 | 17.6 | 20.3 | 19.6 | 18.9 |
| August 30 | 0 | 18.8 | 22.2 | 21.1 | 21.1 | 20.7 | 22.2 |
| | 100 | 22.4 | 22.4 | 18.0 | 21.9 | 22.2 | 23.4 |
| | 200 | 24.1 | 23.2 | 25.0 | 24.2 | 22.5 | 22.9 |
| | 300 | 24.0 | 25.2 | 22.9 | 24.0 | 24.4 | 21.8 |
| October 20 | 0 | 6.5 | 9.1 | 8.6 | 8.5 | 7.8 | 8.8 |
| | 100 | 9.2 | 9.5 | 7.4 | 8.9 | 9.7 | 10.8 |
| | 200 | 10.1 | 9.3 | 11.0 | 9.7 | 9.4 | 10.1 |
| | 300 | 9.9 | 11.2 | 10.2 | 10.3 | 10.5 | 9.0 |

*Moisture content averages 84 per cent

## Soils

MINERALIZATION OF NITROGEN A non-calcareous soil, Amarillo fine sandy loam, and a calcareous soil, Anthony loamy sand, were leached free of salts. To these leached soils were added four salts ($CaCl_2$, NaCl, $CaSO_4$, and $Na_2SO_4$) at rates of 0.5 percent and 1 percent by weight.

Osmotic tensions were calculated from electrical conductivity measurements for each of the samples and a check. The kind of salt has both a general and a specific effect upon osmotic tension. Generally the greater the solubility and dissociation of the salt, the greater the increase in osmotic tension. This is exemplified by NaCl versus $CaSO_4$ in which the increase in salt concentration to 1 percent increases osmotic tension to 26 bars and 1 bar, respectively. The more specific effect is best shown by the effect of the $Cl^-$ and $SO^=_4$.

When the chloride ion is combined with $Ca^{++}$ or $Na^+$, the result is a similar effect upon osmotic tension. However, with the $SO^=_4$ combined with $Ca^{++}$ or $Na^+$ marked differences result in osmotic tension as a result of solubility and dissociation differences of the salts.

Since microorganisms and higher plants are affected by total stress, an integrated moisture stress value was calculated for the incubation moisture, 15 bars, by the relationship $S=T+r$. In this equation S is the integrated moisture stress in bars, T is the hydraulic moisture tension in bars, and r is the osmotic tension in bars. The calculated values followed the pattern discussed for osmotic tensions.

After 1, 3, and 7 days of incubation at 25°C± 1°C and an hydraulic moisture content of 15 bars, nitrate-nitrogen was determined. The Amarillo soil had greater nitrate-nitrogen accumulation than the Anthony soil. The greater organic matter content of the Amarillo soil accounts mainly for this effect. It is also possible that the calcareousness of the Anthony soil inhibited nitrate production. This latter point is supported by the fact that ammonical-nitrogen production was one-fourth that of the Amarillo soil. Increasing salt content decreased nitrate production. In the Anthony soil the decrease was continuous for the three sampling periods while in the Amarillo soil there was a definite reduction in inhibitor effect at 7 days.

Generally it can be said that nitrate-nitrogen production was inversely related to the effect of the salts upon osmotic tension.

SALTS-AFFECTED SOILS Results of a greenhouse experiment showed that fertilizers applied to a salty soil either helped or harmed plant growth, depending upon the amount of salt in the soil. If the salt content of the soil was low, fertilizers helped the barley plants to reduce the harmful effects of the salt. If the soil contained much salt, applying fertilizers, which are salts themselves, harmed the plants. Barley is a salt-tolerant plant.

A slightly calcareous Amarillo sandy loam surface soil from Curry County was used for this experiment because it was low in salts and had good physical condition. The table shows the treatments that were used and the yields of barley straw that were obtained. Each yield figure is the average of three replications. Salt and fertilizer were mixed with all the soil in each pot.

**Soil treatment and barley straw yield, greenhouse experiment**

| Treatment | Straw Weight |
|---|---|
| | *gms.* |
| NPK[1] | 20.7 |
| NPK + 0.5% NaCl[2] | 9.4 |
| 0.5% NaCl | 3.4 |
| NPK + 1.0% NaCl[3] | 0.9 |
| 1.0% NaCl | 1.8 |

[1]NPK = 200 pounds per acre each of N and $P_2O_5$ and 100 pounds of $K_2O$
[2]0.5% NaCl = NaCl added at rate of 0.5 percent of total weight of soil
[3]1.0% NaCl = NaCl added at rate of 1.0 percent of total weight of soil

This experiment shows the need to test a soil for its salt content before deciding to apply fertilizer. Fertilizers used on a highly saline soil would be wasted, but fertilizers used on a moderately saline soil could help offset the harmful effects of the soil salt.

A second greenhouse experiment on the same kind of soil compared the effects of four different salts on barley growth. The four salts were sodium chloride (NaCl), sodium carbonate ($Na_2CO_3$), magnesium carbonate ($MgCO_3$), and potassium carbonate ($K_2CO_3$). Calcium carbonate (lime) was already present in the Amarillo soil to the extent of 0.5 percent. Magnesium, potassium, and calcium are essential to normal plant growth, but sodium is not. Sodium, magnesium, and calcium may be present in large amounts in New Mexico soil solutions, but potassium is seldom found.

**Effect of four added salts on barley growth**

| Treatment | Straw Weight |
|---|---|
| | *gms.* |
| NPK* | 20.7 |
| NPK + 0.5% NaCl | 9.4 |
| NPK + 0.5% $Na_2CO_3$ | 14.0 |
| NPK + 0.5% $MgCO_3$ | 8.8 |
| NPK + 0.5% $K_2CO_3$ | 14.2 |

*NPK = 200 pounds per acre each of N and $P_2O_5$, and 100 pounds of $K_2O$

The three added carbonate salts are partly precipitated. The sodium chloride remained in solution. This probably accounts for the more harmful effect of sodium chloride as compared to sodium carbonate. Potassium carbonate and sodium carbonate reduced barley yields about the same amount. Magnesium carbonate was the most harmful salt tested. In this case, its effect is on the nutrient status of the barley rather than on the soil. High amounts of magnesium in the soil solution upset the balance of potassium and calcium in plants and caused reduced plant growth.

SODIUM-AFFECTED SOILS Sodium-affected soils are widespread in the playas of southwestern New Mexico and they are common in all irrigated areas except for the Pecos Valley and the High Plains. For information about the use of fertilizers on such soils, a green-

house experiment was conducted with barley on a sodium-affected Glendale clay loam soil from the Mesilla Valley. The soil had an exchangeable sodium percentage of 58 (high) and a salinity of 3.8 millimhos/cm electrical conductivity in the saturation extract (moderate).

The table lists the treatments and the barley straw yields obtained at the conclusion of the experiment. Even the best yields are low, reflecting the adverse effects of the badly sodium-affected soil.

**Barley straw yields on sodium soil, by fertilizers***

| Treatment | Straw Weight |
|---|---|
| | *gms.* |
| Check | 0.86 |
| $Ca(NO_3)_2$ | 0.66 |
| $Ca(NO_3)_2$ + SSP | 1.74 |
| $Ca(NO_3)_2$ + $KH_2PO_4$ | 2.30 |
| $Ca(NO_3)_2$ + SSP +KCl | 2.16 |
| $Ca(NO_3)_2$ + SSP + $K_2SO_4$ | 1.62 |
| $Ca(NO_3)_2$ + SSP + $5K_2SO_4$ | 2.52 |
| $Ca(NO_3)_2$+5SSP+$5K_2SO_4$ | 2.39 |
| $NH_4NO_3$ | 0.93 |
| $NH_4NO_3$ + SSP | 2.01 |
| $NH_4NO_3$ + $KH_2PO_4$ | 3.22 |
| $NH_4NO_3$ + SSP + KCl | 2.27 |
| $NH_4NO_3$ + SSP + $K_2SO_4$ | 2.20 |

*$NH_4NO_3$ is ammonium nitrate, $Ca(NO_3)_2$ is calcium nitrate, SSP is single superphospate, $KH_2PO_4$ is potassium hydrogen phosphate, KCl is muriate of potash, and $K_2SO_4$ is sulfate of potash.

Neither nitrogen fertilizer was of any statistically significant benefit to the barley. Calcium nitrate even reduced the straw yields. Phosphorus fertilizer, in combination with nitrogen, increased yields by an amount that was statistically significant at the 1 percent level. Potassium sulfate combined with calcium nitrate and single superphosphate was the only treatment better than nitrogen plus phosphorus. Ammonium nitrate, alone and in combination, gave slightly higher barley yields than the same treatments using calcium nitrate. The nitrogen-fixing abilities of blue-green algae appeared to prevent the response in these normally responsive soils. These microorganisms grow profusely on sodium soil and produce crusts that contain approximately ten times as much nitrogen as the normal soil.

A potassium response for barley on this soil was not expected. This test shows that fertilizing practices on sodium soils should not be the same as on normal soils.

Soil Moisture Distribution When New Mexico's sodium-affected soils are measured for moisture retention under uniform tension by standard methods, water remains trapped in the previously saturated soils. This was substantiated when soil samples were brought to an apparent equilibrium with a given tension and the distribution of moisture was investigated.

The procedure for moisture-retention determination on a centrifuge was calibrated with respect to RPM and to centrifuging time.

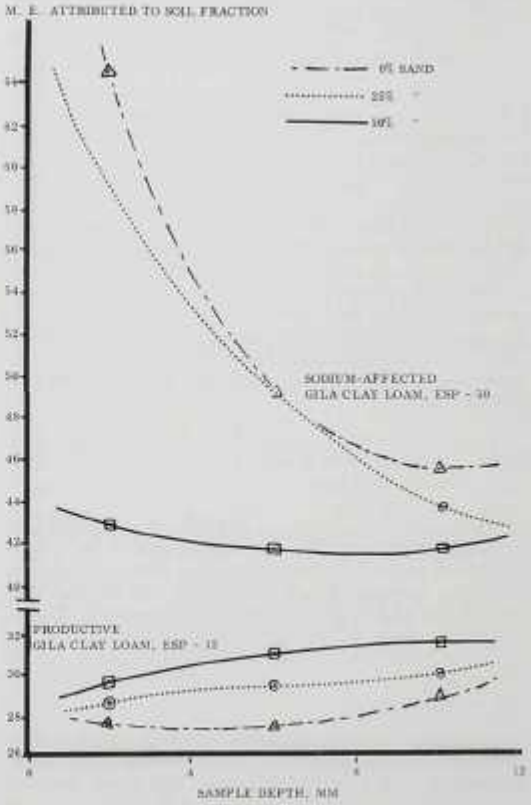
Samples of sodium-affected and productive Gila clay loam were then centrifuged at the standardized rates of 2440 RPM for 30 minutes as follows:

Thirty grams of soil were placed in the soil box in three successive layers. The layers were separated with cheese cloth as shown in figure 1. The soil boxes were saturated, drained, and centrifuged according to

**Fig. 1. This soil box was used in studies of soil moisture distribution.**


the standard (Briggs and McLane) procedure. The moisture content of individual layers of each sample was determined separately and the moisture equivalent values, at various depths, are presented in figure 2. Substantial quantities of moisture were trapped in

**Fig. 2. Moisture equivalent values of sodium-affected and productive Gila clay loam.**



upper layers of sodium-affected poorly aggregated Gila clay loam, but uniform moisture equivalent values were obtained from all depths of a productive (non-sodium) Gila clay loam. In addition to adding to the understanding of soil structure and moisture relationships, this finding may provide the mechanism necessary to convert large areas of abandoned land into productive soil.

The distribution of moisture under high tensions, as measured with Richards' pressure-membrane apparatus, was also investigated. By greatly reducing the size of soil samples, it was possible to completely remove the trapped water from the saturated samples by draining under high tensions. Thus, Richards' procedure may be improved to provide a relatively precise soil moisture content for routine determinations.

Soil Mineralogical Characterization A new method was developed for pretreating soils for mineralogical analysis. Such pretreatments are needed to remove organic matter and cementing materials, and to disperse the soils, so that the particles can be separated by size. The new method utilizes sodium hypochlorite for more efficient removal of soil organic matter, and does not destroy carbonates, or change soil iron and aluminum. A further advantage is that it saves time. It can be supplemented by other methods for removing cementing agents.

The effectiveness of this method for removing soil organic matter is shown in the table.

Estimates were made of the quantities of inorganic amorphous materials in selected New Mexico soils. Samples from which organic matter and sesquioxide coatings had been removed were used for this investigation. Summaries of quantities found are shown in the table. The measurements show that amorphous inorganic materials occur in large enough quantities to be important.

The fine particles of the soil hold nutrients and water most effectively. These fine particles are generally crystalline minerals. If, however, they are largely coated with amorphous materials, the coatings may be of great importance in determining soil properties.

Volcanic ash or pumice has been found in a soil profile in Santa Fe County as well as in two Valencia County profiles, one of which was previously reported. Quantities found range from about 15 to 50 percent of the very fine sand in the sola and parent materials of these three soils. More information is needed to establish a distribution pattern of such materials in this state to improve our knowledge of the materials from which our soils are forming.

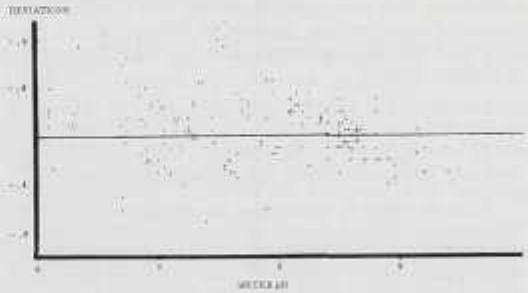
**Quantities of inorganic amorphous materials in selected soils**

| Sample | Particle Size | | Percent |
|---|---|---|---|
| Avg. of 2 Mesilla Valley Samples | Clay | (<.002 mm) | 3.5 |
| | Silt | (.002-.05 mm) | 0.5 |
| Avg. of 2 High Plains Samples | Clay | (<.002 mm) | 15.5 |
| | Silt | (.002-.05 mm) | 3.0 |
| Avg. of 2 Zuni Mountain Samples | Clay | (<.002 mm) | 11.5 |
| | Silt | (.002-.05 mm) | 3.3 |

Soil pH Estimation Indicator solutions are commonly used to measure soil pH because of their convenience and economy. A study was undertaken to evaluate the accuracy of this method with arid-region soils under field conditions.

Although the scatter of points shown in the figure is great, the method does provide a useful approximation.

**Deviations of single indicator values from average meter values in determinations of soil pH.**



Complete results of this study are reported in Research Report Number 48, published by this station.

Soil Surveys The soil survey program in New Mexico is conducted cooperatively with the Soil Conservation Service, the Forest Service, and other agencies concerned with soil survey to provide basic information about the nature and distribution of soils. Soil survey reports also provide information about the

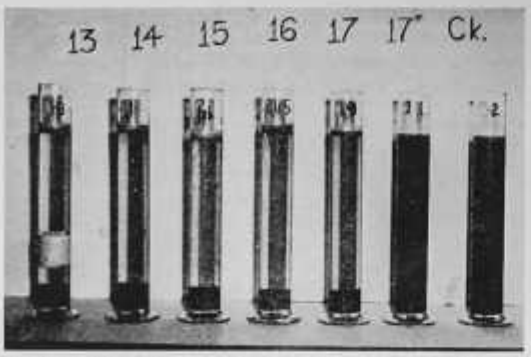
**Percentage of organic carbon in soils treated for removal of organic matter**

| Sample | No Treatment | Sodium Hypochlorite[1] | Treatment 2[2] | Treatment 3[3] |
|---|---|---|---|---|
| Avg. of 6 Mesilla Valley Samples | 0.68 | 0.14 | 0.47 | 0.09 |
| Avg. of 4 High Plains Samples | .77 | .05 | .33 | .08 |
| Avg. of 2 Zuni Mountain Samples | .56 | .04 | .10 | .06 |

[1]Three consecutive treatments with NaOCl Solution

[2]Three consecutive treatments with 30% $H_2O_2$

[3]Three consecutive treatments with 30% $H_2O_2$ preceded by treatments to destroy carbonates and lower soil pH




**Dispersion of sodium-affected Gila clay loam treated with various sugars. Numbers 13 through 17 were treated with different sugars and incubated. Number 17* was treated with methyl glucoside but not incubated.**

nature of soil problems encountered, yields of selected crops, recommendations for the best use and management of these soils, and engineering applications.

The soil survey work is coordinated through an annual work-planning conference held on the New Mexico State University campus. Participants in the conference this year represented the Soil Conservation Service, Forest Service, Bureau of Indian Affairs, Bureau of Land Management, and the Agricultural Experiment Station.

Standard soil surveys were completed in Roosevelt and Torrance counties this year. A new survey of the Tucumcari area was started. Standard soil surveys are being continued in ten other counties.

Highly detailed soils maps have been made of the Experiment Station lands at University Park, and of the five Substations. These surveys will serve to provide detailed soils information to the users of experimental plots, and to provide information for evaluating the criteria used to identify soil series.

A compilation of New Mexico soil survey information is being prepared, and will be available for distribution. This will list and describe a number of little known soil surveys as well as those which have been more widely distributed.

Soil Structure Formation The mechanisms of soil structure formation were explored by investigating the effects of chemical, physical, and biological treatments on the aggregation of soils. Preliminary results suggest that sugars, the major active portion of organic matter, are not good aggregating agents, although they tend to stabilize aggregated soils. The sugar acted as an energy source for microbial metabolism. These metabolic products were paramount in processes that aggregated the dispersed soil (see figure). The energy associated with the aggregation of 1 gram of dispersed Gila clay loam appears on the order of 1 K-Cal.

Freezing and thawing and desiccation at varying temperature levels, as they affect structure stability, were also investigated.

Soil Testing A laboratory technique was developed to estimate rapidly the "potentially available" nitrogen in New Mexico soils. The technique is adaptable to routine volume testing of farmers' samples in the state soil test laboratory and is expected to be more direct and reliable than the method which it will replace.

Since most potentially available soil nitrogen is combined in various organic compounds that may resist rapid decomposition, measurement is uncertain and complicated. The proposed technique rapidly hydrolyzes certain fractions of the organic matter releasing some of the nitrogen which is determined colorimetrically.

Field and greenhouse experiments and plant response correlation studies must be conducted before the technique can be adopted as a routine in the soil test laboratory.

Questions remaining to be answered are: which extractant is preferable? Will one extractant be adequate for all soil textures, or will different extractants be more reliable for different soils? Since a small soil particle size is customarily used in the determination of organic matter, the effect of particle size will also need to be examined.

## Weed Control

Weeds Laboratory During the past year a small but well-equipped weeds laboratory was put into operation. The equipment in the laboratory will make possible basic studies on the physiology of weeds and the mechanism of their responses to herbicides.

Radio-active tracers were used in preliminary investigations of the resistance of some bindweed plants to the killing action of 2, 4-D. The results indicate that the resistance is not related to differences in absorption and translocation, but exists inherently in plant cells. Studies of this mechanism at the cellular level are now possible at the new laboratory.

Weed Control in Cotton Experiments with chemicals for weed control in cotton show that the chemicals are not satisfactory for full season control.

The substituted urea herbicides proved too toxic to cotton and gave inadequate weed control when sprayed on the soil before the beds were formed for the pre-planting irrigation.

In experiments where chemical weed control was not supplemented by cultivation, resistant annuals such as cotton weed (*Anoda spp.*) increased, along with such perennials as nutgrass, blueweed, and white horsenettle.

Chemical residues which carry over to subsequent crops of barley and alfalfa have been a hazard with the substituted urea and atrazine compounds. One of the newer herbicides (2, 6-dichlorobenzonitrile) shows promise of reducing the risk of toxic residues, but further work must be completed before recommendations can be made.

New Herbicides All of the reports by this station on new herbicides are of an informative nature

only. All weed killers must be approved for use on food and feed crops by the Food and Drug Administration, and experimental crops that are treated with new weed killers should be destroyed.

*Pre-emergence*: None of the fourteen herbicides tested proved effective for use on lettuce or onion crops. They were either too toxic for the crops or gave poor weed control. Zytron at 20 pounds per acre showed promise for the control of weeds in chile and cotton. Dacthal at eight pounds per acre showed low toxicity to all crops and, on the average, gave 48 percent weed control. Casoron at four pounds per acre killed the germinating seeds of both crops and weeds.

*Post-emergence*: As a post-emergence treatment, Casoron gave excellent control of weeds that germinated before the application. Furthermore, cotton and sorghum, tolerated the herbicide well. Zytron twenty pounds per acre and Dacthal eight pounds per acre showed promise on alfalfa, beans, chile, cotton, sorghum, and tomatoes.

**In the new weed laboratory, workers can conduct more precise studies in the life cycle and control of weeds for the state.**

Weed Seed Studies The germination requirements and longevity of weed seeds are being studied in a search for more effective control methods. Last year, the germination requirements for 13 common weeds were determined in the laboratory. This year, records were kept on soil temperatures and field emergence.

Under field conditions, the response to temperature is conditioned by how fast the seed coat breaks down. Russian thistle, sunflower, and ragweed exhibited no dormancy, but germinated and emerged as early as February 3. The following weeds were noted in early March: barnyard grass, jungle rice, foxtail, grassbur, cotton weed (*Anoda spp.*), Johnsongrass, annual morning glory, tansy, and London rocket. Sprangle top and stinkgrass showed no dormancy. They required a higher temperature, however, and did not emerge until late May or early June.

Longevity of the seed of these and other species will be determined by regular counts, over a three-year period, of viable seeds remaining in nylon bags. Each bag contains 100 seeds and is buried under approximately one inch of soil.

Johnsongrass Control In cooperation with the Elephant Butte Irrigation District, experiments for the control of Johnsongrass on canal banks were continued for the second year.

Two applications of Dalapon during the 1960 growing season gave 70 percent control. As the amounts of Dalapon and wetting agent were increased, more effective control was obtained. The most efficient control resulted from a spray containing a rate of 10 pounds per acre with one pint of wetting agent for each 100 gallons of spray solution. The increased control obtained from more Dalapon and wetting agent was too slight to justify the added cost.

Neither the time of day at which the treatments were applied nor the inclusion of amino triazole (ATA) significantly influenced the response of the Johnsongrass.

## Weather

Daily weather records at University Park include maximum and minimum temperatures, precipitation, wind direction and velocity, relative humidity, barometric pressure, and evaporation. The evaporation measurement is taken from a standard evaporation pan.

Daily records are given to the local press. The United States Weather Bureau, United States Reclamation Service, International Boundary Commission, and local press receive monthly records.

A summary of weather data for 1960 showed that for the year the average temperature was 60.9°F. or 1.1° above average. Precipitation was 7.73 inches, or 0.20 inch below average. Highest temperature for the year was 107° on June 21 and lowest was 12° on January 31. The last freezing temperature was 28° on April 3 and the first was 29° on October 31, an interval of 211 days.

# ANIMAL HUSBANDRY

## Beef Cattle and Sheep

BEEF CATTLE CARCASS CHARACTERISTICS. Data were obtained on 123 steers for a study of factors affecting live animal and carcass merit, the relative importance of the hereditary and non-hereditary factors, and the genetic and phenotypic relationships between measures of carcass merit and traits of the live animal.

The estimates of heritability reported last year indicate that a herd can be improved considerably by selection for such important carcass traits as conformation, thickness of flesh, uniformity of finish, marbling, grade, and rib eye area.

Analysis of the data on genetic and phenotypic relationships resulted in the phenotypic correlations reported in the table.

These phenotypic correlations indicate that an increase in fat thickness is associated with a decrease in tenderness as measured by the shear value. Also, as the rib eye area increases, the tenderness tends to decrease.

BEEF CATTLE FEEDING. A series of experiments were conducted with pelleted rations to determine which pellets produce gain most efficiently on yearling steers with the least bloating. Carcass grades and yields were also considered.

When pellets containing nearly 50 percent concentrate were compared with a standard hand-fed ration, gains in weight and carcass grades were satisfactory, but costs were high and efficiency declined with the pelleted rations. This may have been because of frequent rather severe bloating in these lots.

Three pelleted rations containing high percentages of roughage were then compared. The three rations contained the following ingredients: Ration 1—80 percent coarse alfalfa hay, 15 percent ground milo, and 5 percent molasses; Ration 2—70 percent alfalfa, 25 percent grain, and 5 percent molasses; and Ration 3—35 percent alfalfa, 35 percent cottonseed hulls, 15 percent milo, 10 percent cottonseed meal and 5 percent molasses. Yearling steers were fed for an average of 167 days for three consecutive years. Gains and carcass grades were somewhat lower than those from the previous experiments. Seventeen percent less total digestible nutrient was required to produce 100 pounds of gain when the high roughage pellets were used.

The amount and severity of bloating was reduced but not eliminated by the use of high-roughage pellets. Pellets containing 70 percent coarse alfalfa hay produced more gains at slightly lower costs than those with 80 percent alfalfa. Higher carcass yields and grades were obtained from the use of the former ration. Cattle fed pellets containing cottonseed meal and hulls ate more and gained faster than those in the other lots, but costs were greater and efficiency was lower. Pellets containing 70 percent coarse alfal-

**Phenotypic correlations from analysis of data on genetic and phenotypic relationships**

| | Traits Measured | | | |
|---|---|---|---|---|
| **Traits Measured** | **Percent Primal Cuts** | **Fat Thickness** | **Shear Value** | **Rib Eye Area** |
| Circumference of Chest — Phenotypic | —.31** | .27* | .11 | .21* |
| Width of Loin — Phenotypic | —.30** | .28** | .24* | —.34** |
| Width of Chest — Phenotypic | —.14 | .01 | .17 | —.16 |
| Percent of Primal Cuts — Phenotypic | — | —.23* | — | .16 |
| Shear Value — Phenotypic | — | .33* | — | —.30** |

* Significant at the 5% probability level
** Significant at the 1% probability level

fa were superior to others used in this experiment in combined efficiency and carcass grade and yield.

BEEF CATTLE REPRODUCTIVE FAILURES In the fall of 1960 the breeding females of three beef herds were examined for pregnancy and for abnormalities of any kind. The findings are shown in the table.

**Data from study of breeding failures, 1960**

| Herd | Number of cows checked | Number of cows pregnant | Percentage of cows pregnant |
|---|---|---|---|
| A | 155 | 146 | 94.19 |
| B | 108 | 50 | 46.29 |
| C | 157 | 157 | 100.00 |

No abnormalities were found during the 1960 examinations. Calving records from herd C show that 96.07 percent of the pregnant cows calved in the spring of 1961. This represents an embryonic and fetal mortality of 3.93 percent.

BULL TESTING A study of factors affecting daily gain and efficiency of feed utilization of young Hereford bulls on 140-day performance tests, from 1951 through 1960, indicates: (1) Bulls fed during the summer gain faster than those fed in other seasons, (2) efficiency of feed utilization varies from year to year, (3) heavier weight on test is associated with larger daily gains and heavier final weight, (4) faster gaining bulls require less feed per pound of gain, and (5) highly inbred bulls tend to weigh less at both the start and completion of feeding trials than other bulls.

FEEDING RANGE HEIFERS Two groups of 32 heifers each, while on pasture, were fed supplements during three periods of their early life to determine the effect of the supplements on the gains of the animals.

The groups were started on the experiment in alternate years. The supplement furnished 40 percent of the total digestible nutrients, 80 percent of the digestible protein, and 100 percent of the carotene required for a gain of ¾ to 1 pound per day. Period 1 was the four months immediately following weaning. Period 2 was the second four months following weaning. Period 3 was a five-month period beginning when the heifers were 19 months old. The feeding treatment included all combinations of feeding and not feeding in the three periods. The treatments, where X indicates supplement feeding and 0 indicates no feeding, and the resulting gains over 17 months for each of the two groups are shown in the tables.

**Gains resulting from supplements fed heifers in Group I, 1958-60**

| Treatment | Average Gain in Pounds | | | |
|---|---|---|---|---|
| | Period 1 | Period 2 | Period 3 | Total |
| XXX | 101 | 136 | 63 | 415 |
| OOX | 65 | 122 | 76 | 398 |
| XOX | 97 | 104 | 68 | 416 |
| OXO | 53 | 152 | —42 | 281 |
| OXX | 38 | 152 | 62 | 379 |
| XOO | 105 | 99 | —38 | 296 |
| XXO | 89 | 122 | —36 | 307 |
| OOO | 65 | 107 | —48 | 251 |

**Gains resulting from supplements fed heifers in Group II, 1959-61**

| Treatment | Average Gain in Pounds | | | |
|---|---|---|---|---|
| | Period 1 | Period 2 | Period 3 | Total |
| XXX | 111 | 144 | 60 | 390 |
| OOX | 2 | 66 | 91 | 280 |
| XOX | 120 | 39 | 70 | 346 |
| OXO | 11 | 146 | —61 | 186 |
| OXX | 8 | 139 | 66 | 295 |
| XOO | 104 | 46 | —65 | 209 |
| XXO | 121 | 139 | —111 | 240 |
| OOO | 12 | 74 | —44 | 158 |

Supplemental feeding for Period 3 was begun about six weeks earlier for Group II than for Group I because of adverse moisture conditions on the range in the autumn of 1960. Precipitation was greater during the first two periods for Group I than for Group II. Results indicate that heifers supplemented during all three periods gained the most weight. Moisture conditions did not affect the amount of weight gained. Heifers receiving no supplement, on the other hand, gained considerably less during the periods of low moisture. Of the three periods of supplementation, Period 3 was the most critical for both groups of heifers. The results also indicate that the heifers given supplement after an unsupplemented period gained at fast rates, whereas the rates of gain for the heifers after being removed from the supplemental ration were slow.

LAMB FEEDING Three years of lamb-feeding trials have been completed. The purpose of the trials was to compare the amount of molasses needed in high roughage pellet mixtures of 70 and 80 percent coarse alfalfa hay with 30 and 20 percent concentrate made up of varying parts of ground sorghum grain and cane molasses.

The results were as follows:

1. Pellets with 80 percent coarse alfalfa were more efficient when grain replaced all the molasses.

2. There was little or no difference in efficiency when the 70 percent coarse alfalfa hay pellet mixture had 10, 5, or 0 percent molasses.

LAMB PRODUCTION Four farm ewe herds have been compared for the past three years to determine the most economical time to wean young lambs. They were weaned at two, three, and four months of age. As soon as the lambs were weaned, the ewes were started on another breeding period. The control group lambed once a year, and the lambs were weaned at four and one-half months. The time required for three lamb crops in each group to be raised and sold as fat was as follows: two-month weaning, 715

days; three-month weaning, 816 days; and four-month weaning, 842 days. Two-month weaning produced 142 percent lamb crop sold in one year, three-month weaning 120 percent, four-month weaning 124 percent, and the control group 132 percent. Ewes bred in June, July, and August produced fewer lambs with twice as many death losses at lambing. It was economical to wean two-month-old lambs.

SHEEP BREEDING In sorting breeding herds, the goal is to increase the differentials in clean wool production and body weights so that the best in the herd can be used for improving the herd average. At this station, a study was made of sorting methods. Sorting breeding herds each year into the top 10 percent and three other groups of 30 percent each was compared to using one previous year's sort for all future years.

One ranch herd of 343 rams with individual six year records on clean wool and body weights was used. The other herd consisted of 600 two-year-old ewes on which individual two-year records had been kept.

In both the ram and ewe herd, it was found that sorting by one previous year's sort reduced the differentials of the top 10 and 40 percent sorts by 50 percent for clean wool and 25 to 30 percent for body weight.

SHEEP CARCASS MERIT Live animal, slaughter and carcass data were obtained on 119 lambs in a study of the effects of weaning age, sex, and breeding on subsequent feedlot performance and carcass merit. Weaning age (60, 90, or 120 days) had no significant effect on feedlot performance or carcass merit. Fine wool X Suffolk crossbred lambs showed a significant advantage over lambs of fine wool breeding in chilled carcass weight per day of age, yield, percentage of retail trimmed fat, rib eye area, and carcass cut-out value. No differences in carcass grade, fat thickness, or percentage of preferred retail trimmed cuts could be attributed to breeding. Ram lambs produced carcasses equal to wether and ewe carcasses and had the added advantage of reaching market weight at a significantly earlier age.

SELECTIVE REGISTRATION STUDY An experiment was undertaken to measure the selection differentials obtained in the selective registration process for Debouillet sheep. From a total of 286 ewes presented for registration on one ranch in the spring of 1960, 166 were registered.

The registered ewes showed a selection differential of .04 inch in staple length, 3.77 pounds in body weight, −.76 microns in fineness, .59 crimps per inch, .39 pounds of grease wool, and .28 pounds of clean wool. These figures indicated that selective registration improves the Debouillet breed in economically important factors. These figures could also be used to evaluate the present program of the Debouillet Breed Association and to guide any change in present selective registration regulations. With caution, it might be applied to other breeds, or at least provide a basis for the inauguration of similar programs.

SHEEP SELECTION To determine the selection differentials, or differences from the average, which can be expected from sorting range sheep, data were compiled for 53 groups of range sheep, representing some 14,000 individual measurements. The sheep were sorted for clean wool production and body weight into the top 10 percent and a combination of the top 10 percent with the next 30 percent which made a top 40 percent.

In the sort for clean wool, percentage differentials of 30 and 15 for ewes and 23 and 12 for rams for the top 10 and 40 percent, respectively, were found to have high accuracy for estimating actual differentials for any age and sex.

Body weight percentage differentials were 17 and 9 for ewes and 14 and 8 for rams, respectively, in the top 10 and 40 percent groups.

WOOL COLOR STUDY Using the top turnout method of evaluation, it was found that on a clean wool basis white wools were 3.7 percent more valuable to the manufacturer than were yellow wools. The study also indicated that on a per fleece basis, sheep which produced white fleeces had a per fleece marketing advantage of 10.1 percent over the yellow-fleeced sheep. The figures were not conclusive in this study, but they were similar to the empirical estimates of the wool trade and merited the recommendation that New Mexico wool growers select against this factor in their breeding program.

WOOL STRENGTH Using the top turnout method of wool evaluation, it was found that wool which the wool buyers considered strong was more valuable than that which they considered weak. In 1959, the


**Samples of New Mexico wool are drawn by "coring" to supply data for studies to make the wool marketing system more efficient.**

increase in value due to strength was 22.45 percent on a clean wool basis and 32.19 percent on a per fleece basis.

In 1960, the advantage was still high enough to be of considerable importance. A pound of strong, clean wool was 7.28 percent more valuable to the manufacturer than weaker wools. Per fleece, the strong wool had a value advantage of 13.32 percent over the weaker stapled wools. These data indicate that the New Mexico sheep rancher should adjust his management practices to minimize production of weak fleeces.

## Range Nutrition

Research workers in range nutrition need procedures for precise determination of feed intake and digestibility by animals on pastures or range. It is difficult to know which plant species the animals select, which parts of plant they eat, and how much forage they consume daily. At this station, formulas were developed for estimating the amount of dry matter intake and the dry matter digestibility.

Several indicators, such as chromium oxide, chromogens, lignin, and nitrogen, have been used to estimate forage intake and digestibility by grazing animals. Since lignin is largely indigestible, digestibility can be calculated from the percentages of lignin in the feed and feces samples. The intake of feed may be calculated if the daily output of feces can be estimated. The major problems in the use of indicators are concerned with sampling.

Methods of sampling fecal output were compared. Eight two-year-old Hereford heifers were used in the comparisons, which included confinement on a concrete platform and use of digestion harnesses that secured bags for feces collection but allowed the urine to escape. Kinds and amounts of feed were controlled and fecal outputs were measured for periods of four and six hours.

Of the various methods of feces collection employed in this experiment, the four-hour feces bag was the most accurate in predicting feed intake and dry matter digestibility of TDN by formula. The actual dry matter intake associated with the four-hour feces bag collections was 15.02 pounds. By formula which would have required determination of fecal dry matter and lignin in feed and feces, the intake would have been:

$$\frac{\%\text{ lignin in feces} \times \text{lbs. feces dry matter} \times 6}{\%\text{ lignin in feed}}$$

$$\frac{22.36 \times 1.060 \times 6}{9.03} = 15.76 \text{ lbs. dry matter intake}$$

In calculating dry matter digestibility by formula from the four-hour feces bag collection the following figure was obtained:

$$\%\text{ DM digestibility} = 100 - \left(\frac{100 \times \%\text{ lignin in moisture-free feed}}{\%\text{ lignin in moisture-free feces}}\right)$$

$$= 100 - \left(\frac{100 \times 9.03}{22.36}\right) = 59.62\%$$

The 59.62 percent dry matter digestion coefficient above compares with 61.68 percent dry matter digestibility as determined in the actual digestion trial. When the amount of dry matter digested was calculated from the actual digestion trial it was found to be 9.3 pounds as compared to 9.4 pounds determined by formula from four-hour feces bag collections.

These methods of range nutritional research along with other methods of investigation give promise of helping solve the difficult problems of determining quantity and quality of forage consumed by grazing animals.

## Range Management and Wildlife

Creosotebush Ecology — In a study of the interrelationship of the creosotebush and its environment, research was conducted on perennial grasses which compete with the creosotebush plant and on the causes of creosotebush death in established stands.

Several perennial grasses, including black grama, tobosa, side oats grama, and bush muhly, compete strongly with creosotebush. Bush muhly is an especially strong competitor. It commonly becomes established within a shrub, outgrows small and medium-sized shrubs, and reduces light reaching them to a critical degree. Under high-intensity competition from grasses, numerous unthrifty and a few dead creosotebush plants were found.

Generally speaking, dead creosotebush plants are not common in the creosotebush type; however, counts at six widely scattered locations in the type revealed 48 to 63 dead plants per acre. Most of these have been dead for several years. Dead plants represent only a small part of the stands, in no case reaching 10 percent of the stands on the areas.

Examination of the crowns of several groups of dead creosotebush plants revealed 90 percent occurrence of channels of larvae of insects of the families Buprestidae, Cerambycidae (Coleoptera), and Megachilidae (Hymenoptera), as yet unidentified as to species. Unthrifty and thrifty live plants had an equally high incidence of larval channels. Decay of varying degrees is generally associated with the channeled crowns, especially in the dead and unthrifty plants. Widely scattered plants in grassland had little borer channeling and the channels were small with little associated decay. Fungi isolated from dead and unthrifty plants are nearly all common saprophytes of soil and decaying plant material. No specific pathogen is indicated. Death of plants appears to be caused by several factors working in combination: borer channels, decay, and drought stress on affected plants.

Cottontail Control — A study was begun this year to determine the importance of cottontails (*Sylvilagus auduboni*) on the semi-desert grassland range and factors relating to their distribution, abundance, and control. Three areas were selected for intensive study of the relationship between the number of cottontails and the density of brush. One area has a brush density of more than 50 plants to the acre with little or no perennial grass. The second area has

a brush density of not over 25 plants to the acre with a poor condition range. The third area is a good condition range with a brush density of less than 10 plants per acre. Preliminary checks, made according to Raunkaier's law of frequency, show cottontails to be associated with the denser brushy areas that support good ground cover.

Fifty Mosby-type live traps were constructed after several types of traps had been compared to determine the most suitable and economical for this area.

Poison baits for cottontail control have been obtained, and containers for distribution of the poison are being constructed for field tests.

Mesquite Control. In experiments with ground treatments for mesquite control, both monuron and 2, 4, 5-T were found to be effective and relatively economical for controlling mesquite in the early stages of invasion. The costs of the two chemical treatments were as follows:

| *Treatment* | *Ground Spray 2, 4, 5-T* | *Monuron* |
|---|---|---|
| Acres Treated | 655 | 3088 |
| Plants per acre | 24 | 10 |
| Cost per acre: | | |
| Chemical | $0.30 | $0.41 |
| Labor: | | |
| Foreman | $0.17 | $0.04 |
| Crew | $0.34 | $0.15 |
| Equipment | $0.17 | ---- |
| Total | $0.98 | $0.60 |

The costs per acre were calculated from the following expenses: 2, 4, 5-T, $7.50 per gallon; Monuron, $2.55 per pound; foreman, $1.50 per hour; crew, $1.00 per hour for spraying, $0.85 per hour for monuron application; equipment, $1.50 per hour. Spraying required more labor than applying monuron, because all of the foliage had to be wet.

**This unthrifty creosote bush competes with a vigorously growing bush muhly plant at its base.**

A high-volume spray of 2, 4, 5-T (0.15 percent acid equivalent) in water was applied to each plant. The equipment was tractor-drawn. A 300-gallon sprayer was fitted with 70-foot side hoses suspended to 34 feet on swivel-mounted booms and a 50-foot rear center hose on a 10-foot swivel boom. Water was hauled in a 700-gallon tank. The crew consisted of one man who drove the tractor and set flags and three men who directed the spray guns. One of these men also hauled the water.

Monuron was applied by a crew of seven or eight men on foot, working in flagged strips. The 80-percent active powder was placed at the base of individual plants at dosages of approximately one gram of the active powder per foot of shrub crown. The average dosage was about six grams per plant.

Range Revegetation. Because black grama stabilizes soil and produces abundant forage under semi-arid conditions, research is underway to determine the seed characteristics and seeding requirements of the species.

In a greenhouse and garden study, black grama seedlings emerged most successfully when the seed was planted at depths ranging from ¼ to ½ inch. Little or no emergence was noted at depths of ¾, 1, and 1½ inches. The soil, a light loamy sand, characteristic of the black grama type of vegetation, dried from the surface downward at a rate of about ½ inch per day. In three or four days without water the soil dried below all planting depths. In the field, seed should probably be planted deeply enough to minimize the drying of the soil around the seed and shallow enough to allow most of the seedlings to reach the surface.

In both field and greenhouse plantings, damping off has killed many very young black grama seedlings. However, dusting the seed with a fungicide and planting in sterilized soil did not prevent seedling losses.

At the experimental ranch, plantings made in late June and mid-August produced significantly greater numbers of seedlings than plantings made in late August. Abnormally low rainfall in September may have accounted for reduced emergence of the late-planted seed.

Under field conditions, emergence of seed planted in shallow furrows was 75 percent less than that planted in flat beds. Mulching produced no significant difference in emergence. Fertilization increased emergence about 100 percent. These same treatments in combination produce an 82 percent reduction in emergence.

Rodent Control. Rodent population studies on semi-desert rangeland indicate that there are enough rodents to consume sizeable quantities of vegetation.

Methods of controlling range rodents were evaluated during the winter and spring on 12 sections of

black grama range in poor condition. The area was divided into one-section areas. Half of the sections were poisoned with strychnine-treated oats and half with "1080" poisoned oats. Six different methods of distributing the poison were used with each type of poison. The methods included broadcasting the materials, placing them in piles on grid patterns with

**Species composition and mean weight of rodents on the semi-desert grassland ranges of the NMSU ranch**

| Species | Mean wt. grams | % composition |
|---|---|---|
| Dipodomys ordii | 49.1 | 49.1 |
| Dipodomys merriami | 43.6 | 15.6 |
| Onochomys torridus | 33.8 | 8.8 |
| Dipodomys spectabilis | 109.9 | 6.4 |
| Citellus spilosoma | 104.6 | 5.5 |
| Perognathus flavus | 6.1 | 4.1 |
| Peromyscus sp. | 22.6 | 3.8 |
| Neotoma albigula | 125.6 | 2.7 |
| Neotoma micropus | 190.6 | 2.1 |
| Reinthrodontomys sp. | 10.4 | 1.1 |
| Sigmodon hispidus | 56.0 | 0.8 |

intervals of 200 x 100, 200 x 50, 100 x 100, and 100 x 50, and placing them at the dens. No section was treated with more than 100 pounds of grain.

The rodents were counted in each section with eight modified Calhoun census lines before the poisons were distributed and again one month after poisoning.

Before poisoning, the rodent population was computed on an acre basis by Zipens' multinomial method. After poisoning, the density was computed by direct count. Since the direct conversion does not project beyond the actual catch, the estimates of density may be slightly less than the actual density.

The mean rodent density of the area prior to poisoning was 2.28 rodents per acre or 1441.2 per section. This gives a total of about 17,294 rodents or 1759 pounds of rodents on the 12-section area.

The "1080" poisoned oats gave a slightly better control than the grain treated with strychnine. The grid method was far superior to the conventional methods of treatment in that it required less poison and gave a much higher percentage of control. The strychnine gave 68 to 98 percent control and the "1080" gave 87 to 99.6 percent control. Evaluation of the broadcast method has not been completed.

**An estimated 1441 rodents per section were found on semi-desert rangeland. These rodents consume large quantities of vegetation, and research is underway to find the best method of controlling them.**

All 14 species of rodents in the area were considered as a unit for estimating densities but they were considered independently for calculating biomass. The species composition of the range lands of this area is based on the capture of 1348 rodents (see table).

**Methods of poisoning rodents and results obtained, each poisoned area included 640 acres**

| Poison and Pounds of Poisoned Grain Used | Method of Application | Mean Density Per Acre 30 Days After Poison | Percentage of Census Lines Catching Rodents | Percentage of Original Population Eliminated |
|---|---|---|---|---|
| **Strychnine** | | | | |
| 50 | Grid 200 x 100 | 0.08 | 25 | 96.0 |
| 100 | " 100 x 100 | 0.05 | 25 | 98.0 |
| 100 | Den to den | 0.72 | 75 | 68.0 |
| **1080** | | | | |
| 70 | Grid 100 x 100 | 0.00 | 0 | 100.0 |
| 35 | " 200 x 100 | 0.01 | 12 | 99.6 |
| 70 | " 100 x 50 | 0.02 | 12 | 99.2 |
| 100 | Den to den | 0.29 | 75 | 87.0 |

# BOTANY AND ENTOMOLOGY

## Alfalfa

PLANT RESISTANCE TO APHIDS Spectrophotometric comparisons were made between aphid-resistant and aphid-susceptible alfalfa plants. Various solvent extracts were measured in the ultra-violet, visible, and infra red ranges. Only with a water extract in the ultra-violet range was there any indication of a chemical difference. This was at approximately 265 millimicrons wave length. It is still not known if this actually denotes a difference between the two plants, or if this difference is related to resistance.

**Some alfalfa plants are resistant to aphids and others are susceptible. Research is underway to determine what causes the difference.**

Further evidence was obtained to substantiate the 1959-1960 report that spotted alfalfa aphids, after they have been fed on an aphid-resistant plant for 24 hours, consume less oxygen than aphids that have been fed on a susceptible plant. This reduced respiratory rate lasts for about an hour and then becomes equal to that of starved aphids. Susceptible-plant aphids have a respiratory rate that is constant and higher than either resistant-plant aphids or starved aphids.

In the preparation of subcellular oxidative particles from aphids, it was found that a grinding medium of 0.25 M sucrose and 0.01 phosphate is superior to a higher concentration. Frozen aphids yielded particles with only about one-fourth the activity of live aphids.

Attempts to feed aphids on a synthetic diet, through various membranes, have been unsuccessful.

## Apples

SPIDER MITES Experiments to find effective means of controlling spider mites in apple orchards included work with varieties, cultural practices, and miticides.

Stayman Winesap and Richared Delicious were the two varieties in the experiments. They were grown in clean, mulched, and sodded plots. Sprays for the Stayman Winesap were (a) 1½ pounds Sevin plus 1 pound Tedion, and (b) 1½ pounds Sevin plus ½ pound Tedion, each in 100 gallons of water. For the Richared Delicious trees, the sprays were (a) 2 pounds DDT plus 1 pound Tedion, and (b) 2 pounds DDT plus ½ pound Tedion, each also in 100 gallons of water. All the trees were initially sprayed on June 27, 1961.

On June 30, the Richared trees in the clean culture plots were more heavily infested than any of the other trees. The weekly mite counts and the addi-

**Number of spider mites per 100-leaf sample, by rate of Tedion application, apple variety, and orchard culture, initial treatment June 27, 1961**

| Examination Date | ONE POUND TEDION | | | | | | ONE-HALF POUND TEDION | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | STAYMAN | | | RICHARED | | | STAYMAN | | | RICHARED | | |
| | Clean | Mulch | Sod | Clean | Mulch | Sod | Clean | Mulch | Sod | Clean | Mulch | Sod |
| 6/30/61 | 51 | 10 | 106 | 710 | 54 | 469 | 6 | 2 | 80 | 287 | 104 | 269 |
| 7/ 1/61 | 24 | 15 | 73 | 434 | 64 | 164 | 37 | 21 | 72 | 179 | 143 | 140 |
| 7/ 6/61 | 25 | 5 | 0 | 67 | 7 | 0 | 6 | 9 | 27 | 2 | 5 | 8 |
| 7/14/61 | 16 | 11 | 9 | 37 | 9 | 12 | 19 | 18 | 21 | 28 | 11 | 24 |
| 7/22/61 | 28 | 3 | 5 | 89 | 13 | 6 | 14 | 18 | 5 | 129 | 147 | 88 |
| 7/29/61 | 46 | 5 | 9 | 163 | 130 | 122 | 40* | 66* | 21* | 72* | 44* | 63* |
| 8/ 3/61 | 32 | 23 | 18 | 10† | 14† | 6† | 15 | 28 | 12 | 38 | 51 | 44 |
| 8/22/61 | 382 | 243 | 73 | 11 | 5 | 8 | 21 | 16 | 1 | 25 | 23 | 19 |
| Seasonal TOTALS | 634 | 367 | 348 | 1535 | 301 | 799 | 173 | 188 | 250 | 791 | 543 | 677 |

*Sprayed with ½ pound Tedion/100 gal. of water on July 27, 1961.
†Sprayed with 1 pound Tedion/100 gal. of water on August 3, 1961.

tional spray applications are shown in the accompanying table. The mixture containing 1 pound of Tedion controlled the mites on the Stayman Winesap for about seven weeks. All of the other trees required re-treatment after approximately one month.

Preliminary results of this work indicate that (1) spider mites potentially will cause heavier losses to Delicious varieties; (2) trees grown under clean culture practices will have greater seasonal mite populations and; (3) using the miticide, Tedion, at the rate of 1 pound per 100 gallons of water will be more efficient and, in the long run, cheaper in controlling mites than the ½ pound rate.

## Bean Root Rot

A soil fungus complex, which includes *Fusarium solani* f. *phaseoli*, *Rhizoctonia solani*, and *Thielaviopsis basicola*, causes a severe dry root rot of pinto beans in New Mexico. Because the low value of the crop makes chemical control impractical, studies are being made to find ways to control the complex through cultural practices, particularly crop rotation. Residues of rotation crops affect the development and severity of bean root rot. Barley straw, sorghum silage, soybean hay, corn silage, and Sudangrass residues were found to suppress the disease. The two which are best suited to New Mexico crop rotations, barley and sorghum, were selected for further study.

Both residues appear to exert a selective effect on the root-rot complex. As it decays, barley residue provides a favorable substrate for the growth of fungi competitive and antagonistic to *R. solani* and *F. s.* f. *phaseoli*, so that their growth is restricted and the infection of the beans is reduced. Sorghum residue gives similar results. Neither residue appears to suppress *T. basicola*.

Field experiments were initiated in 1960 to evaluate 16 different cropping sequences for their effects on cotton seedling diseases, pinto bean root rot, and verticillium wilt of cotton. Set up in three replications, the plots are farmed according to standard practices, and the crops grown on the plots were turned under. The year-to-year effects on the crops included in the experiment are being checked as well as the over-all effects of the four-year rotation on a common crop, cotton. Initial microflora composition was determined, and quarterly samplings have been employed in detecting qualitative and quantitative changes in soil fungus populations. Antagonism studies will be made on promising soil isolates. Initial samplings have shown the pathogens (*R. solani*, *Fusarium* spp., *T. basicola*, and *Verticillium albo-atrum*) to be uniformly distributed over the experimental area, which for four successive years had been planted to cotton. No data were obtained from the plots while planted to first-year crops. There were no apparent effects upon seedling disease incidence the second year, and bean root rot was moderately severe in all plots during the current season. No trends have been observed in studies of the composition of the microflora which related to specific crop sequences.

## Cattle Grubs

For two consecutive years, cattle grubs have been controlled with Co-Ral and Ruelene, applied in late summer or early fall. Ruelene gave a more uniform

**Parasites like cattle grubs cause millions of dollars of loss each year in New Mexico. Research is underway to control these pests.**

**Number of cattle in each class, following treatments with systemic insecticides for the control of cattle grubs Hypoderma sp.**

| Treatment | Date Treated | No. Grubs | 1-5 Grubs | 6-10 Grubs | 11-15 Grubs | 16-20 Grubs | 21-25 Grubs | 26-30 Grubs | Over 30 Grubs | Avg. Grubs per Animal | Percent Reduction |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5% Co-Ral | 7-18 | 17 | 24 | 3 | 0 | 0 | 0 | 0 | 0 | 1.54 | 92 |
| 0.375% Ruelene | " | 9 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 1.52 | 92 |
| Untreated | - | 0 | 0 | 3 | 5 | 3 | 3 | 0 | 3 | 18.53 | — |
| 0.5% Co-Ral[1] | 8-4 | 14 | 17 | 4 | 0 | 0 | 0 | 0 | 0 | 2.08 | 77 |
| 0.375% Ruelene[1] | " | 16 | 21 | 4 | 0 | 0 | 0 | 0 | 0 | 1.73 | 81 |
| Untreated | - | 0 | 5 | 10 | 7 | 3 | 0 | 0 | 0 | 9.00 | — |
| 0.5% Co-Ral | 8-29 | 1 | 24 | 19 | 14 | 1 | 0 | 0 | 0 | 7.34 | 18 |
| 0.5% Ruelene | 8-30 | 10 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 1.41 | 84 |
| Untreated | - | 0 | 5 | 10 | 7 | 3 | 0 | 0 | 0 | 9.00 | — |
| 0.5% Co-Ral | 9-13 | 43 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0.12 | 98 |
| Untreated | - | 0 | 5 | 3 | 2 | 0 | 0 | 0 | 0 | 6.00 | — |
| 0.375% Ruelene | 9-15 | 38 | 64 | 18 | 5 | 1 | 1 | 0 | 0 | 2.37 | 88 |
| Untreated | - | 1 | 3 | 4 | 13 | 2 | 5 | 5 | 9 | 20.26 | — |
| 0.5% Co-Ral[2,3] | 10-12 | 20 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0.72 | 90 |
| 0.5% Co-Ral[3] | " | 12 | 19 | 3 | 0 | 0 | 0 | 0 | 0 | 1.76 | 76 |
| Untreated[3] | - | 4 | 8 | 11 | 4 | 0 | 0 | 1 | 0 | 7.46 | — |
| 0.5% Co-Ral[2,4] | 10-12 | 13 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 1.36 | 70 |
| 0.5% Co-Ral[2,3] | " | 13 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0.44 | 90 |
| 0.5% Ruelene | " | 26 | 28 | 6 | 3 | 0 | 0 | 0 | 0 | 2.32 | 52 |
| Untreated | - | 2 | 8 | 6 | 0 | 0 | 0 | 0 | 0 | 4.62 | — |
| 0.39% Ruelene[5] | 11-10 | 44 | 15 | 1 | 0 | 0 | 0 | 0 | 0 | 0.27 | 96 |
| Untreated | - | 1 | 8 | 7 | 6 | 0 | 1 | 0 | 0 | 7.61 | — |
| 2.0% Dylox | 11-10 | 35 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0.05 | 99 |
| 0.2% Bayer 29493[6] | " | 17 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0.39 | 96 |
| 2.0% Bayer 29493[7] | " | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 100 |
| 0.5% Co-Ral[8] | 12-1 | 6 | 30 | 16 | 1 | 0 | 0 | 0 | 0 | 4.15 | 60 |
| Untreated | - | 0 | 3 | 6 | 7 | 2 | 0 | 0 | 0 | 10.44 | — |

[1]Spreader Activator X-77 added @ 4 oz/100 gal. water
[2]Spreader (Am Cy. Vatsol) added @ 4 oz/100 gal. water
[3]Yearling heifers
[4]Heifer calves
[5]Only Angus herd, all others Hereford
[6]Spray formulation
[7]Pour-on method, ½ pt. per head, Mineral oil formation.
[8]Sprayed by rancher

performance than Co-Ral, which occasionally tends to produce erratic results.

In limited tests, spray formulations of Dylox and Baytex were highly successful in controlling cattle grubs. A mineral oil formulation of Baytex was applied to animals by the "pour-on" method, with highly successful results. By this method, a small amount (8 to 16 fluid ounces) of a certain formulation is poured on the back of the test animals. The method of application has been successful in other areas in the control of horn flies, lice, and ticks, in addition to cattle grubs. The "pour-on" application technique, together with effective systemic insecticides, will reduce, and may eliminate, the use of expensive sprayers. This should increase the efficiency of beef cattle production. The accompanying table gives a summary of the systemic insecticides tested, cattle grub infestation classes, and the results obtained.

## Cotton

Bacterial Blight The prevalence of races of cotton blight bacterium was studied during 1957, 1958, and 1959. A total of 961 samples of diseased cotton from New Mexico were assayed by the cotyledon scratch technique. Stoneville 2B, Stoneville 20, and Mebane 1 were the test varieties. In 1957 and 1958, race 2 occurred in six percent of the samples, in 1959, race 2 occurred in 29 percent of the samples. The increase in prevalence of race 2 means a corresponding decline in the usefulness of varieties resistant to race 1.

Studies were continued with the mutant culture which came from the roots of grasses collected at Tucumcari. This mutant infected Mebane 1 and breeding lines 250, 9136, 8606, 8373-1- and Oklahoma 17-3-4. Stoneville 20, Alabar 49, and Knight $B_2B_6$ were resistant to this mutant culture.

Nematodes In the survey of plant parasitic nematodes in New Mexico, one new nematode was found in large numbers in a weedy cotton field late in the season. The new nematode was tentatively identified to genus, and it is being studied for host specificity and parasitism on cotton.

Nematocides were applied in the fields of five farms in Dona Ana, Luna, and Eddy counties. In irrigation water, 1, 2-di-bromo-3-chloro-propane generally was not effective in controlling the root-knot nematode *Meloidogyne incognita*. Rates varying from 1 pint to 1 gallon of technical DBCP per acre were compared, but there was no appreciable difference in the results. There was no appreciable difference, either, between the two formulations tested, fumazone 70E and Nemagon EC-2. Nemagon 8-1 and Dowfume W-85, chiselled into the field, continued to give best results. Granular applications of DBCP proved very effective in controlling the cotton root-knot nematode, but the cost of this formulation might be prohibitive.

Greenhouse biocidal tests with a nematocide (DBCP) and a fungicide (PCNB), separately and in

combination, were conducted to explore the relationship between the incidence of nematodes and the severity of seedling diseases. Results indicated that, on naturally infested soils, better seedling disease control can be expected when the nematocide and fungicide are applied in combination.

Further greenhouse tests showed that the severity of *Rhizoctonia* and *Thielaviopsis* diseases was increased with the feeding and penetration of *Meloidogyne incognita*. Root material has been fixed, imbedded in paraffin, and sectioned to provide for a histological study of disease development.

SEEDLING DISEASE Every year, cotton seedling diseases and sore shin take a substantial slice out of the income from New Mexico cotton. In 1961, moderate stand losses, primarily due to *Rhizoctonia solani* and *Thielaviopsis basicola*, were sustained in most of the state's cotton acreage. The most severe losses in the state occurred in the Pecos River valley.

Earlier experiments with fungicides have shown that PCNB is quite effective against *R. solani*. In 1961, however, much of the seedling disease was due to severe black root-rot injury caused by *T. basicola*, and PCNB failed to give adequate control. Recent control efforts combining PCNB with several fungicides which have shown some protection against *T. basicola* have given encouraging results. The materials performing best were PCNB plus thiram, PCNB plus Dexon, PCNB plus Maneb, and PCNB plus phaltan. These combinations reduced disease severity 26 to 62 percent. PCNB alone continued to give excellent control where *T. basicola* was not serious. More than 20 chemicals and chemical combinations were included in the tests.

In tests of experimental chemicals for insecticide manufacturing companies, a few appear to be more effective than current commercial materials for the control of cotton seedling diseases.

As for application methods, sprays applied at low volumes, in the furrow, give better results than other methods.

A number of strains of *R. solani*, which causes sore shin, were found not sensitive to chemicals presently used for control. A similar variation in sensitivity to soil fungicides was found in several strains of *T. basicola*. It may prove necessary, in each instance, to isolate the fungus from soil to be treated and conduct sensitivity tests with several chemicals, before recommending materials to be used in field control.

*R. solani* is more active and more pathogenic at higher temperatures, 80° to 90° F., but sore shin in-

**These seedlings were planted in soil inoculated with different fungi, as part of research in the nature and control of the damaging fungi.**

**Yields of seed cotton, in pounds per acre, by insecticide treatment, Hatch, 1963**

| Treatment | 1st Picking | 2nd Picking | Total | Pounds Increase Over Check |
|---|---|---|---|---|
| Di-Syston[1] + No treatment[2] | 2706 | 957** | 3663** | 461 |
| Di-Syston[1] + Di-Syston[2] | 2616 | 1065** | 3681** | 479 |
| No treatment[1] + Di-Syston[2] | 2306 | 991** | 3298 | 96 |
| Phorate[1] + No treatment[2] | 2462 | 1195** | 3657** | 455 |
| Phorate[1] + Phorate[2] | 2255 | 1229** | 3484 | 282 |
| No treatment[1] + Phorate[2] | 2557 | 936* | 3493* | 291 |
| Spray 1[3] | 2531 | 918* | 3450 | 248 |
| Spray 2[4] | 2429 | 979** | 2408 | 206 |
| Check | 2542 | 660 | 3202 | — |
| L.S.D., 5% | 231 | 216 | 289 | |
| L.S.D., 1% | 313 | 293 | 392 | |

1. Application at planting time
2. Application immediately prior to first irrigation
3. Seven applications (Toxaphene - 4 applications; methyl parathion - 2 applications; and methyl parathion plus toxaphene - 1 application)
4. Three applications (Methyl parathion plus toxaphene - 1 application; toxaphene - 2 applications)
* Difference significant at the 5 percent level of probability
** Difference significant at the 1 percent level of probability

jury at those soil temperatures is less extensive than at 60° to 70° F., because at higher temperatures cotton grows vigorously and is less susceptible to the fungus. *T. basicola* is most severe at relatively low soil temperatures, 55° to 70° F., when the growth and vigor of the cotton seedling is quite low. The severity of the seedling disease in the Pecos Valley, where black root rot occurred, was caused by a long cool period before and after the usual planting date in that area.

THRIPS The systemic insecticides Di-Syston and Thimet (phorate), applied in the seed furrow as granules at planting time, successfully controlled heavy infestations of western flower thrips, (*Frankliniella occidentalis*), on cotton plants seven and eight weeks after planting. Sprays of methyl parathion alone and methyl parathion plus toxaphene controlled similar thrips infestations, but toxaphene alone did not.

The harvest results from this experiment showed that seed cotton yields were significantly increased by controlling heavy infestations of early season thrips, and that in-furrow applications of granular Di-Syston were especially effective (see table). Further studies will aid in determining the economic practicality of these systemic insecticides.

Airplane spray deposit patterns of DDT were studied on mature Deming cotton during the late summer of 1960. Better spray deposit patterns were obtained when the plane delivered five gallons of DDT spray per acre from seven to eight feet above the plants than when the plane delivered three or five gallons at a height of three to four feet.

VERTICILLIUM WILT

*Cotton plants:* Studies are being made on the physiological relationship of the cotton plant and the organism causing verticillium wilt of cotton to search for possible leads in developing a control for this disease.

The toxic material in etiolated seedling hypocotyls, previously reported to be inhibitory to the mitochondrial enzyme, is also present in the stems and, to a lesser extent, in the roots of green seedlings. Determinations now show that only about five to ten percent of the total toxic activity was accounted for by previous measurements. Improved analytical techniques show a much larger quantity of the toxic activity located elsewhere in the plant and about equally divided between the cellular debris fraction and the final supernatant. The toxic material has not been shown to be ether-soluble.

Continued attempts to isolate mitochondrial particles from green leaf tissue have produced no positive results. Bovine serum albumin concentrations equal to or greater than that used for non-green tissue have not been effective.

The rates of inorganic phosphorus fixation were measured in the subcellular particles isolated from etiolated seedling hypocotyls. The enzyme systems responsible for this metabolic process were inhibited even more by the toxic material and were more difficult to isolate in an active state than the mitochondrial enzymes. It was necessary to increase the concentrations of bovine serum albumin in the grinding medium, to grind in a mortar rather than to blend, and to omit phosphorus in order to obtain particles that would carry on phosphorylation as well as oxidation.

Preliminary tests studied the effects of culture filtrates of *Verticillium albo-atrum* on the oxidative activity of the subcellular particles. Whereas oxygen consumption in the presence of succinate seemed to be unaffected, carbon dioxide evolution was apparently stimulated. There was some indication that both oxygen consumption and carbon dioxide evolution were stimulated by the filtrate in the presence of malate, ketoglutarate, isocitrate, fumarate, and pyrurate.

*Chloropicrin:* The discovery of economical soil-chemical treatments for wilt would reduce losses caused by this disease and contribute materially to increased efficiency of cotton growing. In earlier work, chloropicrin was shown to reduce the amount of wilt and increase the yield of cotton, but the cost of chemical was too high ($450 per acre) for practical use if charged against the increased yield of a single crop.

An experiment was started in 1959 to measure the benefits of chloropicrin treatment on two successive crops with the hope that wilt control would presist and cost could be amortized over two years or longer. The results are shown in the accompanying table. In 1959, on the first crop after treatment, the amount of wilt was reduced and yield increased by successive increments in the rate of chloropicrin used. However,

**Effect of soil treatment with chloropicrin on amount of wilt and yield of cotton, 1959 and 1960**

| Chloropicrin, gallons per acre, April 1959 | 1959 | | 1960 | |
|---|---|---|---|---|
| | Plants wilted | Seed cotton per acre | Plants wilted | Seed cotton per acre |
| | *Percent* | *pounds* | *Percent* | *pounds* |
| 0 | 48 | 1867 | 60 | 2058 |
| 10 | 44 | 2386 | 61 | 1993 |
| 20 | 33 | 2657 | 66 | 2055 |
| 30 | 26 | 2955 | 61 | 2338 |
| L.S.D. 5% | 5 | 409 | — | 110 |
| L.S.D. 1% | 7 | 619 | — | — |

on the second crop, grown in 1960, only the 30 gallon rate increased the yield and the cost of this amount of chloropicrin is too great for practical use in verticillium wilt control.

*Soil fungicides*: A new procedure for testing experimental soil fungicides for toxicity to Verticillium was developed. The first step is to grow the fungus on glass cloth extended above a culture solution in test tubes. This produces an abundance of microsclerotia, the resistant spores that persist in the soil. Strips of the glass cloth containing the microsclerotia are then placed in field soil in jars. Measured amounts of water and the test chemical are applied. After a 48-hour exposure, the glass cloth strips are removed from the soil, washed, and individual threads of the specimen are plated out on agar to measure survival of the fungus. Twenty-four fungicides were tested in the laboratory, and sixteen of them gave enough control to be tested in the field in 1961.

## Range Grass Seed

THRIPS AND HARVESTER ANTS Of the nine major groups of insects found on black grama grass, only thrips affected the seed set of the grass. One species, *Chirothrips falsus*, accounted for about 97 percent of all thrips present and about 90 percent of all insects, including other species of thrips.

Springtails were present in small numbers, but they feed mostly on fungi and decomposed organic matter. Aphids were occasionally present in very small numbers, and they feed mostly on the foliage. Mealybugs were sometimes profuse on the roots or lower stems, but there was no indication that they influenced seed set. Occasionally, leaf hoppers were numerous, especially on lush, new foliage. Their feeding appeared to be restricted to stems and foliage and did not influence seed set. Beetles were scarce and caused no visible damage to the aerial portion of the plant. The worm stage of at least one species of weevil probably feeds on the roots. Wasps, mostly beneficial forms, were common. Flies were common, but none were observed attacking the grass. True bugs were represented by a small number of several species of both beneficial and plant feeders. None of the plant feeders were observed feeding on the seeds and are presumed to play no significant role in seed set.

*Chirothrips falsus* and other members of this genus feed primarily, if not exclusively, on grasses. On grama grass, they are found mostly on the seed heads. Individual specimens are commonly found within the individual florets where they are in almost direct contact with the young developing seed.

To study more closely the relation of the various species of insects to the seed set of grama grass, broad spectrum insecticides were applied to plots of grass 900 feet square to alter the insect population. Only the population of *C. falsus* was greatly affected. It was reduced by about 90 percent, and the population reduction was accompanied by about a 450 percent increase in seed set. This further indicated a relationship between *C. falsus* and seed set of black grama.

Large quantities of grass seed are collected, stored, and used as food by harvester ants. Several insecticides, applied to various seed baits, effectively controlled infestations of western harvester ants on rangeland near Corona and Magdalena. Kepone, sodium monofluoro-acetate, heptachlor, aldrin, dieldrin, and the experimental insecticide S. D. 4402 mixed with either alfalfa tailings, cracked corn, cracked wheat, or milo at weight ratios of one part actual insecticide to 200 to 400 parts of bait all proved to be initially effective. However, the majority of ant colonies treated with aldrin, dieldrin, and heptachlor recovered and became active again several months after treatment.

**The aerial map shows harvester ant mounds near Las Vegas. The mounds, 10 to 25 feet in diameter, grow no grass and thus reduce the grazing capacity of rangeland.**

The ants quickly forage these baits whether they are applied to the individual mounds or broadcast over an acre of rangeland. They are controlled when they utilize the poisoned food.

In a second study, 70 percent of the ant mound entrances were found to be in the southeast quadrant of all the mounds investigated. Since the early morning sun heats the eastern slope sooner than any other side of the mound, ant activity such as foraging probably occurs sooner than if the entrances were located on any other quadrant of the mound.

Temperatures on and within the ant mounds were found to vary considerably according to exposure to the sunlight, and depth within the mound. Harvester ant activity appears to be directly associated with these mound temperatures.

# DAIRY HUSBANDRY

## High-energy Alfalfa Silage

High-energy silage was fed to milking dairy cows to determine its effect on milk production. The silage consisted of 90 percent fresh-cut field chopped alfalfa and 10 percent ground milo grain or barley. The alfalfa was harvested at the one-tenth bloom stage.

This silage was fed to balanced groups of the cows as 25, 50, or 75 percent of the roughage, on a dry matter basis. The cows also were fed a standard grain mixture in amounts based on milk production.

The total digestible nutrients ingested and the total four percent fat-corrected milk produced by the cows were determined. Data from the 1959 and 1960 crops have been analyzed statistically.

An increase in four percent fat-corrected milk was obtained when 25 percent of the roughage dry matter was derived from alfalfa silage. The increases were 15.4 percent and 4.8 percent for 1959 and 1960, respectively, over the milk production from cows receiving all their roughage dry matter from alfalfa hay. There was no significant change when 50 percent and 75 percent of the roughage dry matter was derived from silage.

## Breeding Efficiency

All cattle in the NMSU dairy herd and 560 milking cows in the Price's El Paso dairy herd were used to determine the effectiveness of regular examination of the reproductive tract and prompt treatment of abnormal conditions as they were discovered.

Treatments consisted of the manual rupture of cysts, the manual removal of retained corpora lutea, and the use of hormones to correct either condition. In Price's El Paso dairy herd 281 cows were used as a control, or check, group with which to compare the group of 280 cows which received regular examination and appropriate treatment.

Among the treated animals in the University herd, 5.3 percent failed to conceive after treatment and eventually were sold as non-breeders. Eleven percent of the animals, after calving, suffered some abnormal ovarian condition which delayed the appearance of first-heat an average of 33 days. In addition, there was a further delay of 35 days before these animals were in condition to breed.

Almost 12 percent of the cattle in this herd suffered from retained corpus luteum. Manual removal of the corpus luteum from the ovary was the most effective way to correct this condition. Hormone injections were effective in only about half of the cases, and the combination of manual removal followed by hormone treatment was even less effective.

Untreated animals with retained corpus luteum were slow in recovering and required more services per conception than did treated animals.

Manual rupture of cysts on the corpus luteum or the Graafian follicle was far more effective than hormone treatment and prompt rupture of the cysts was far more effective than waiting for spontaneous recovery.

In the Price's El Paso dairy herd, where a direct comparison could be made between the control group and the treated group, regular examination and prompt treatment of abnormal cows saved 1,323 cow-days in milk. Nine more cows were sold as non-breeders from the control group than from the treated group.

Apparently, regular examination of the reproductive tract and prompt treatment of abnormal conditions can improve the breeding efficiency of the dairy herd.

# HOME ECONOMICS

## Foods and Nutrition

SIZE OF NEW MEXICO CHILDREN Several years ago, reports of two surveys of the nutritional condition of children and adolescents in New Mexico showed that the Spanish-American children in the groups were smaller than the Anglo children of the same age, had less adequate diets, lower levels of some blood constituents, and a somewhat higher incidence of physical signs of malnutrition. On the credit side, they had fewer decayed teeth and lower serum cholesterol values.

Certain body measurements were made on 365 of these children. These data, shown in the table, em-

**Average body measurements for New Mexico girls, by age and culture group**

| Age and Culture Group | No. | Height | Weight | Iliac | Chest Breadth | Chest Depth | Subcutaneous Tissue | | Leg Girth | Dev. Level |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Scapula | Iliac | | |
| | | *inches* | *pounds* | *cm.* | *cm.* | *cm.* | *cm.* | *cm.* | *cm.* | |
| 6 years old | | | | | | | | | | |
| SA | 9 | 44.76** | 42.67** | 17.79* | 16.98* | 13.10 | 0.71 | 0.69* | 21.99* | 37 |
| A | 9 | 47.34 | 54.89 | 19.31 | 18.23 | 13.48 | 1.07 | 1.02 | 25.13 | 62 |
| 7 years old | | | | | | | | | | |
| SA | 12 | 47.18 | 47.17** | 18.48** | 17.46* | 13.03 | 0.63 | 0.63* | 22.82** | 49** |
| A | 12 | 48.61 | 55.50 | 19.47 | 18.51 | 13.33 | 0.74 | 0.84 | 24.63 | 64 |
| 8 years old | | | | | | | | | | |
| SA | 10 | 49.62* | 49.00** | 19.15 | 18.14* | 12.71 | 0.58 | 0.54** | 22.99** | 53** |
| A | 12 | 50.70 | 63.17 | 20.21 | 19.24 | 13.66 | 0.94 | 1.11 | 25.86 | 77 |
| 9 years old | | | | | | | | | | |
| SA | 13 | 52.41 | 67.19 | 21.01 | 19.52 | 14.54 | 0.92 | 1.04 | 26.53 | 84 |
| A | 12 | 53.74 | 67.58 | 21.55 | 19.95 | 14.44 | 0.82 | 0.84 | 26.77 | 87 |
| 10 years old | | | | | | | | | | |
| SA | 11 | 54.15 | 70.45 | 21.85 | 20.19 | 14.93 | 0.88 | 0.91 | 26.63 | 90 |
| A | 10 | 54.80 | 73.85 | 22.59 | 20.17 | 14.83 | 0.85 | 0.85 | 27.58 | 95 |
| 11 years old | | | | | | | | | | |
| SA | 12 | 56.30* | 73.54* | 22.23 | 20.57 | 15.09 | 0.80 | 0.78* | 27.10 | 95* |
| A | 12 | 59.00 | 89.04 | 23.38 | 21.62 | 15.47 | 0.98 | 1.15 | 29.16 | 115 |
| 12 years old | | | | | | | | | | |
| SA | 7 | 59.90 | 92.57 | 24.44 | 22.06 | 16.40 | 1.01 | 1.03 | 29.37 | 119 |
| A | 8 | 61.64 | 98.75 | 24.50 | 22.53 | 15.85 | 0.99 | 1.04 | 30.54 | 127 |
| 13 years old | | | | | | | | | | |
| SA | 9 | 59.77 | 101.72 | 25.16 | 22.18 | 15.58 | 1.18 | 1.12 | 31.94 | 128 |
| A | 9 | 60.46 | 103.67 | 25.13 | 22.42 | 16.10 | 1.13 | 1.08 | 31.04 | 130 |
| 14 years old | | | | | | | | | | |
| SA | 9 | 61.36 | 100.56 | 25.63 | 22.54 | 15.98 | 1.17 | 1.11 | 30.26 | 127 |
| A | 7 | 62.30 | 106.14 | 25.86 | 23.14 | 17.80 | 1.24 | 1.39 | 32.03 | 134 |
| 15 years old | | | | | | | | | | |
| SA | 2 | 63.40 | 106.00 | 24.10 | 22.30 | 17.80 | 1.10 | 1.20 | 31.70 | 136 |
| A | 0 | | | | | | | | | |

* Difference significant at the 5 percent level of probability
** Difference significant at the 1 percent level of probability

**Average body measurements for New Mexico boys, by age and culture group**

| Age and Culture Group | No. | Height | Weight | Iliac | Chest Breadth | Chest Depth | Subcutaneous Tissue | | Leg Girth | Dev. Level |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Scapula | Iliac | | |
| | | inches | pounds | cm. | cm. | cm. | cm. | cm. | cm. | |
| 6 years old | | | | | | | | | | |
| SA | 10 | 44.71* | 42.95** | 17.43 | 17.44 | 13.36 | 0.51 | 0.51 | 21.46 | 38 |
| A | 11 | 46.47 | 47.45 | 18.15 | 17.86 | 13.26 | 0.54 | 0.52 | 22.91 | 48 |
| 7 years old | | | | | | | | | | |
| SA | 13 | 47.81 | 49.85** | 18.67 | 18.68 | 13.48 | 0.59 | 0.57 | 33.26 | 54 |
| A | 11 | 49.35 | 57.77 | 19.32 | 19.10 | 13.97 | 0.62 | 0.62 | 25.31 | 69 |
| 8 years old | | | | | | | | | | |
| SA | 12 | 49.78* | 56.50 | 19.48 | 18.60* | 14.18 | 0.61 | 0.58 | 24.38 | 67 |
| A | 12 | 51.80 | 61.00 | 20.24 | 19.75 | 14.78 | 0.61 | 0.62 | 25.23 | 76 |
| 9 years old | | | | | | | | | | |
| SA | 10 | 52.09* | 61.20* | 20.61 | 19.97 | 14.81 | 0.62 | 0.58 | 25.05 | 76 |
| A | 10 | 55.64 | 70.75 | 21.00 | 20.89 | 14.99 | 0.73 | 0.69 | 27.46 | 92 |
| 10 years old | | | | | | | | | | |
| SA | 11 | 54.01 | 71.45 | 21.25 | 21.16 | 14.40 | 0.76 | 0.81 | 27.07 | 91 |
| A | 10 | 56.19 | 80.90 | 22.19 | 21.14 | 15.29 | 0.97 | 0.99 | 27.41 | 103 |
| 11 years old | | | | | | | | | | |
| SA | 9 | 56.70 | 72.00 | 21.60 | 20.86 | 15.56 | 0.69 | 0.74 | 26.78 | 95 |
| A | 9 | 59.14 | 82.94 | 22.61 | 21.67 | 13.62 | 0.71 | 0.63 | 28.63 | 109 |
| 12 years old | | | | | | | | | | |
| SA | 9 | 59.87 | 101.83 | 24.83 | 23.82 | 17.20 | 1.11 | 1.06 | 30.65 | 127 |
| A | 9 | 59.19 | 92.33 | 22.97 | 22.26 | 15.90 | 0.87 | 0.89 | 30.73 | 118 |
| 13 years old | | | | | | | | | | |
| SA | 9 | 58.82* | 89.50* | 23.61 | 22.13 | 16.50 | 0.98 | 0.89 | 29.25 | 116 |
| A | 9 | 62.73 | 105.75 | 24.05 | 23.34 | 16.35 | 0.82 | 0.83 | 30.90 | 134 |
| 14 years old | | | | | | | | | | |
| SA | 5 | 58.46 | 93.20 | 24.66 | 23.20 | 15.0 | 0.72 | 0.64 | 29.45 | 120 |
| A | 3 | 63.43 | 106.00 | 25.03 | 23.73 | | 0.73 | 0.83 | | 135 |
| 15 years old | | | | | | | | | | |
| SA | 4 | 65.00 | 119.25 | 26.05 | 25.30 | 16.6 | 0.90 | 0.83 | 31.30 | |
| A | 1 | 67.20 | 131.00 | 26.90 | 29.60 | | 1.2 | 0.70 | | |

* Difference significant at the 5 percent level of probability
** Difference significant at the 1 percent level of probability

phasize the smaller size of the Spanish-American children. However, the differences are not statistically significant in all age groups and are most evident in the younger children.

The increase in height and weight of the Spanish-American children is not less than that of the Anglos during the period from 6 to 14 years so the difference in size must be due to slower growth before 6 years of age.

PROTEIN OF PINTO BEANS. The nutritional advantage of supplementing the protein of dried beans with protein from animal sources was shown by feeding experiments with young rats. The protein of dried beans lacks certain amino acids essential for growth. Addition of small amounts of these amino acids results in increased growth.

In general, protein foods of animal origin are good sources of the amino acids lacking in proteins from plants. Young rats were fed diets containing 10 percent protein from dried, cooked pinto beans, defatted whole egg, defatted fish meal, or mixtures of beans with egg or with fish meal. Some of the diets were supplemented with methionine and tryptophan, the two amino acids most deficient in beans.

Ten percent protein from beans alone produced a gain of 22 grams in six weeks. The same diet supplemented with 0.5 percent methionine and 0.1 percent tryptophan, a gain of 114 grams. The diet containing 10 percent protein from defatted whole egg produced a gain of 165 grams. Rats fed a diet containing 5 percent protein from beans and 5 percent from egg gained 128 grams. When this diet was supplemented with methionine and tryptophan, the gain increased to 140 grams.

The fish meal was prepared for human consumption, but the rats apparently found it unpalatable as they ate the diet poorly. Gain in weight on this diet was 63 grams. A mixture of 5 percent protein from beans and 5 percent from fish meal, plus methionine and tryptophan produced a gain of 112 grams.

Perhaps a better picture of the value of these proteins or mixtures of proteins is shown when the rates of gain are expressed as grams gained per gram of food eaten. Protein from beans alone produced a gain of .074 grams per gram of diet; from egg alone, .316; from fish meal alone, .194 gram.

The study of the effect of varying the amounts of methionine and tryptophan is being continued. Other amino acids have been added, alone or in various combinations. So far threonine and histidine were found to have a slight supplemental effect.

VEGETABLE VARITIES FOR FREEZING. Selected varieties of peas, green beans, and sweet corn have been grown in two localities in New Mexico for four successive seasons and tested for freezing quality.

**To determine the resistance of western cottons to the intense incident solar energy these squares of fabric were exposed to the sun.**

The frozen vegetables were cooked and scored by tasting panels. The judges evaluated color, flavor, texture, and appearance of the cooked frozen vegetables. Wando peas and Huron sweet corn were rated highest.

One problem is to harvest the vegetables at the stage of maturity which will make them tops in flavor, color and texture. The more mature peas and sweet corn are higher in starch content and less sweet.

High temperatures hasten the maturing process. Overmature vegetables yield a frozen product that is of poorer color and flavor than those harvested earlier. Overmature green beans tend to be stringy, and overripe corn and peas have a starchy texture. A prolonged hot period may send vegetables rapidly into a stage of maturity unsuited to freezing. Even the same size of pea which gave a satisfactory frozen product early in the season may not give as good a frozen product later in the season after continued high temperatures.

This hastening of maturity in vegetables has been verified with color measurements on the Beckman DU Spectrophotometer. Measurements of color of peas of the same sieve size from different harvests gave different reflectance values indicating different starch content.

## Textiles and Clothing

ACALA 1517G COTTON FIBER. Many of the changes which take place in a cotton dress as it wears out are changes in the physical properties of the fabric and take place more or less slowly. The accuracy with which these changes can be measured depends upon the skill of the person who makes the measurements, the temperature and humidity under which the measurements are made, as well as upon the precision of the equipment being used. Changes in the fabric of a dress may not mean that the dress is no longer serviceable. In our economy, garments are often discarded for reasons other than serviceability of fabric.

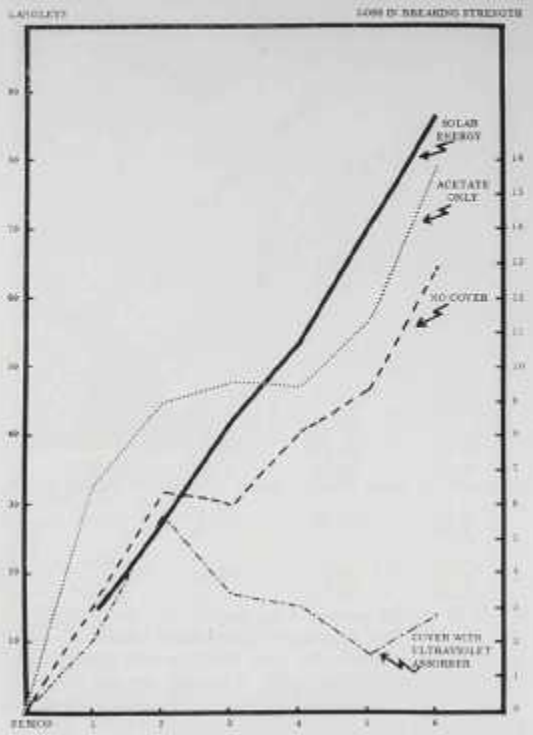
Properties of fabrics change at different rates in different parts of a garment. These changes present a problem in measuring the wear on the garment. The first problem is to decide which properties of a fabric cause significant or undesirable changes in either the appearance or the durability of the fabric. Since the deterioration of the fabric in most garments is relatively slow, the areas showing the most wear or change in appearance were chosen for testing.

To test garments of different sizes on comparable areas for changes in a given property, a diagram of the location of each test specimen was prepared to fit the smallest garment used. This diagram was then adapted to the larger dresses by adjusting the sampling pattern from the waist line and the hem line.

Ten tests for changes in the physical properties of the fabrics were used: breaking strength, breaking elongation, rate and amount of crease recovery, coefficient of friction, drape, capacitance, thickness, weight, yarn count, and color. There were 76 test specimen taken from each of 120 dresses. This involved 35,328 actual measurements in addition to the 6,668 color reflectance measurements over the visible spectrum to determine the amount of fading.

The dresses in this study were worn a maximum of 1,350 hours and laundered, to specifications, a maximum of 48 times. The dresses were worn approxi-

**Fig. 1. The cumulative effect of incident solar energy upon the breaking strength of protected and unprotected cotton fabric exposed to New Mexico sunlight.**




mately 14 hours per day by girls from six to sixteen years of age.

The data are being analyzed, but no interpretations have been made.

Cotton Fabrics Exposed to Outdoor Weather

One objective of a western regional pilot study is to measure the resistance of western cottons to specific elements of outdoor weather in certain areas. In New Mexico, the high intensity of the incident solar energy was considered to be a prime factor in weathering. At the exposure site, continuous recordings were made of the incident solar energy as well as for temperature and humidity.

Four one-yard squares of fabric made of Acala cotton were exposed at a 45° angle, facing south. Each replication was exposed under three conditions. One-third of each square was covered with a 0.12 mil clear cellulose acetate film which transmitted about 90 percent of both the ultraviolet and visible light. Another third of each was covered with a 0.12 mil cellulose acetate film containing a compound which absorbed most of the ultraviolet light but transmitted the visible rays. The third portion remained uncovered. These fabrics were sampled six times from October, 1960, to April, 1961.

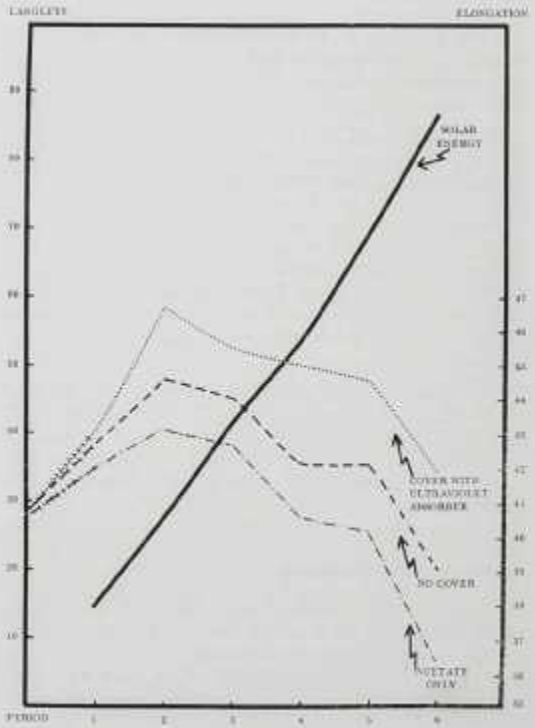
The fabrics covered with the film containing the ultraviolet absorber showed no significant loss of strength or elongation. The short ultraviolet rays, when absorbed by the cotton cellulose, caused rapid deterioration as shown by the fabric which was covered by the clear cellulose acetate.

Research has its share of surprises. It had been assumed that the uncovered fabric which received all of the incident solar radiation would show the most deterioration. This was not the case (figures 1 and 2). There are some possible explanations. The uncovered fabric might have been shielded by dust which may have clung to the cloth more than to the slick acetate films. Since the acetate films transmitted only about 90 percent of the light, the additional 10 percent could have itself provided the additional protection. Then too, extra moisture may have been held under the acetate film to aid the ultraviolet rays in their action on the cotton cellulose. More information is necessary to clarify the results.

The data as obtained has been charted against the total incident solar energy for each period of observation. An attempt was made to relate results to the changes in temperature and humidity.

Results of the pilot study will be used as a guide in planning details of the study of varietal differences in resistance to weathering of Acala 1517C, Acala 4-42, and Pima S-1.

**Fig. 2. The cumulative effect of incident solar energy upon the fiber elongation of protected and unprotected cotton fabric exposed to New Mexico sunlight.**



# HORTICULTURE

## Flowers and Ornamentals

CUT FLOWER CROPS — Chrysanthemum — Rooted cuttings of seven varieties (courtesy of Yoder Brothers, Barberton, Ohio) were planted outdoors, at a spacing of six-by-eight inches on July 7, 1960. The tips were pinched on July 21 and later pruned to two stems. This crop was planned for the 10-week varieties to flower by October 27 in time for All Saints Day, November 1.

Cutting of the seven-week variety (Enterprise) began on October 10, and the nine-week varieties, Crystallite and Fred Yule, were harvested next. On October 31, a 30° frost blackened the centers of the unharvested flowers of the 10-week varieties, Golden Shoesmith, Indianapolis Pink Luminary, and Whirlwind. Some flowers from these varieties were harvested prior to the frost. All of these varieties may be grown for a commercial crop provided an early frost does not occur. Most of the flowers that were damaged could have been cut at the latest by October 27.

A planting of the varieties mentioned above was made in a greenhouse bench at a six-by-six inch spacing on July 7, 1960. The cultural practices were the same as for the outdoor crop. Cutting dates of the flowers were about two weeks later, probably because of poorer light conditions in the greenhouse. All varieties produced salable flowers.

Fifteen garden varieties of chrysanthemums, after flowering in the greenhouse, were shifted to an outdoor plot, May 13, 1960. They were set eight inches apart in rows 30 inches apart and cut back to a height of six inches. They flowered in the fall before frost and all plants survived the winter of 1960-61.

Results indicate the greenhouse grower may recommend that garden varieties purchased as potplants in the spring or early summer and planted out may be expected to flower again in the fall.

Carnations — The varieties, Aurora and Garnet Sim, were the most productive of six varieties tested for a two-year period, producing an average of 67.08 and 60.32 flowers per square foot of bench.

Snapdragons — Plants of five varieties were benched on December 13, 1960, at a six-by-six inch spacing in a 60° F. greenhouse. These were summer varieties. The varieties were Dark Star, Crystal White, Gaytime, White Skies, and Summer Jewell. Skips (missing florets) occurred only in Summer Jewell and White Skies. All varieties produced marketable flowers.

POTPLANTS — Poinsettia — Cuttings of the varieties, Ecke White, Indianapolis Red, and Ecke Pink, were taken on August 30, 1960, and rooted under mist and lighted for two hours each night from August 30 to October 11, 1960. The rooted cuttings were panned, three to a six-inch plastic azalea pot.

BEDDING PLANTS — Pansy — Giant Oregon mixed seed were sown on January 13, 1961, germinated on January 24 and produced salable plants in 2½-inch jiffy pots by April 18, 1961. Heavy flowering of these plants occurred from April 28 to May 25, 1961.

CHLOROSIS CONTROL — For treatment of iron chlorosis (yellowing of foliage on tips of plants), Wacco Sulfasoil was applied to the soil around various ornamentals. The material is 42 percent iron, 20 percent sulfur, 3 percent manganese, and 1.25 percent zinc.

Trees responded more slowly than roses and herbaceous plants.

Severely chlorotic Mermaid rose plants responded to one application of 12.5 pounds of the material applied in bands one foot within and one foot beyond the spread of the plants and worked into the upper three inches of moist soil. The plants were irrigated within two days after treatment.

A 25 pound surface application around each of several Flory Dwarf peach trees did not produce toxic symptoms, although the plants greened more slowly

**Research on flowers and ornamentals at University Park includes work of interest to both home gardeners and commercial producers.**

than did the roses. Six pounds of Sulfasoil distributed equally in holes around the drip line of a Santa Rosa plum tree made the leaves somewhat greener than those of adjacent untreated trees.

Seedling redbud trees and American arborvitae liners in gallon containers responded to the application of one-half cupful of Sulfasoil per container without toxic symptoms from the treatment.

Foliage Plants for New Mexico Homes and Commercial Establishments. The following plants, tested in the greenhouses, are suggested for use as indicated.

For pot plants and interior planter boxes:

Botanical Wonder—*Fatshedera lizei*

Ponytail Plant—*Beaucarnea recurvata*

Purple spot Pseuderanthemum — *Pseuderanthemum atropurpureum*

Fluffy Ruffles Fern—*Nephrolepis exaltata*

Pepperomia—various species

For tubs:

Orangeberry Pittosporum — *Pittosporum undulatum*

Lance Bird-of-Paradise-Flower — *Strelitzia parvifolia*

Pineapple—*Ananas comosus*

Wormwood Senna—*Cassia artemisioides*

Neanthe Palm—*Neanthe elegans*

Liquid Iron Chelate. Tips of 10 species of woody and herbaceous plants were dipped in each of three concentrations (83, 165, and 330 p.p.m.) of Versenol FL M-1566. The foliage was observed for symptoms of toxicity after two days and again after five days. Of the woody plants, only slight toxicity was observed on Mermaid rose and Chinese wistaria.

Bridal wreath which was chlorotic at the tips greened rapidly following treatment with the chemical. Other woody plants treated were Chinese photinia, silver maple, European cranberry bush, sungold St. Johnswort and alligator juniper. The juniper was the only plant which did not respond to the treatments.

Ornamental Plants. An additional 54 species or varieties of ornamental plants have been placed under observation for adaptability. Of these, 44 will be maintained in containers until shifted to the field plot.

In the first season after the seed were planted, the California planetree, *Platanus racemosa*, reached a height of 5.5 feet with a spread of 3 feet. In the same

time, the London planetree, *Platanus acerifloia*, grew 3.5 feet with a 6- to 9-inch spread.

Threadleaf groundsel, *Senecio longilobus*, and broom snakeweed, *Gutierrezia sarothrae*, both native plants, grew well in containers. Both may be used in a landscape planting. The foliage of the groundsel is grey-green year around, and the plants may be used as a border 2 to 3 feet high. The yellow flowers are abundant in summer and sparse during the winter in Las Cruces. It will withstand shearing. The snakeweed also produces yellow flowers. Its foliage is dark green, and the flowers are produced in the fall. It will withstand shearing.

Ornamental plants which failed to survive the winter of 1960-61 were:

Mexican Orange—*Choisya ternata*

Barbados Cherry Malpigia—*Malpigia glavbra*

Bush Germander—*Tecrium fruticans*

Redberry Buckthorn—*Rhamnus crocea*

Umbrella Pine—*Scadopitys verticillata*

Holly—*Ilex liukiuensis*

Crimsonspike Netbush — *Colothamnus homalophyllus*

Peppermint Tree—*Agonis marginata*

Tea Tree—*Leptospermum luehmanni*

Peninsula Madrone—*Arbutus peninsularis*

Striped Moorgrass—*Molina caevalea*

Lantana varieties, Confetti, Pink Frolic, and Cream Carpet

Sicklethorn asparagus, *Asparagus falcata*, and cape-honeysuckle, *Tecomaria capensis*, were injured by low temperature but they came back from the root system. These two are suitable for outdoor culture only in southern New Mexico.

Plants recommended for landscape use in New Mexico are Chinese twisted juniper, Armstrong's juniper, Hetz juniper, evergreen candytuft, devilwood osmanthus, Yellow Banks rose, and cutleaf Persian lilac.

Eucalyptus varieties showing promise for southern New Mexico are *E. rostrata, viminalis, bicolor, perriniana, and E. gunni*. The foliage of *E. gunni* was slightly injured by low temperatures, but it recovered by summer.

## Fruits and Nuts

Apple Harvest The correct time to pick apples depends somewhat upon the length of time they will be held before marketing. Ripe apples do not keep long, even in cold storage. If they are picked too early they may not break down in storage, but they shrivel and never attain good eating quality. The correct time to harvest is exceedingly difficult to determine. Climatic conditions, size of the crop, vigor of the tree, and other such influences affect the composition of the fruit so that no one index of maturity suffices for all conditions.

The expressible juice content of the fruit has been investigated for several seasons as a possible index of maturity.

The respiration rates of these fruits were also measured. In general, varieties with a high respiration rate do not keep as well as those with a low rate of respiration.

A good correlation was found between juice content and respiration rate as the fruit matured on the tree. Richared and Jonared (varieties with relatively high rates of respiration) increased in juice content as the respiration rate increased to a peak (climacteric). Blaxtayman and Arkansas Black (varieties with relatively low respiration rates) did not show definite climacteric rises, and increased little in juice content during the maturation period.

Apple Rootstocks for Dwarf Trees Dwarf apple trees planted in 1958 grew well in 1961 but were not permitted to fruit, although some of them flowered. The interstem dwarfs probably are not as well adapted to New Mexico conditions as the other stocks, since 11 out of 50 trees died in the first three years. Only one of 75 trees on Malling I, II, and VII stocks has been lost. All three of these Malling stocks appear to be well adapted and are recommended for trial planting where semi-dwarf trees are desired. Malling VII is smaller than the other two.

Grape Rootstocks A new vineyard, planted in 1959, includes a replicated block of four varieties on three nematode resistant rootstocks as well as a number of new varieties.

After two years, the European varieties, Thompson Seedless and Cardinal, grafted upon rootstocks, are more vigorous than non-grafted vines. Less vigorous, ungrafted vines of Thompson Seedless produced a few grapes the second year. Both grafted and ungrafted Cardinal vines were vigorous, but all winterkilled the first year with no crop the second season.

Ungrafted Concord and Fredonia, American varieties, were weak and chlorotic. Grafted vines were more vigorous and the leaves were greener. Winterkilling was not a problem with American grapes, either grafted or not grafted.

Peach Dormancy and Rest Period A cyanide-containing, growth-inhibiting substance has been isolated from extracts of dormant peach flower buds and identified as mandelonitrile. The substance is being applied to peach trees at different times of the year to determine whether or not it will delay the blooming until after the late spring frosts.

This material is quite toxic to buds and wood at certain concentrations and should not be used by growers until further investigations are completed.

Peach Rootstocks and Stone Fruit Varieties Redhaven peach trees, grafted to S-37, Lovell, Yunnan, or Flory Dwarf roots, are growing in the experimental orchard. Some are also growing on their own roots. The trees on S-37 rootstock are larger in trunk diameter and size of top than those on Lovell or Yunnan. On its own roots, the variety grew little during the first year in the orchard. Redhaven on Myrobalan and Mariana plum stocks was removed from the ex-

**These two-year-old Thompson Seedless plants, grafted upon nematode-resistant rootstock, grew more vigorously and produced a better crop than non-grafted plants.**

periment because of incompatability of stock and cion. Iron chlorosis or gummosis has not developed on trees in the roostock planting.

Of the 36 varieties of peaches in the stone fruit variety planting, seven fruited during 1960 for their first bearing year. From the standpoint of fruit quality, the Sunhigh and Redhaven varieties were outstanding. Other yellow-fleshed, freestone varieties which appeared to be promising were Redcap, Redglobe, Coronet, Redskin, and Ranger.

None of the cherry, plum, apricot, or nectarine varieties have fruited.

PECAN BREEDING During the 1960 season, 521 pecan varieties, selections, and new hybrids were harvested separately, by date of ripening. Of this number, 183 produced nuts for two or more years. On the basis of shelling and kernel qualities, size of nut, earliness of maturity, and black pecan aphid tolerance, 18 were considered for limited propagation. These were budded on seedling rootstocks for study of growth and development.

Hybrids of different parentage varied considerably in the characteristic of bearing a heavy crop one year and a lighter crop the following year. Hybrids derived from crosses with either the variety Onliwon or Success as one of the parents tended to produce a more consistent yield each year than those of other parentage. Hybrids with Mahan as one of the parents more often produced nuts with improperly filled kernels, and the nuts were much larger than those from other parentage.

Trees of eight promising extra early and early maturing hybrids were planted in several different locations in the shorter growing season areas of the state. Data on vigor, tree development, and winter hardiness of these new hybrids will be recorded.

Two varieties which originated in other states appeared to be adapted to New Mexico conditions. Limited propagation of one of these varieties by commercial nurseries is underway.

Approximately 60 new selections of backcross and double cross origin were made this year. Buds from these selections were placed on mature trees for future studies on the progenies resulting from this method of breeding pecans.

PECAN PRODUCTION Two hybrids that produced highly uniform seedling trees in the rootstock test were selected for further study. Four commercial pecan varieties were budded on seedling trees to study the effect of rootstock on cion vigor, growth habit, and earliness of production.

The selections in the rootstock test that showed severe zinc deficiency symptoms last year expressed similar symptoms this year. Selected trees within a line that showed severe zinc deficiency symptoms were topworked to three commercial varieties, one severely affected, one moderately susceptible, and one not sus-

ceptible to zinc deficiency. This study was initiated to determine if zinc deficiency susceptible rootstock trees would similarly affect the topworked variety.

In studies to determine effect of age of rootstock at budding time on earliness of production of pecans, five commercial selections were budded on rootstock trees one, two, and three years of age. At budding time the one year old trees had small (three-sixteenths inch) diameters and only five percent of the buds survived. On trees that were two and three years old, bud take was about 98 percent successful. The minimum diameter on these trees was one-half inch. Budding on rootstocks smaller than one-half inch diameter is generally not recommended because of the low percentage of bud take.

## Vegetables

FERTILIZER Fertilizer tests were conducted with spring lettuce to determine nitrogen and phosphorus requirements under New Mexico conditions. Levels of nitrogen were 50, 100, 200, and 300 pounds per acre; levels of phosphorus were 0, 100, 200, and 400 pounds per acre. All fertilizer was banded. Date of maturity and head size indicate the response to treatments. Best head size was obtained with 200 pounds of nitrogen. At the 200 and 300 pound rates, lettuce matured slightly earlier than at the lower rates. Apparently the nitrogen requirement of spring lettuce is between 100 and 200 pounds per acre. Experiments will be conducted to obtain a more precise value for this requirement.

The different phosphorus treatments did not affect head size. The plots not receiving phosphate matured two to three weeks later than other plots, and were so badly tipburned that very few marketable heads were harvested from them. The severity of tipburn on these plots probably was not a direct result of low phosphate, but was due to late maturity.

Similar results were obtained from pot experiments in which the plants were harvested before head formation. Average plant weights are shown in the table.

**Effect of phosphate on growth of lettuce plants**

| Treatment | Average Plant Weight |
|---|---|
| | *gms.* |
| Control (No phos.) | 0.26 |
| 100 Lbs. P per A | 3.19 |
| 200 Lbs. P per A | 3.82 |
| 400 Lbs. P per A | 4.91 |

ONION IMPROVEMENT Evaluation of test cross progenies for the production of a Grano-type white hybrid onion shows that the frequency of the genes for production of yellow bulbs was much reduced. In bulb shape, size, and uniformity of maturity, the hybrids very closely resemble the commercially grown white Grano strains.

Considerable progress was made in the transfer of the gene for pink root disease resistance to the 235 pollen-sterile and 114 pollen-fertile lines used in the work. Bulb shape varied from slight Grano shape to that resembling the flat Crystal Wax parent which originally carried the resistant gene. Mother bulbs were selected within the lines that more closely resembled the Grano type. These are to be considered for additional crossing and production of seed next year.

Yellow Grano, pollen-sterile lines varied in date of maturity. Bulbs for the production of seed were selected on the basis of maturity, amount of top growth, bulb shape, and color. Several promising lines in the early, medium, and late maturity groups were retained.

Seed harvested from crosses made this year are to be planted next year for evaluation of these lines as parents in the production of hybrid yellow onions.

In the open-pollinated white Grano improvement program, the parent lines to be included in the proposed S-1D strain of white Grano were again tested. These parent lines produced fewer seedstalks than the existing commercial strains of white Grano, and matured at least one week earlier than the S-1 strain. In bulb shape and color, the lines closely resemble the S-1. Selected bulbs were planted in a mass crossing block and seed was harvested for limited commercial plantings next fall.

VARIETIES AND PLANTING DATES Nine vegetable crops—lettuce, tomato, cabbage, carrot, cauliflower, garlic, watermelon, squash, and cucumber — were planted to determine the best planting dates and varieties for production in southern New Mexico.

Spring lettuce planted on November 20 had good solidity and no tipburn, but the average head weighed less than two pounds. December plantings produced heads of good solidity and size, but tipburn was severe in some varieties. The optimum planting date for the spring crop apparently lies between November 20 and December 20.

A high percentage of the lettuce planted on July 25 bolted. August 24 plantings did not mature before severe freezes occurred. Of the varieties planted, Great Lakes 659 and selections of 659 were outstanding in performance.

J. Moran and Pearson V-10 produced the highest yields of 21 tomato strains tested.

Round Dutch, Marion Market, Detroit, and strains of Copenhagen Market were outstanding in both spring and fall cabbage plantings.

One strain of white garlic was planted at monthly intervals beginning on September 18 and ending on February 16. December, January, and February plantings were superior in yield.

Twelve varieties of hybrid squash were tested for performance. Hybrid Zucchini types were superior in yield.

Pinkshipper was the outstanding tomato variety in the greenhouse.

## Chickens and Eggs

EGG HATCHABILITY Eggs produced by chickens bred at three altitudes were hatched at three locations to determine how altitude affects the hatch. The results are shown in the table. In every case except one, the hatch of all eggs was best at the lowest altitude. Eggs originating at 7160 feet hatched one percent better at their natural location than at the 3945-foot elevation. At 240 feet, eggs from the two highest elevations hatched the best. These data confirm the results obtained during the 1960 season. It is better to hatch chicken eggs at altitudes below 3900 feet even though they may have been produced by birds adapted to higher altitudes.

**Percentage of hatch of all eggs at all locations**

| Origin of eggs | Place of Hatch | | | |
|---|---|---|---|---|
| | Oregon | New Mexico | Wyoming | Total |
| Oregon | 69.4 | 61.7 | 56.8 | 65.6 |
| New Mexico | 84.5 | 71.3 | 59.0 | 71.4 |
| Wyoming | 85.9 | 64.8 | 65.8 | 69.5 |
| Cornell | 83.0 | 58.3 | Not set | 70.3 |

EGG PRODUCTION Eggs from chickens bred at different altitudes — 240, 3945, and 7160 feet — were hatched at 3945 feet and the chicks were reared to determine whether the strains originating at different altitudes would differ in production.

When they were 25 weeks old, the birds were housed at random in either floor pens or individual cages. The values obtained during the experiment are reported in the table. None of the birds were culled during the experiment, which ran for eleven 28-day periods.

The strain from the lowest altitude performed better than the other strains, although the other two strains performed satisfactorily.

Birds kept in floor pens produced more eggs than birds kept in cages. Mortality and feed conversion were slightly higher in the floor pens than in the cages. However, the caged birds gained about twice as much body weight as the birds in the floor pens. Much of the additional weight on the caged birds was fat.

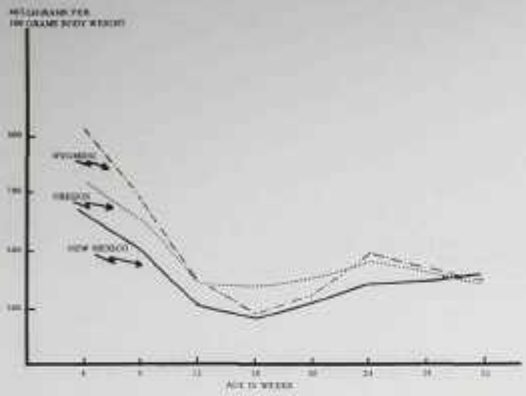
**Average production from three strains of white Leghorns originating at different altitudes but hatched and reared at 3,945 feet. 1960-61**

| Item | Production from Strains Originating in | | |
|---|---|---|---|
| | Oregon (240 ft.) | New Mexico (3945 ft.) | Wyoming (7160 ft.) |
| **Egg production per hen-day** | | | |
| Floor pens, % | 60.2 | 50.6 | 51.5 |
| Cages, % | 55.3 | 46.2 | 45.0 |
| **Egg production of survivors** | | | |
| Floor pens, % | 57.1 | 50.8 | 51.5 |
| Cages, % | 53.7 | 50.3 | 44.1 |
| **Mortality** | | | |
| Floor pens, % | 25.0 | 35.0 | 35.0 |
| Cages, % | 10.0 | 40.0 | 20.0 |
| **Feed per dozen eggs** | | | |
| Floor pens, lbs. | 4.87 | 5.95 | 6.19 |
| Cages, lbs. | 4.47 | 6.02 | 5.70 |
| **Body weight at housing** | | | |
| Floor pens, lbs. | 3.05 | 3.72 | 3.44 |
| Cages, lbs. | 3.09 | 3.76 | 3.40 |
| **Gain during production period** | | | |
| Floor pens, lbs. | 0.40 | 0.56 | 0.41 |
| Cages, lbs. | 0.85 | 1.17 | 0.83 |

HEART MEASUREMENTS Research workers sometimes evaluate various genetic or physiological changes in chickens by measuring organs and glands. To test the accuracy of this method, heart sizes were studied from the three strains of chickens, at four-week intervals, for 32 weeks.

The size of the heart was determined by the weight of the organ corrected for body weight.

**Heart weight, corrected for body weight Leghorn males, 1960.**



The figure shows that significant differences between the test strains occurred during the fourth and eighth weeks. However, the corrected heart weights became about the same and reached a plateau at 12 weeks.

Analysis of all the data at the end of the experiment shows no significant differences between strains. Heart measurements must be made for more than one week, particularly during the early periods of observation, for evaluation of genetic or physiological changes.

## Geese

ANATOMICAL DEVELOPMENT Knowledge of the anatomical development of the gosling is important if this bird is to be slaughtered for meat at an early age.

Five male and five female goslings were sacrificed at biweekly intervals from the time they were one day old to 22 weeks of age. The following measurements were taken and adjusted to body weight: breast weight, wing length, total visceral weight, and abdominal fat.

Body weight increased rapidly to the eighth week, then slowed. The wings developed to their maximum length by the eighth week. Total visceral weight was greatest for young goslings. Abdominal fat increased with advancing age.

Breast weight increased with body weight and age. Breast weight increased more rapidly after extensive wing development.

FEEDING GEESE Twelve rations—three levels of protein (16, 20, 24 percent) each at four levels of energy (1100, 1250, 1400 and 1550 calories of metabolizable energy per pound of feed) were compared to determine their effect on growing goslings. The rations were fed in two experiments, which included 2040 White China goslings.

In the first experiment each of the twelve rations was fed to 100 goslings from the time they were a day old until they were slaughtered. All the goslings in the second experiment were fed the ration containing 24 percent protein and 1550 Cal. M.E./lb. of feed for the first four weeks. The goslings were then divided into groups of 35 goslings each. Two groups (70) were fed each of the twelve rations used in the first experiment from four weeks until slaughter.

In the first experiment, weight gains paralleled protein level. The differences were greater during the early growing period, but they were still present at slaughter.

In the second experiment, weight gains improved with increasing protein level to the eighth week. After this there was no difference in weight gains of these goslings.

Weight gains did not improve with increasing energy level. The two higher energy levels depressed weight gains during the first four weeks.

**Cages were compared with floor pens to determine the most efficient method of laying flock management.**

# ESPANOLA VALLEY SUBSTATION

The Espanola Valley Substation, located near Alcalde, is one-fourth mile west of U. S. Highway 64 and seven miles north of Espanola. The research here is primarily crop variety evaluations of vegetables, small fruits, chile, pasture combinations, alfalfa, field corn, small grains, tree fruits, and miscellaneous crops.

VEGETABLES Seven varieties of peas were harvested during the last week in June. The high yielders were Wando and Freezonian.

The cantaloupe variety trial included seven varieties. Delicious, Pride of Wisconsin, and Rock O'Honey were the best producers.

Five carrot varieties were grown. Danvers and Chantenay were high producers and yielded 33 and 31 tons of marketable roots per acre, respectively.

SMALL FRUITS None of the 16 bramble varieties under test survived the winter in a thrifty condition. Much of the new growth was winterkilled, and the surviving canes produced only small berries. Twelve plants of Early Harvest produced only six pints of berries, and 12 plants of New Logan produced only five pints.

Of seven strawberry varieties, Gem and Fairfax are top yielders.

Couderc 13 and Golden Muscat grape varieties yielded 30 to 27 pounds of fruit per vine, respectively. These two varieties outyielded 14 others.

CHILE IMPROVEMENT Chile improvement entails selecting individual plants that are early maturing, that have an upright growth habit, and that produce large, smooth, well shaped pods of medium pungency.

PASTURE COMBINATIONS Ladino clover mixed with brome, orchardgrass, alta fescue or tall oatgrasses appears more satisfactory than alfalfa or birdsfoot trefoil.

MISCELLANEOUS CROPS Sesame and safflower seeds were not harvested this year because they failed to ripen before frost.

Trials were made on six grain sorghum varieties. NK 3000 was the earliest maturing and the only variety that produced good ripe grain.

Turf grasses planted were Kentucky blue, Commercial, Newport C-1, Arboretum, Merion, Park, Bents 554A and 7908, Creeping Red Fescue, and Perennial rye.

Small plots of sixteen range grass species were established this season.

ALFALFA Ranger and New Mexico 11-1 alfalfa gave higher yields than Zia, Caliverde, and Lahontan.

FIELD CORN Observations were made on the grain and forage yield ability of 25 medium early corn hybrids. The highest yields were produced by Embro 101A. Indications are that several other hybrids are adapted to the valley.

SPRING PLANTED SMALL GRAINS Several varieties of barley, wheat, and oats were compared. Atlas 37 was the highest barley grain producer and Lee the highest wheat grain producer. Weights of the harvested oats were not compared because gusty winds mixed the bundles.

TREE FRUITS Most of the fruit trees were damaged by unusually cold weather, April 25 and 26. Recorded minimum temperatures on these dates were 25°F. and 22°F., respectively. Cherry, peach, plum, and apricot crops were lost. Small crops of Red Rome, Jonathan, Yellow Delicious, and Blaxtayman apples were harvested. Bartlett and Waite pear varieties also produced small quantities of fruit.

# MIDDLE RIO GRANDE SUBSTATION

## Field Crops

SMALL GRAIN VARIETIES Spring Barley Nursery: Grain yields of 19 varieties and strains of spring barley ranged from 30.2 bushels per acre for the variety, Bonneville 446, to 105.8 bushels for the strain, No. 4363-62 (Canada). Nine other varieties and strains yielded more than 80 bushels per acre. These entries and their yields were as follows: 51AB-5936CCV, 82.1 bushels; B298-4, 82.1 bushels; Traill, 82.1 bushels; 51AB-4720CCV, 86.4 bushels; California 1019, 88.6 bushels; Firlbecks III, 92.8 bushels; Atlas 57, 92.8 bushels; Atlas 46, 95.0 bushels; and 51AB-5348 CCV, 103.6 bushels. All of these strains and varieties were more productive than Trebi, the check variety, and some indicated adaptability to the Middle Rio Grande area.

Spring Barley Varieties: Ten spring barley varieties in the advanced variety trial produced mean grain yields ranging from 69.1 bushels per acre for the variety, Frontier, to 111.8 bushels for the variety, Atlas 57. Trebi, the check variety, produced 74.7 bushels. Atlas 57 and Atlas 54 yielded 100.2 bushels per acre, which was higher than the Trebi yield by a statistically significant amount. Varieties Unitan, Lico III, Atlas 46, and Harlan all yielded more than 80 bushels per acre but were not significantly higher than Trebi.

Atlas 54 and Atlas 57, relatively new varieties of spring barley, indicate climatic and soil adaptability to the Middle Rio Grande area as well as the desirable characteristics of earliness and good straw strength.

The test weight per bushel of all barley varieties was below the U.S. standard. This may be partially attributed to a 90°F. temperature, May 20, when barley varieties were in the boot stage.

Spring Oat Varieties: Mean grain yields, in bushels per acre, were: Fultex, 81.6; Mustang, 88.1; Bridger (CK), 90.7; Overland, 99.2; and Bannock, 99.2. Fultex, Overland, and Mustang oat varieties are relatively low growing, fine-stemmed varieties, resistant to lodging, and very adaptable to combine harvesting. Bannock and Bridger are taller growing, larger stemmed varieties, but they are more subject to bird damage and lodging than fine-stemmed varieties.

ALFALFA VARIETY EVALUATIONS Six alfalfa varieties, grown in a 6 x 6 Latin square field, were harvested for the first time in 1960. The mean yield of six varieties for four cuttings was 7.16 tons per acre of air-dry forage with no significant differences between varieties.

The varieties included in the trial and their yields of air-dry forage, in tons per acre, were: Zia, 6.95; Ranger, 7.59; NM11-1, 7.15; Lahontan, 7.04; Talent, 7.29; and Vernal, 6.95.

Spotted alfalfa aphids were evident in plots before the second cutting, but the population was small. The aphid population increased shortly before the third cutting, and aphid counts were made. Aphid populations were highest on NM11-1 and Vernal, intermediate on Ranger and Talent, and lowest on Zia and Lahontan.

Varieties also differed in rate of recovery after cutting. Talent and Lahontan regrew fastest and were followed by NM11-1, Zia, Ranger, and Vernal.

SORGHUM HYBRIDS AND VARIETIES Thirty-seven hybrids and two varieties of grain sorghums ranged in grain yields from 81.0 bushels for NK135 to 187.8 bushels for D-50A.

The relatively high yields were attributed largely to high soil fertility and sufficient soil moisture, which caused profuse tillering or suckering of plants. Most plants produced three to five tillers besides the main stalk. The high soil fertility was due to the commercial fertilizer being applied twice, in light amounts, during the growing season rather than once, heavily at the beginning of the season.

FORAGE SORGHUM VARIETIES Eighteen forage sorghum hybrids and varieties were compared for green weight yield, length at maturity, resistance to lodging, disease, and insect incidence. The mean green-weight yield of all varieties and hybrids was 26.6 tons per acre. The yields ranged, by varieties, from 17.6 tons for Atlas sorgo to 40.0 tons for Sugar drip.

**Field Day visitors view plots of turfgrasses being evaluated at this substation for adaptability in the Middle Rio Grande area.**

Three other relatively high yielding entries were NKX 3065, 35.0 tons; Sourless, 33.9 tons; and Beefbuilder, 33.4 tons. On the basis of data obtained, 13 varieties and hybrids were significantly higher than Atlas in green-forage yields.

SUDANGRASS VARIETIES The mean green-forage yields in tons per acre were: 372-S-1, 24.9; Commercial Sweet, 24.2; Asgrow Sweet 2160, 23.0; Greenleaf, 22.0; California 23, 21.9; and Piper, 20.4. All of these variety yields were higher than Common Sudangrass, the check variety, by a statistically significant amount.

TURFGRASS EVALUATIONS Out of 69 strains and varieties of Bermudagrass, under evaluation for two years, only three show climatic adaptability and desirable turfgrass characteristics. These are:

—T-47: Low growing turf of high density, dark green, winter hardiness, medium-coarse texture, and free of seed heads. It establishes rapidly, grows slowly after establishment and requires minimum maintenance.

—USDA #3: Coarse texture, high density, dark green, very few seed heads, and slightly faster growth rate than T-47. A very attractive coarse-textured grass.

—Sunturf: Medium texture, high density, dark green, very few seed heads, and more cold tolerance than other entries. Grows faster than T-47 and USDA #3, and is very attractive.

Bluegrass Varieties: Eleven bluegrass varieties have been evaluated for two years. Of the eleven, only Newport C-1 showed resistance to both rust and fungus in 1960. The rust infestation started in Merion bluegrass in June and spread to all of the bluegrass except Newport C-1. Newport C-1 had every chance to become infested with rust as irrigation water ran over Merion onto Newport C-1. Substation personnel and visitors also walked over Merion onto Newport C-1, but it remained rust free.

Newport C-1 is the most outstanding of all bluegrass varieties grown. It is dark green and grows much more slowly than Kentucky bluegrass. Its turf type is more open, which permits air circulation and undoubtedly makes it more heat tolerant than Kentucky bluegrass. Newport C-1 seems adaptable to being grown without shade in the Middle Rio Grande area.

## Horticulture

TOMATO NUTRITION Four levels each of nitrogen and phosphorus were combined in a factorial design and applied to J. Moran tomatoes. The nitrogen was applied at the rate of 0, 50, 150, and 300 pounds in the form of ammonium nitrate (33 percent), and the phosphorus at the rates of 0, 50, 150, and 300 pounds in the form of super-phosphate (45 percent).

Yields increased with increasing phosphorus levels, but this increase was more pronounced when the nitrogen was absent than at the 50 pound level. When as much as 150 pounds of nitrogen per acre was applied, the addition of phosphorus did not increase the yields enough to be justified.

The nitrogen increase from 0 to 300 pounds per acre increased the yields of tomatoes from 8 tons to 15 tons per acre. The greatest increase in yield, however, was obtained from the first 150 pounds of nitrogen. The average yield from this was 29,773 pounds of tomatoes per acre. When 300 pounds of nitrogen were applied, the yield increased only to 30,308 pounds. Doubling the amount of nitrogen increased the yield by about 600 pounds.

The tomato leaves were chemically analyzed for their phosphorus and nitrogen content three times during the growing season, and a correlation is being determined between the amounts of these elements in the soil and plants and the yield.

VEGETABLE VARIETIES Varieties of head lettuce, cantaloupe, tomatoes, and potatoes are being tested to determine their adaptability to the Middle Rio Grande Valley on the basis of total yield and quality.

*Lettuce*: Nine lettuce varieties were compared and, for the first time in four years, Great Lakes Regular outyielded Great Lakes 659. Wes Pak and Great Lakes 366 equaled Great Lakes 659 and were followed closely by Great Lakes 118 and A-36.

*Cantaloupe*: Seven varieties of cantaloupe were planted in this year's trials. Hales Best 36, Gold Cup, and 4-50 were the highest yielders, with Gold Cup having the highest sugar content.

*Tomatoes*: Fifteen tomato varieties were included in the test. The highest yielding variety was T2, which was new in the test this year. It was followed by the standard variety grown in the valley, J. Moran. The earliest variety was Alpha 8-F2, but its yield was low and the quality and size of the tomatoes were poor.

*Potatoes*: Five potato varieties were planted. Red Lasoda and Pontiac were the highest yielders and were followed closely by Katahdin.

*Onions*: Three onion varieties which yielded highest in previous tests were planted at weekly intervals from March 1 to March 31, 1960. The White Sweet Spanish Utah yielded the most in the first planting, but in the last three plantings, Sweet Yellow Spanish Utah produced by far the highest yield.

CHILE BLOSSOM-END ROT Four levels of calcium and three levels of moisture were combined in a factorial design to determine their effect on the control of blossom-end rot in chile pods.

Calcium sulfate was applied at the rate of 0, 50, 150, and 300 pounds of calcium per acre, and the moisture levels were maintained at 10, 40, and 70 percent of the field capacity as determined by nylon moisture blocks and the Boyocous moisture meter.

The blossom-end rot percentage in the chile pods decreased with increasing moisture levels and with increasing amounts of calcium in the soil. The decrease of blossom-end rot attributed to the calcium increase seems, however, due to a balance attained between calcium, potassium, and magnesium and not to the calcium alone.

CHEMICAL APPLE THINNING Two different chemicals are being tested for their effectiveness in thinning apples. They are applied at different times after full bloom, at different concentrations, and on different varieties of apples.

CHEMICAL WEED CONTROL IN VEGETABLES Different chemicals are being used as pre-emergence and post-emergence applications to control weeds in cantaloupe, onion, and chile fields. The chemicals are evaluated for their effect on the weeds and on the vegetables.

## Plant Materials Center

GRASS SEED PRODUCTION Initial and quantity seed increase blocks, planted to 135 species and strains of perennial warm- and cool-season grasses, occupy 14 acres of land. Twenty-two of these accessions were planted in 1960 and will not be in full seed production for another year or two. Most of the grasses are native to New Mexico and the Southwest.

A total of 8,230 pounds of grass seed were harvested and cleaned. Seed yields varied greatly, depending on species, strain, stand, and age of planting. The harvesting began in May with the cool-season grasses and ended in November with warm-season grasses. An all-purpose harvester was used to combine most of the material. Indian ricegrass, an important native, does not combine well and was collected with a forage chopper, which is fairly effective. Most of the material was run through a modified variable speed hammermill, reducing it to spikelets and florets, and breaking up the bulky stems and leaves, which were then separated from the good seed material in a four-screen fanning mill. Material with excessive amounts of hay was passed over a vibrating scalper before going to the fanning mill.

Five named varieties of grasses are being increased for foundation stock. In 1960, seed yields per acre for these varieties were: Vaughn sideoats grama, 251 pounds; Woodward sand bluestem, 400 pounds; Amur intermediate wheatgrass, 315 pounds; Sandia orchardgrass, 236 pounds; and Vinall Russian wildrye, 618 pounds.

Several accessions, although not named varieties, have either proved desirable in range trial plantings or look quite promising. The following is a list of these grasses and the acre seed yields for 1960: Sand bluestem PM-NM-14, 835 pounds; blue grama A-12424, 108 pounds; switchgrass A-5669, 358 pounds; Indian ricegrass PM-C-42, 183 pounds; tall wheatgrass A-12465, 253 pounds (more palatable than A-1876); and pubescent wheatgrass A-1115-$R_2$-B, 378 pounds.

**These plots contain a few of the native grasses being grown for seed increase.**

Also being maintained are production blocks of other native range-grass seed which are either not in commercial production or are in short supply. The more important species are little bluestem, Indian grass, black grama, tobosa, galleta, sacaton, alkali sacaton, vine mesquite, spike muhly, and western wheatgrass. It appears that certain strains of little bluestem, Indian grass, sacaton, alkali sacaton, spike muhly, and western wheatgrass may be produced commercially in New Mexico with irrigation. Low yields were due to thrips damage of black grama, easily shattered seeds of tobosa and galleta, and poor seed set in vine mesquite. Studies to improve the yield will continue.

All mature grasses in seed production blocks (exclusive of those in fertilizer trials) received 120 pounds available nitrogen per acre in one application with the first irrigation of the season. They were irrigated thereafter every two to four weeks until seed maturity.

Seed shipments from the Plant Materials Center were made to soil conservation districts for distribution to seed producers for seed increase, and to other plant materials centers, various state and federal agencies, and colleges and universities for evaluation and experimental purposes. The remainder of the seed will be used in range trial field plantings in New Mexico and Colorado.

HERBAGE PRODUCTION Information about the New Mexico herbage yields of many grasses grown at the Substation is rather limited. A few of these species are being used successfully in irrigated pastures and others have possibilities. For this reason, yield data were compiled from ten cool-season grasses. Although the plantings were made for seed increase, in rows 38 inches apart, they indicated possible herbage yields. One cutting only was taken from each species in late June, leaving an average stubble height of five inches. Stage of seed-head maturity varied, but all species had made full vegetative growth. The table shows yield averages from three samples taken from each accession.

**Herbage yields of cool-season grasses from one cutting**

| Common Name & Variety or Accession No. | Green Weight lbs. per acre | Air-dry Weight lbs. per acre | |
|---|---|---|---|
| Orchardgrass Sandia | 10,188 | 4,464 | |
| Intermediate wheatgrass Amur | 12,276 | 5,076 | |
| Intermediate wheatgrass A-12496 | 26,820 | 9,648 | |
| Slender wheatgrass PM-C-25 | 13,428 | 5,184 | |
| Agropyron sp (hybrid) A-12477-$S_1$I-$F_1$ | 13,608 | 5,760 | |
| Pubescent wheatgrass A-1115-$R_2$-B | 19,044 | 7,668 | |
| Tall wheatgrass A-12465 | 21,852 | 7,776 | |
| Tall wheatgrass A-1876 | 31,068 | 11,052 | |
| Western wheatgrass PM-C-30 | 17,820<br>23,760 | 8,208<br>9,612 | 17" row spread<br>38" row spread |
| Western wheatgrass PM-C-27 | 20,169<br>26,892 | 9,407<br>11,016 | 17" row spread<br>38" row spread |

FERTILIZER AND IRRIGATION TRIALS. Nitrogen alone and various levels of nitrogen combined with phosphorus gave results similar to those in the 1960 experiments. Nitrogen alone increased the seed yield of both sideoats grama and pubescent wheatgrass above those from the plots receiving no nitrogen. Increase in available nitrogen up to 120 pounds per acre resulted in corresponding increases in yield for both species. Amounts above 120 pounds and up to 225 pounds were erratic, with no significant increase in yield. Combinations of nitrogen and phosphorus gave little or no increase in seed yield.

Two blocks of western wheatgrass were given early and late applications of irrigation water with a regular application of nitrogen. The early irrigation was applied February 12, and the yield was of 205 pounds clean seed per acre. The late irrigation was made May 12, and the yield was 91 pounds per acre.

One block of spike muhly was first irrigated and fertilized May 13. Water and fertilizer were withheld from another block until June 30. Both blocks ripened at the same time and the seed yields did not differ. The block not irrigated until June 30 required two less irrigations and less hand weeding and cultivation to keep the block clean.

CHEMICAL WEED CONTROL TRIALS. Chemical weed control was used on five plantings of warm season grasses to improve stand establishment. Four herbicides were applied two weeks before planting. Two quarts per acre each of Vegedex, Randox, Premerge, and Eptam were used. Results were negative from all herbicides except Eptam, which gave good control of broad-leaf plants and annual grasses. Areas infested with nutgrass were free of the pest at end of the growing season. However, plantings made two weeks after applying Eptam were complete failures.

Eptam applied at a rate of two quarts per acre, six and a half weeks before alkali sacaton was planted, and 10 weeks before blue grama and sideoats grama were planted, gave fair to good weed control. Established stands of these three species were rated fair to good and appeared not to be adversely affected by Eptam. A safe, but shortened, time interval between treatment and planting for the various species now in commercial production is yet to be determined.

COMPARISON PLANTINGS. A total of 560 accessions of warm- and cool-season grasses are being maintained in rod-row blocks for initial evaluation and comparison. Two hundred seventy-seven of these were planted in 1960. The following accessions, selected for their superiority in seedling vigor, forage, and seed production, were planted for initial seed increase: Sideoats grama PM-NM-28 (origin Socorro) and PM-NM-123 (origin Antelope Wells), blue grama PM-NM-115 (origin Hillsboro) and PM-NM-118 (origin Antelope Wells), spike muhly PM-NM-216 (origin Collins Park) and PM-NM-199 (origin Rutheron).

FIELD TRIAL PLANTINGS. In the summer of 1960, plantings were made near Cuchillo, Silver City, Lordsburg, and Deming on semi-desert upland sites in deteriorated condition; near Crownpoint on a steep slope in poor condition; and near Cuba on a foothill in poor condition. In October, a preliminary check was made on the plantings. Initial results were generally very poor and only at Cuchillo was the stand rated fair to good. At the Cuchillo planting site, black grama, blue grama, and sideoats grama rated good initial stands, and other species rated from fair to no stand. Stand failures at the other sites were due primarily to insufficient moisture.

A new type range pitting disc, developed at the Substation and jointly designed by personnel of the Soil Conservation Service and Substation, was used at each location, except Cuba, to form pits or basins and broadcast seed immediately behind the pitter. The new pitter has four cut-away discs. Two discs each are mounted on two independent shafts, one pair balancing the other.

**This experimental disc pitter was developed at the Middle Rio Grande Substation for more efficient grass seeding on deteriorated rangeland.**

# NORTHEASTERN SUBSTATION

## Field Crops

GRAIN SORGHUM P.A.G. 665S, N.K. 310, Kansas 701, P.A.G. 515S, Amak R-12, Lindsey 788, and P.A.G. 625S, all produced yields of over 8000 pounds of grain per acre. Other hybrids which yielded only slightly less included DeKalb F-70, Steckley R-212, DeKalb F-63, Texas 660, Coastal, and Steckley R-106.

FORAGE SORGHUM Beefbuilder, Silo King, DeKalb FS-22, Lindsey 115F, and Taylor Evans Yieldmaker, all produced over 27 tons of green silage material per acre. Lindsey 101F, Taylor Evans Yieldmaker, and Northrup King X-3059 gave grain yields slightly over 6000 pounds per acre. Lodging was a serious problem in 1960. The Atlas, check variety, lodged as heavily as other tested hybrids.

ALFALFA Zia continued to give slightly higher yields, producing over 8 tons of air-dry hay per acre. Buffalo, Ranger, Lahontan, and New Mexico Common yielded slightly less. The spotted alfalfa aphid did not seriously damage any alfalfa varieties in 1960.

COTTON As a result of unfavorable climatic conditions, all cotton yields were very low in 1960 and few, if any, conclusions could be drawn from the yield data. Strains B-479, 4496, and B-691, all produced 647 pounds of seed cotton per acre in the advanced 1517 strain test.

Paymaster 54B yielded 618 pounds of seed cotton per acre in the short staple trial. Other entries produced slightly lower yields.

PASTURE MIXTURES As it has in previous years, alfalfa alone produced more air-dry hay than did the pasture mixtures. Each of the four trial mixtures included alfalfa and a combination of orchardgrass, alta fescue, or smooth brome. The trial, initiated in 1957, seems to indicate that none of the mixtures are especially adapted to the area.

FIELD BEANS Common bacterial bean blight again damaged the pinto bean strains and varieties. The damage, however, was not as severe as it has been during the past few years. Acre yields of the 14 entries varied from 1176 pounds for San Juan to 294 pounds for Strain 56-761.

CORN No real yield differences were found between corn hybrids in the 1960 trials. Yields ranged between 100 and 129 bushels per acre. Entries in the trials included Watson 124A, Asgrow 106, Watson 111, Asgrow 105W, P.A.G. 633W, Asgrow 107W, P.A.G. 434, Bagley Gold Tex 88, Asgrow 101W, Texas 30, Texas 17W, Holden 2124A, Asgrow 102, P.A.G. 444, Asgrow 119W, and Texas 34.

## Small Grains

WINTER WHEAT Concho and Apache both produced yields of over 50 bushels per acre. Cheyenne, Aztec, Quanah, and Crockett gave slightly lower yields. Winter moisture conditions were favorable for winter wheat production in 1960-1961.

WINTER BARLEY New Mexico Winter, the highest yielding variety, produced 59 bushels per acre. Other entries, including Texan, Ward, Harbine, Kearney, and Tennessee Winter, produced lower yields.

SPRING WHEAT All entries produced very low acre yields ranging from 10 bushels for Pilot to 6 bushels for Mida. Although the exact cause or causes are unknown, the low yields appeared to be associated with unfavorable weather conditions at certain stages of plant development.

SPRING BARLEY Otis was the highest yielding variety with 30 bushels per acre. Other entries, including Trebi, Lico, Atlas 54, Velon II, and Gem, all produced lower yields.

SPRING OATS Spring oats variety yields were extremely low in 1960. Acre yields ranged from 9 bushels for Fultex to 8 bushels for Bronco. Other trial entries included Markton, Alamo, Bannock, and New Nortex.

## Vegetables

CANTALOUPES Mildew Resistant 450, Edisto, and Sulfur Resistant 1463 all produced yields of over 15

**Corn varieties under comparison in 1960 yielded from 100 to 120 bushels per acre.**

tons of marketable cantaloupes. Lower yielding varieties included Sulfur Resistant 91, Gold Cup 55, Golden Gate 45, Mildew Resistant 45, and Arizona Sunrise.

CARROTS Royal Chantenay, with an acre yield of 42 tons of marketable carrots, was the highest yielding variety. Gold Spike produced only 17 tons of marketable carrots. Other varieties including Tendersweet, Long Imperator, Chanticleer, Long Imperator 11, Gold Pak, and Long Imperator 58 produced intermediate yields.

ONIONS Onions are a questionable crop for this area. Yields are low and variable. X-100F Sweet Spanish produced 13 tons of marketable onions per acre and Asgrow Y53 yielded 5 tons. Utah Sweet Spanish, Colorado No. 6 Yellow Sweet Spanish, Yellow Sweet Spanish, Los Animas Sweet Spanish, Utah White Sweet Spanish, and Idaho White Sweet Spanish gave intermediate yields.

CHILE PEPPERS Yields varied from 11 tons of marketable green peppers for Strain 6-18 to 8 tons for Sandia B. Other varieties and strains in the trial included Sandia A, Sandia AR-1, Rio Grande 21, and Sandia BW-4.

SWEET PEPPERS Seven varieties of sweet peppers were included in the test. The highest yielding varieties included Yolo Wonder B.M.R., Yolo Wonder A, and Yolo Wonder M.R. Acre yields varied from 7 to 10 tons of marketable green peppers.

**Castorbeans are one of the crops being tested at this substation as a possible crop for Northeastern New Mexico.**

TOMATOES All the tomato varieties included in the 1960 trial produced relatively low yields. Pearson VF6, the highest yielding variety, produced slightly over 8 tons of marketable tomatoes per acre, while Homestead 24 W.R., J. Moran, Pearson VF11, Pearson C, and Homestead FM61 had slightly lower yields.

## Miscellaneous

SOYBEANS Yields ranged from 42 bushels per acre for Strain D 55-8144 to 26 bushels for Hood. Other strains and varieties were intermediate in their yield. Lee had the highest shatter resistance.

CASTORBEANS Baker Hybrid 48, Pacific Hybrid 6, Baker 148, and R.A. 348, all yielded over 3000 pounds of beans per acre. Six other entries gave only slightly lower yields.

SAFFLOWER Acre yields varied from 1941 pounds of seed for N-4051 to 294 pounds for U.S. 10. Strain N-4051 appeared to have some resistance to a root rot type disease which has consistently damaged safflower at this Substation.

PEANUTS Valencia produced slightly higher yields than two other tested strains. No serious agronomic problems have been encountered in growing peanuts in the experimental trials.

GUAR Groehler produced 1353 pounds of seed per acre while Texsel yielded 1206 pounds and Mesa 559 pounds. An unidentified leaf disease caused moderate to heavy damage to the guar in 1960.

SESAME Oro was the highest yielding variety, with an acre yield of 1714 pounds of seed. Considerable trouble was encountered in obtaining uniform stands.

DWARF CORN P.A.G. Experimental Hybrid 121-45 produced 92 bushels of corn per acre, while Hybrid 12034 yielded 75 bushels. About 20 percent of the plants of both entries was lodged at harvest. This was similar to lodging of the standard hybrids grown in an experimental trial near the dwarf corn plots.

SUMMER PASTURE Gahi No. 1 Pearl Millet yielded over 28 tons of green silage material per acre. Other relatively high yielding entries included Starr Millet, Frontier 37X, Sudan 23, Sudo, and DeKalb SX-11. Six other varieties produced lower yields.

## Small Fruit

GRAPES Caco yielded an average of 2.8 pounds per plant, Concord 1.3 pounds, Delaware 1.1 pounds, Catawba 0.8 pound, Golden Muscat and Westfield both 0.4 pound, and Seneca 0.2 pound. Other trial entries have not yet come into production. Low yields of 1960 were attributed to a late freeze which occurred April 30.

BERRIES The Texas Wonder Blackberry continued to grow profusely. It yielded 36 pints of berries in a plot 60 feet in length. Latham produced 5 pints per plot, and Indian Summer Chief yielded 2 pints. Both Latham and Indian Summer Chief had only about a 60 percent stand. Other varieties and types of small fruit failed to produce any measurable quantity of fruit.

# PLAINS SUBSTATION

In November, 1960, a six-inch irrigation pump was installed at the Plains Substation to provide water for irrigated crops. This improvement will greatly expand the opportunities for research at this location and will permit more complete coverage of agricultural problems of the area.

## Wheat

CULTURAL STUDIES Experiments to determine optimum rates and dates for planting winter wheat in eastern New Mexico are being continued. Six years of data are now available. Results indicate that wheat planted between September 1 and November 1 is fairly productive. Yields drop sharply where wheat is planted later. According to the six-year comparative averages, the optimum date for high grain yield is probably in early October.

Average bushel yields from different planting dates were as follows: September 1, 17.8; September 15, 20.2; October 1, 19.9; October 15, 21.6; November 1, 17.9; November 15, 12.1; December 1, 10.4; December 15, 9.0.

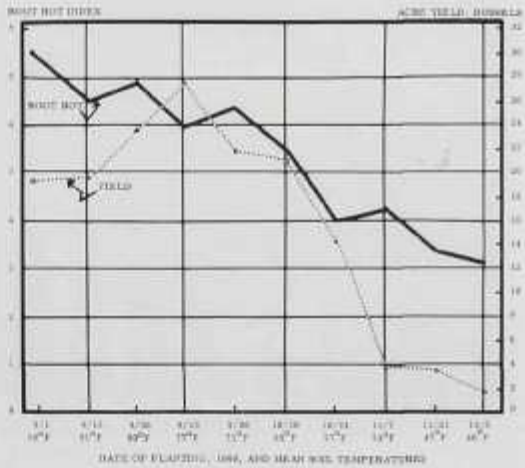
Significant differences in production were obtained in the rate-of-seeding experiment. Seeding at rates of 21, 26, 31, 37 pounds per acre produced six-year average yields of 15.8, 16.4, 16.9, and 17.4 bushels per acre, respectively. For the past three years, a lower rate of 15 pounds per acre and higher rates of 47 and 58 pounds have been added to the test. The15-pound rate showed lower yields than the 21-pound rate. Results from 47 and 58 pounds suggest that there is little chance of improving yields by using such heavy rates for dryland wheat.

Trials of nitrogen and phosphate fertilizers on dryland wheat are being continued, although no response has been obtained in years of testing.

WHEAT ROOT ROT Laboratory trials indicated that certain chemicals possess some inhibitory effect on the growth and colonization of the wheat root rot fungus *Helminthosporium sativum*. These and other compounds were used as seed treatments and tested in the field. The rate of treatment was 1000 ppm. of active ingredients. Several of the chemical compounds showed limited promise in suppressing root rot infection as compared with the check. Evaluations of these and other new promising materials are to be continued in repeated trials in field, greenhouse, and laboratory.

Five varieties of winter wheat were seeded on ten dates at two-week intervals, beginning August 1. Root rot readings were taken two months and again two weeks before harvest. Only the average root rot index and the average yield of five varieties are given in this report (see figure). From August 1 to October 10, high root rot infection was generally associated with some reduction in yield. Highest yields were recorded from the September 13 planting when the infec-

**Average root rot index and average yield of five varieties of wheat, Plains Substation, 1961.**



tion level was low. After October 10, both root rot infection and yield were at low levels, and the relationship between these two variables was not consistent. The extremely low yields of the last three planting dates were caused mainly by the damaging effect of western wheat aphids. Results indicated that planting early, when mean soil temperatures exceeded 70° F., definitely predisposed wheat plants to the root rot. In 1960, the optimum planting time for high yield and moderate root rot infection was about September 13.

VARIETY TRIALS The first results from experiments in which the new irrigation plant was used were obtained in a variety trial of 25 winter wheats. Itana, an improved Turkey-type wheat from the Pacific Northwest, produced the highest yield, 45 bushels per acre. Chevenne, Bison, and Aztec produced 40 bushels per acre. Turkey, Tenmarq, Kaw, and Tascosa made 37 bushels per acre. These varieties are all satisfactory in quality and agronomic characteristics for production in New Mexico. The only new experimental variety which showed particular promise was Itana.

In the comparison of dryland wheat varieties several recommended varieties were again near the top of the list. These, with their yields in bushels per acre, were as follows: Aztec, 22.4; Kaw, 21.3; Turkey, 21.1; *Comanche*, 20.6; *Tenmarq*, 20.5; *Cheyenne*, 20.3; and Tascosa, 19.8. These varieties all have good agronomic features and very good baking characteristics. They have all demonstrated good yielding ability and can be recommended to growers in the Plains area.

A bright outlook for the future was provided in 1961 by the performance of a group of 80 new strains from the New Mexico breeding program. Over 50 of these new lines outyielded the four standard varieties included as yardsticks in the test. Twenty-five of them exceeded the checks by 20 to 50 percent. The performance of these promising new lines needs to be verified by continued trials, including tests of usefulness for bread making. They are the most promising lines to appear in the evaluation program during the past 10 years.

**These are a few of the plots of experimental wheat varieties at the Plains Substation, 1961.**

## Broomcorn and Sorghum

SORGHUM VARIETIES The 1960 sorghum trials had the highest yields in the station's history due to extremely favorable moisture conditions.

Hybrids with yields of about 100 bushels per acre included DeKalb D-50A, Frontier 400C, RS 610, and Garst & Thomas Medium Early. These were significantly higher than all others in a test of 30 hybrids. In another test of 43 new commercial hybrids, Steckley R-108, KFU 444, and KFU 333 looked promising. Beefbuilder and Silo King had top yields in the forage sorghum trials. Over a period of several years, African Millet, an old variety, has a yield record equal to that of the new hybrids and it stands up better. Rennel's Dwarf No. 11 remains consistently the best broomcorn variety.

BROOMCORN VARIETIES Broomcorn varieties, strains, and progenies of crosses were planted in a badly disease-infected field north of San Jon, for evaluation on agronomic characters and resistance to anthracnose stalk rot. Many of the materials, including the local standard varieties, were stunted in various degrees, sickly, rotted out, and, for all practical purposes, useless. Approximately one-third of the experimental materials, however, was vigorous, promising, and disease-free. Work now in progress includes the elimination of the possibility of any disease escapes and the isolation of disease resistant strains. These resistant strains have dwarf plant types, tan color, and good brush characteristics.

SORGHUM CHARCOAL ROT In the 1960 field tests, natural infection was slight on plants growing in fields heavily infested with the charcoal rot fungus. Plants in the same row which were inoculated artificially with the fungus-infested toothpicks developed more charcoal rot even though environmental conditions were not conducive for the spread of the disease. Under conditions favorable for the disease, such as those existing in the summer greenhouse, intensified infection and fewer disease escapes were noted on plants inoculated artificially with the infested toothpicks, than on the check plants grown on the same hills in disease-infested soil. Time of inoculation or age of plants when inoculated influenced the outcome of charcoal rot infection. Plants inoculated three weeks after anthesis developed considerably more extensive infection than those inoculated at or shortly after anthesis.

## Minor Field Crops

In 1960, the pinto bean crop failed because of bean blight. Safflower trials were lost because the young seedlings were damaged by rabbits. In 1961, spring wheat, oats, and barley produced small yields compared to winter cereals. Winter barley continues to be a fair second choice to wheat for fall planting. Tokak, the leading variety in 1961, yielded 28 bushels per acre, about the yield of wheat under the same conditions. Harbine, Rogers, and Tokak are the most promising varieties available.

## Peanuts

New strains of medium bunch peanuts and Valencia peanuts were grown near Portales for comparison with the local Valencia variety. The experiments were conducted in stem-rot infested fields and were cared for in the usual manner. Portions of individual rows were inoculated artificially with the stem rot inoculum at flowering time. Results indicated that, as a group, medium bunch peanuts are highly resistant or tolerant to stem-rot. However, the average yields from these strains were inconsistent. Test yields ranged from 1750 to 2400 pounds per acre. Furthermore, their pods contained many immature seeds at the time of digging. Because of these shortcomings, medium bunch peanuts are not suitable as a crop in the Portales Valley. Chances appear remote for introducing disease resistant characters from the medium bunch peanuts to Valencias without interfering with the desirable characters of the latter. For the third consecutive year, Valencia strain PI 119880-2 demonstrated superior yielding ability and good resistance to stem rot. However, this strain possesses small pods and pink seed coats. These two characters are sufficient to make it unacceptable for the local market outlets. As yet, none of the new strains appeared promising enough to replace the local standard variety. Evidence to date suggests that the Valencia variety grown here descended from the Tennessee Red variety introduced into the area some 40 years ago.

## Sweet Potatoes

Several new strains and varieties of sweet potatoes were found to be resistant to stem rot in tests conducted near Portales. Half of the test plants were dipped in a spore suspension solution before being set out. Some of the stem-rot resistant varieties such as Oklamar, Acadian, L-3-64, and NC-171 excelled the locally grown, stem-rot susceptible variety, Kandee, in yield and adaptability. The difference in yield exceeded the five percent level of significance. Should the stem-rot build-up continue at the present pace, local producers will have to give up the commercial growing of Kandee even though the variety is recognized to be resistant to black rot, to keep well, and to have a strong market demand.

# SOUTHEASTERN SUBSTATION

## Field Crops

ALFALFA VARIETIES Three alfalfa trials were continued in 1960. In a comparison of 49 strains in 1959, only one strain outyielded Zia. Differences in aphid resistance were not expected, since aphids were no problem in 1960.

**Yield, in tons of dry matter per acre, of alfalfa varieties planted in 1957**

| Variety | 1957-60 | 1960 | 1961* | 1960 Stand** |
|---|---|---|---|---|
| Zia | 6.9 | 8.1 | 7.5 | 118 |
| Lahontan | 6.8 | 8.3 | 7.0 | 120 |
| 17-1 | 6.4 | 8.0 | 7.1 | 95 |
| Caliverde | 5.8 | 7.5 | 7.2 | 50 |
| 11-1 | 5.5 | 7.0 | 6.8 | 62 |
| New Mexico Common | 5.4 | 6.7 | 6.8 | 60 |

** Number of plants per eight square feet
* Total of first four cuts in 1961

Varieties planted in 1957 for comparison continued to produce excellent yields. As the table shows, the aphid-resistant varieties—Zia, Lahontan, and 17-1—greatly surpassed the non-resistant varieties, Caliverde, 11-1, and New Mexico Common, in stand survival.

COTTON STRAINS Twenty-seven preliminary cotton strains and fourteen advanced cotton strains were compared with 1517D and 1517BR-1 in 1960. Two advanced strains and three preliminary strains exceeded 1517D in lint yield, but not statistically so. Fifteen preliminary strains were significantly higher in lint turn-out than 1517D. Several strains were noticeably more wilt-tolerant than 1517D. None of the advanced or preliminary strains were significantly earlier than 1517D in maturity.

COTTON VARIETIES Sixteen commercial varieties were compared in 1960. Austin produced the greatest yield, but 1517D and 1517BR-1 were superior in quality of fiber. Since 1956, only Austin has produced significantly more lint than 1517D.

SORGHUM VARIETIES Grain and forage sorghum tests were evaluated in 1960 as well as a Sudangrass-related species test.

Nineteen of 25 entries of grain sorghum yielded over 100 bushels per acre. Northrup King 300 and DeKalb F63 produced the highest average yields—152 and 140 bushels, respectively. Plainsman, the standard variety, yielded 111 bushels per acre.

**Cotton variety test, Southeastern Substation, 1960**

| Variety | Lint Yield Pounds per Acre | Maturity First Picking % | Lint % | Micronaire Fineness | Fiber Length UHM |
|---|---|---|---|---|---|
| Austin | 1810 | 65 | 40 | 4.40 | 1.08 |
| Dixie King | 1648 | 50 | 38 | 4.70 | 1.11 |
| Coker 100W | 1630 | 44 | 38 | 4.58 | 1.16 |
| Rex | 1615 | 66 | 38 | 4.30 | 1.12 |
| Acala 4-42 | 1605 | 63 | 40 | 4.54 | 1.12 |
| Empire | 1585 | 72 | 39 | 4.56 | 1.07 |
| Deltapine 15 | 1534 | 57 | 38 | 4.68 | 1.11 |
| Wescot | 1523 | 60 | 39 | 4.58 | 1.14 |
| Stoneville 7 | 1497 | 56 | 38 | 4.88 | 1.12 |
| Acala 1517D | 1491 | 72 | 37 | 4.62 | 1.20 |
| Auburn 56 | 1486 | 59 | 37 | 4.74 | 1.09 |
| Acala 44-10 | 1483 | 40 | 39 | 4.50 | 1.15 |
| Lankart | 1411 | 53 | 38 | 4.86 | 1.09 |
| Acala 1517BR-1 | 1406 | 64 | 38 | 4.52 | 1.16 |
| Northern Star | 1339 | 61 | 37 | 4.64 | 1.13 |
| Acala 44WR | 1330 | 57 | 37 | 4.78 | 1.12 |

Twelve forage sorghum entries were evaluated. The variety, DeKalb FS-22, produced the greatest yield, 9.4 tons of dry matter per acre, which is equivalent to 38 tons of silage. The varieties, Northrup King 320, Tracy, and Sourless, did not differ significantly in yield from DeKalb FS-22. The commonly grown variety, Atlas, produced 6.2 tons of dry matter per acre, and was the lowest yielding of all the entries.

Piper Sudan, Grazer, and SX-11 were the highest yielding entries of the Sudangrass-related species test. Each of these three entries yielded over seven tons of dry matter per acre from three cuttings. Early Sumac and Wiley Sorghum yielded considerably less than the other entries. Results indicate that several commercially available sorghum-Sudangrass entries are comparable to the better Sudangrass varieties in dry matter production, seedling vigor, and leafiness.

New Mexico Winter Barley In the fall of 1959, approximately 41000 individual plants were established from nine sources of New Mexico Winter barley to serve as an observational nursery. In the spring of 1960, 356 individual selections were made on the basis of the amount of winter and early spring growth for pasture, lodging, growth habit, tillering, heads per plant, head size, awn characteristics, and disease resistance. These selections were planted in a replicated nursery in the fall of 1960. Approximately 200 of these selections were discarded because of disease susceptibility or other undesirable characteristics. Forty-five of the most desirable selections were planted in the fall of 1961. Further selections will be made on the basis of forage yield, grain yield, and other desirable traits.

## Field Crop Nutrition

Alfalfa Nutrition Zia alfalfa was planted in September 1958 and was top-dressed with phosphate in selected combinations after each harvest. The yield of oven-dry matter is given in the table. The treatments were repeated each year on the same plots.

**Yield of Zia alfalfa by amounts of phosphate applied, 1959, 1960, 1961**

| Phosphate Applied | | | Yield per harvest | | |
|---|---|---|---|---|---|
| 1959 | 1960 | 1961 | 1959 | 1960 | 1961 |
| *pounds per acre* | | | | | |
| 0 | 0 | 0 | 1534 | 1535 | 4010 |
| 17 | 14 | 14 | 1443 | 1909 | 3993 |
| 34 | 28 | 28 | 1768 | 2027 | 3883 |
| 51 | 42 | 42 | 1578 | 2035 | 4337 |
| 68 | 56 | 42 | 1507 | 2200 | 3958 |
| 68 | 70 | 42 | 1630 | 2052 | 3758 |
| 68 | 70 | 42 | 1557 | 2141 | 4211 |
| 68 | 84 | 56 | 1552 | 1952 | 4382 |
| 102 | 84 | 84 | 1546 | 2165 | 4324 |
| Harvest per year | | | 4 | 5 | 3 |
| DSD | | | 265 | 216 | */ |

*. Season not completed when data was reported

The differences in yields indicate that top dressing 15 pounds of phosphate before each harvest did not increase the yield enough to pay for the extra labor required by five rather than one application. Amounts of phosphate between 50 to 75 pounds per acre per year produced the optimum yield.

Cotton Nutrition The effects of nitrogen and phosphate upon the amount of lint produced were studied through 25 treatments of nitrogen and phosphate. These fertilizers were applied as two mixtures of ammonium nitrate and concentrated superphosphate. The treatments were selected to show the effects of amount of nitrogen, of phosphate, and of time of application. Cotton was grown for two subsequent years on the same plots. The yield of lint from these later years when fertilizer was not applied will show the residual duration of these fertilizer substances.

The direct and residual effects of these fertilizer materials are given in the table. These data were adjusted statistically for the effects of leveling. The depressing effect of extra phosphate reported in 1959-60 was present only when the amount of phosphate exceeded 424 pounds per acre. The relationship found was one of nitrogen:phosphate balance rather than a consistent reduction in yield when the amount of phosphate exceeded 200 pounds per acre.

**The direct and residual effects upon 1517 cotton of levels and time of band applications of nitrogen and phosphate**

| Amount of Fertilizer | | Yield of Lint* | |
|---|---|---|---|
| Nitrogen | Phosphate | Direct | Residual |
| *pounds per acre* | | | |
| 0 | 0 | 1068a | 994a |
| 71 | 91 | 1163b | 1099a |
| 143 | 182 | 1214c | 1199a |
| 279 | 361 | 1230c | 1256b |
| 167† | 218 | 1186b | 1164a |
| 163† | 214 | 1237c | 1198a |
| 158† | 208 | 1184b | 1195a |

* Adjusted for effects of leveling; yields labeled similarly are alike statistically
† Early, medium, and late applications of fertilizer

Sorghum Nutrition Plainsman grain sorghum was planted in early June in 1959, 1960, and 1961 within an area protected from the feeding of birds by a high-voltage scaring device. The plots were side-dressed with two mixtures of ammonium nitrate and concentrated superphosphate in 1959. The grain was harvested from the same plots without fertilization in subsequent years. The results are presented in the table.

**Yield of grain sorghum with nitrogen and phosphorus treatments: direct and residual effects**

| Nitrogen Level | Fertilizer Applied */ | | Grain Yield | |
|---|---|---|---|---|
| | Nitrogen | Phosphate | 1959 | 1960b/ |
| | *pounds per acre* | | | |
| None | 0 | 0 | 4500 | 3400 |
| Single | 60 | 75 | 4800 | 3050 |
| Double | 120 | 155 | 5500 | 4250 |
| Triple | 180 | 225 | 5100 | 4450 |
| DSD | | | 1300 | 800 |

a/ Fertilizer applied in 1959
b. Residual effects from 1959 fertilizer

The effect of nitrogen and phosphate upon the yield of sorghum grain was similar to the effect upon the yield of cotton lint. The intermediate amount of nitrogen with phosphate (2:1 ratio) produced the optimum amount of grain. The higher amounts of nitrogen with phosphate produced greater yields of grain one year after the use of fertilizers. The observations of size of heads in 1961 suggest that the effect of fertilizers applied in 1959 disappear two years after fertilization.

## Lettuce Varieties

Nine lettuce varieties were planted every two weeks from mid-January to mid-March. Great Lakes 659 far surpassed other varieties in yield and quality. Great Lakes Premier was the next highest yielding variety in the spring plantings. The optimum planting time appeared to be from mid-January to early February. In the fall planting, the variety, Great Lakes Wes Pak, was the highest yielder and July 20 appeared to be the optimum planting date. The yields for the July 20 plantings of fall lettuce were nearly double those of the optimum planting dates of spring lettuce. The results indicated that varieties which were superior in spring lettuce plantings might not be desirable for fall plantings.

## New Field and Truck Crops

Four crops were evaluated in 1960: sesame, soybeans, tomatoes, and onions.

The highest yielding of nine sesame entries was the strain, T53181-3-20-4-5-1-1-2, which produced 1701 pounds of grain per acre. This strain exhibited no symptoms of verticillium wilt and was above-average in seedling vigor. Margo was the highest yielding commercial variety, producing 1572 pounds of seed per acre.

Sixteen entries of soybeans were evaluated. The seed was inoculated prior to planting. No significant differences in yield were detected, but two strains slightly outyielded the standard variety, Lee. The strains, D55-4960 and D55-1087, produced yields of 39.6 and 39.1 bushels per acre, respectively, whereas Lee produced 38.1 bushels per acre. Most of the entries developed chlorosis early in the season but recovered normal color by late August.

Six tomato varieties were planted on three different dates. Grandpak and Earlypak were the highest yielding varieties. All varieties in the May 12 planting gave the greatest yield. Substantial stand losses resulted from diseases, particularly blight and curly top.

Five onion varieties were evaluated in 1960. The yield of the varieties, Yellow Grano and White Grano was more than twice that of the other varieties, Excel 986, Granex, and White Granex.

Sugar beets were planted on five dates from late February to late April in 1961. The yield of roots and tolerances to insects and diseases of varieties will be evaluated as well as the optimum planting and harvesting dates.

## Pasture Grass Studies

Seventeen irrigated pasture species were planted in the fall of 1958 alone and in mixtures with alfalfa and Ladino clover. Irrigation and frequent mowing practices were applied. The 1960 results are presented in the table. None of the grass species were competitive in mixtures with alfalfa. Ladino clover was not as competitive as alfalfa in mixtures with grasses.

**Yield, in tons of dry matter per acre, of 17 irrigated pasture species grown alone and in mixtures**

| Species | Alone | With Alfalfa[1] | With Ladino Clover[1] |
|---|---|---|---|
| Alfalfa | 5.96 | ..... | ..... |
| Ladino Clover | 3.77 | ..... | ..... |
| Alta Fescue | 3.02 | 6.24a | 4.81e |
| Common Ryegrass | 1.63 | 5.59a | 2.95d |
| Lincoln Bromegrass | 2.71 | 5.15a | 4.86e |
| Orchardgrass | 2.55 | 6.02a | 3.44e |
| Coastal Bermudagrass | 5.24 | 5.59a | 5.78b |
| Gulf Ryegrass | 2.10 | ..... | ..... |
| Sorghum Almum | 5.48 | 6.56a | 5.11b |
| Hybrid Wheatgrass | 3.03 | 5.29a | 4.18b |
| Indian Grass | 4.69 | 5.14a | 4.65a |
| Blue Panic | 3.93 | 5.00a | 3.77d |
| Blue Grama | 3.67 | 5.93a | 4.53a |
| Reed Canary Grass | 4.51 | 6.66a | 3.34g |
| Empire Birdsfoot Trefoil | 2.80 | 6.67a | 3.93b |
| Green Spangletop | 3.83 | 6.00a | 5.69d |
| Stiffhair Wheatgrass | 3.64 | 6.02a | 4.84c |

1/ Botanical Composition:
a — 90-100% Alfalfa or Clover
b — 80-89% " " "
c — 70-79% " " "
d — 60-69% " " "
e — 50-59% " " "
f — 40-49% " " "
g — 30-39% " " "

**Demonstrations such as this one are prepared each year at this substation, as they are at NMSU and at other substations, to help farmers keep abreast of the findings of the research.**

# INFORMATION

The Experiment Station publishes its research findings in bulletins, research reports, and technical journals. As long as they are available, these publications and reprints are distributed free of charge to persons who request them. Notices of new publications are mailed at least once a year to persons who request them.

Station staff members also disseminate their findings to the public through the Cooperative Extension Service of New Mexico State University, and through magazines, newspapers, and radio and television stations.

A series of feature articles, Research on Review, were prepared weekly throughout the year for use of newspapers and magazines in the state and region.

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The list of publications for 1960-61 is as follows:

## Bulletins

NO.

447 *Field Crop Variety Trials, Northeastern Substation, 1950-1959.* David H. Williams.

448 *Rural People and Their Resources, North Central New Mex.* Marlowe M. Taylor.

450 *Crop Variety Evaluations at the Espanola Valley Substation.* Phillip M. Trujillo.

451 *Mesquite Control with 2, 4, 5-T by Ground Spray Application.* K. A. Valentine and J. J. Norris.

452 *Performance of Head Lettuce Varieties Planted on Different Dates.* M. B. Jones.

453 *Economics of Dairy Farming in the Rio Grande and Estancia Valleys of New Mexico.* George R. Dawson.

454 *Northern New Mexico Sheep Enterprises.* James R. Gray.

455 *Farm Marketing of Hays and Feed Grains, Western States.* James R. Gray and H. Z. Rosenberg.

456 *Wool Producing Areas in Twelve Western States.* A. D. Jones and H. R. Stucky.

457 *The Combining Ability of Some Varieties and Strains of Gossypium hirsutum.* Carl E. Barnes and Glen Staten.

## Research Reports

No.

42 *Factors Affecting Sizes of Agricultural Loans in New Mexico.* James R. Gray.

43 *Wholesale Fruit and Vegetable Markets in El Paso and Albuquerque.* James L. Stallings and Jere R. Boyer.

44 *Two Systemic Insecticides for the Control of Cattle Grubs in New Mexico.* Louis O. Sanchez.

45 *The Availability and Price of Fruits and Vegetables in Retail Outlets in Bernalillo and Eddy Counties, New Mexico.* Eunice Kelly.

46 *Comparisons of Peanut Varieties and Strains, Portales, New Mexico, 1958-1959.* C. H. Hsi.

47 *Irrigation and Fertilization of Chile.* Mohsen Nour and Harbour D. Jones.

48 *Estimation of Soil pH by Indicators.* James U. Anderson.

49 *Acala 1517D, A New High Quality Cotton Variety for New Mexico.* Glen Staten.

50 *1960 Vegetable Variety Trials.* M. B. Jones.

51 *Performance of Sorghum Hybrids and Varieties in New Mexico.* Charles E. Cypert, David H. Williams, Harbour D. Jones, and Arthur G. Matches.

52 *Egg Production Characteristics of Pullets Managed Under Three Systems.* D. W. Francis, R. H. Roberson, and L. N. Berry.

53 *Fertilizer and Water Relations in Three High Plains Soils.* H. E. Dregne, C. A. Breshears, and R. S. Gomez.

54 *The Conservation Reserve Program in New Mexico.* Marlowe M. Taylor.

55 *Culling vs. Not Culling Caged Layers.* R. H. Roberson, D. W. Francis, and L. N. Berry.

56 *Hay Marketing News in Southern New Mexico.* H. Z. Rosenberg and James R. Gray.

57 *Selective Registration in Debouillet Sheep.* William D. McFadden, L. A. Holland, and P. E. Neale.

## Journal Articles

No.

142 D. W. Francis, Howard Campbell, and Guy R. Newton, "The Use of Furazolidone for Chukar Partridges," *Avian Diseases*, 4 (3), August 1960.

143 S. R. Race, "A Comparison of Two Sampling Techniques for Lygus Bugs and Stink Bugs on Cotton," Journal of Economic Entomology, 53 (4), 689-690, August 1960.

144 H. E. Dregne, "Soil Problems in Irrigated Agriculture," American Association for the Advancement of Science *Arid Land Symposium*, Bul. 367, Wyo. Agri. Exp. Sta., 1-8, May 1960.

145 D. W. Francis, "Case Report—an Outbreak of Ornithosis in New Mexico," *Avian Diseases*, 4 (3), August, 1960.

146 M. B. Jones, "Seasonal Trend of Cyanide in Peach Leaves and Flower Buds and its Possible Relationship to the Rest Period," *American Society for Horticultural Science*, 77, 117-120, 1961.

147 M. B. Jones and J. V. Enzie, "Identification of a Cyanogenetic Growth-Inhibiting Substance in Extracts from Peach Flower Buds," *Science*, 134 (3474), 284, July 28, 1961.

148 D. T. Sullivan and J. V. Enzie, "The Expressible Juice Content of Richared and Jonared Apples as Related to Respiration Rate, Soluble Solids Content, and Firmness," *American Society for Horticultural Science*, 77, 43-49, 1961.

149 C. W. Chang, "A New Method for Measuring Moisture Retention Values and Stability of Structure of Sodium-Affected Soils," *Seventh International Congress of Soil Science*, 1, 217-224, 1960.

150 Duane Knipe and Carlton H. Herbel, "The Effects of Limited Moisture on Germination and Initial Growth of Six Grass Species," *Journal of Range Management*, 13 (6), 297-302, November 1960.

151 G. H. Abernathy and J. M. Williams, "Baling Seed Cotton for Storage and Handling," *Transactions of the ASAE*, 4 (2), 182-184, 1961.

152 Julia Southard Lee, Helen F. Barbour, and Morris D. Finkner, "Wearing Qualities of Selected New Mexico Wools, Part I: Strength and Elongation," *Textile Research Journal*, 31 (6), 540-550, June 1961.

154 R. E. Hunter, E. E. Staffeldt and Charles R. Maier, "Effects of Soil Temperature on the Pathogenicity of Rhizoctonia solani Isolates," *Plant Disease Reporter*, 44 (10), 793-795, October 15, 1960.

156 Glyn O. Throneberry, "Isolation of Metabolically-Active Subcellular Particles from Etiolated Cotton Seedling Hypocotyls Using Bovine Serum Albumin in Preparative Medium," *Plant Physiology*, 36 (3), 302-309, May 1961.

157 C. R. Maier and E. E. Staffeldt, "Cultural Variability of Selected Isolates of Rhizoctonia solani and Thielaviopsis basicola, and the Variability in Their Pathogenecity to Acala and Pima Cotton, Respectively," *Plant Disease Reporter*, 44 (12), 956-961, December 15, 1960.

159 C. H. Hsi, "An Effective Technique for Screening Sorghum for Resistance to Charcoal Rot," *Phytopathology*, 51 (5), 340-341, May 1961.

160 Theodore H. Belling, Jr., "Ventricular Septal Defect in the Bovine Heart—Report of 3 Cases," *Journal of the American Veterinary Medical Association*, 138 (11), 595-598, June 1, 1961.

161 T. E. Smith, "Verticillium Wilt Resistance in Peanuts (Arachis hypogaea)," *Phytopathology*, 51 (6), 411-412, June 1961.

162 J. U. Anderson and Jack Soules, "A Specimen Mount Holder and Radiation Shield for the Norelco Wide Angle Goniometer," *Norelco Reporter*, 8: 28, March-April 1961.

163 Theodore H. Belling, Jr., "Preparation of a 'Teaser' Bull for Use in a Beef Cattle Artifical Insemination Program," *Journal of the American Veterinary Medical Association*, 138 (12), 670-672, June 15, 1961.

164 Charles R. Maier, "In-the-Furrow Application of Soil Fungicides for Control of Cotton Seedling Diseases," *Plant Disease Reporter*, 45 (4), 276-280, April 15, 1961.


**Several foreign information workers spent time this year in the department learning techniques for disseminating information. Here, John Wilson, of Liberia, learns how art work is done for use by station staff members. Ann Zohn, artist, instructs him as John White, agricultural editor, looks on.**

# PROJECT CHANGES AND PERSONNEL

## New Projects

July 1, 1960, to June 30, 1961

FUND & PROJECT No.

Hatch 12 (REV)—Breeding and Evaluation of Strains and Varieties of Upland Cotton for New Mexico.

Hatch 46 (REV)—Factors Influencing the Application and Activity of Herbicides on Weeds Under Irrigated Conditions in the Mesilla Valley.

Hatch 49 (REV)—Yield Comparisons, Management Studies, Protein Yields and Mixture Trials on Forage Plants.

Hatch 71 (REV)—Economic Adjustments Resulting from the Adoption of Range Improvement Practices on Ranch Organization and Management in New Mexico.

Hatch 109 —Alternative Cotton Marketing Practices and Systems for Increased Efficiency in Channels of Trade for New Mexico Cotton.

Hatch 111 —Comparison of Three Strains of S.C.W.L. Chickens from Different Altitudes Under Two Management Systems.

Hatch 112 —Marketing Practices and Prices for Producers of Farm Lot Timber in New Mexico.

Hatch 113 —Prices and Marketing Practices of Initial Processor of Farm Woodlot Timber in New Mexico.

Hatch 114 —The Influence of the Microclimate Upon the Spotted Alfalfa Aphid and Its Natural Enemies.

Hatch 116 —The Influence of Salt Content and Moisture Upon Mineralization of Nitrogen.

Hatch 117 —Economics of On-Farm Conveyance of Irrigation Water and Projected Water Savings in Southwestern New Mexico.

Hatch 118 —Influence of Ditch Linings on Seepage Losses from Farm Ditches in Southwestern New Mexico.

State 115 (REV)—Foot and Root Rots of Wheat in the Plains Area.

State 125 (REV)—Charcoal Rot of Sorghum in the Plains Area of Eastern New Mexico.

State 260 —Improvement of Sorghum Hybrids and Varieties for the High Plains Area of Eastern New Mexico.

*State 279 —The Effect of Various Energy and Protein Levels on the Performance of White China Geese.

State 280 —Crop Responses to Fertility Levels and Fertilizing Practices on Selected New Mexico Soils.

State 281 —Factors Relating to Distribution, Abundance and Control of the Cottontail (Sylvilagus auduboni) on Semi-Desert Grassland Range.

State 284 —Survey and Classification of New Mexico Soils.

State 286 —Evaluation of Sorghum Hybrids and Varieties for Adaptability to the Middle Rio Grande Area.

State 287 —The Effect of Enzymes on the Digestibility and Efficiency of a Cattle Fattening Ration.

State 288 —The Effect of Reserpine, Ascorbic Acid and Calcium on Laying Hens Under Semi-Arid Conditions.

State 290 —Influence of Harvester Ant Control on Re-establishment of Range Grasses.

State 16 (REV)—Publication and Distribution of Research Findings.

Sales 66 —Milk Producing Ability of Various Cuttings of Mesilla Valley Alfalfa Hay.

## Closed Projects

July 1, 1960 to June 30, 1961

Hatch 39 —The Economics of Milk Marketing.

Hatch 40 —Economics of Dairy Production in the Rio Grande Valley and Adjacent Areas in New Mexico.

State 32 —Combine Type Grain Sorghum Variety Test.

State 103 —Effect of Soluble Salts on Growth and Chemical Composition of Cotton and Alfalfa.

State 221 —Effect of Na/Ca Ratio in Irrigation Water and in the Soil Solution upon Sodium Adsorption.

State 230 —The Effect of Feeding Antibiotics to Fattening Calves.

State 237 —Laying Performance of Hens in Individual Cages, Colony Cages and on the Floor Under Standard Housing Conditions.

State 238 —Optimal Hen Replacement Procedure for a Continuously Operating Cage Management System.

## Cooperative Work

Bureau of Reclamation, USDI

Soil and Water Conservation Research Division, ARS, USDA

Animal Disease and Parasite Research Division, ARS, USDA

Esso Research and Engineering Company

Animal Husbandry Research Division, ARS, USDA

Crops Research Division, ARS, USDA

Forest Service, USDA

Soil Conservation Service, USDA

Farm Economics Research Division, ERS, USDA

Western Utilization Research and Development Division, ARS, USDA

Marketing Research Division, AMS, USDA

New Mexico Crop Improvement Association

Shell Chemical Company

Kern County Land Company

Elephant Butte Irrigation District

Stahmann Farms, Inc.

Diamond Alkali Company

Stauffer Chemical Company

New Mexico Farm and Livestock Bureau

California Spray Chemical Corporation

Velsicol Chemical Corporation

Hercules Powder Company

# NEW MEXICO AGRICULTURAL EXPERIMENT STATION

June 30, 1961

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| M. B. Jones, M.S. | Asst. horticulturist |
| J. N. Corgan, Ph.D. | Asst. horticulturist |

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| Virginia Johansen, M.A. | Asst. agricultural editor |

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| H. D. Jones, B.S. | Superintendent, Middle Rio Grande Substation |
| R. W. Livers, Ph.D. | Superintendent, Plains Substation |
| C. H. Ho, Ph.D. | Asst. plant pathologist, Plains Substation |
| J. S. Williams, M.S. | Asst. in agronomy, Plains Substation |
| Mohsen Nour, Ph.D. | Asst. horticulturist, Middle Rio Grande Substation |
| J. E. Anderson, M.S. | Asst. animal husbandman, Middle Rio Grande Substation |
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| L. R. Lytton | Senior agricultural aide, ARS, Iguala, Mexico |
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| R. W. Allen, M.S. | Parasitologist, ARS |
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| V. L. Stedronsky, B.S. | Engineer in charge, ARS |
| Clarence Leonard, B.S. | Physicist, ARS |
| David Alberson, B.S. | Ag. engineer, ARS |

*Department head

## Financial Statement of the New Mexico Agricultural Experiment Station for the Fiscal Year Ended June 30, 1961

| | Federal Funds | | Non-Federal Funds | | | |
|---|---|---|---|---|---|---|
| | Hatch Act | Regional Research | Station Sales | State Station | Soil Conservation Service | Special Receipts |
| RECEIPTS | | | | | | |
| Balance on hand, July 1, 1960 | | | $37,360.89 | $ 51,939.40 | $ 6,776.33 | $ 8,217.89 |
| State appropriation | | | | 505,964.00 | | |
| Receipts from sales | | | 48,819.91 | | | |
| Receipts from U.S. Treasurer | $277,302.00 | $71,280.00 | | | | |
| Special receipts | | | | | 23,000.00 | 18,660.41 |
| | $277,302.00 | $71,280.00 | $86,180.80 | $557,903.40 | $29,776.33 | $26,878.30 |
| EXPENDITURES | | | | | | |
| Personal Services | $243,403.44 | $58,821.71 | $34,039.27 | $367,310.07 | $20,156.80 | $ 8,807.65 |
| Travel | 6,733.43 | 3,923.50 | 1,384.66 | 5,884.24 | 105.35 | 961.09 |
| Transportation of things | 175.75 | 149.15 | 680.59 | 473.79 | 8.63 | 115.36 |
| Communications service | 361.02 | 275.36 | 425.76 | 1,928.93 | 142.95 | 49.64 |
| Rents and utility services | 3,611.71 | 244.20 | 2,422.80 | 12,304.69 | 490.37 | 74.36 |
| Printing and binding | — | — | 544.29 | 5,618.50 | — | — |
| Other contractual services | 3,622.37 | 1,921.56 | 3,384.27 | 24,583.61 | 2,068.11 | 1,455.09 |
| Supplies and materials | 13,398.67 | 4,556.11 | 11,861.98 | 38,520.09 | 2,391.68 | 2,781.59 |
| Equipment | 4,226.20 | 1,585.41 | 14,215.53 | 20,674.39 | 5,574.00 | 1,966.16 |
| Land and structures | 1,769.41 | — | 10,336.53 | 18,905.93 | — | — |
| Contributions to retirement, Social Security, and insurance | — | — | — | 51,707.38 | — | 136.95 |
| Unexpended balance | — | — | 6,885.12 | 9,991.78 | 838.44 | 10,532.41 |
| | $277,302.00 | $71,280.00 | $86,180.80 | $557,903.40 | $29,776.33 | $26,878.30 |

[1]Kern County Land Co.; Shell Oil Co.; Soil Testing Service; N.M. Farm and Livestock Bureau; California Spray Corporation; Velsicol Chemical Co.; Hercules Powder Corporation; Stahmann Farms, Inc.; Stauffer Chemical Co.; Esso Research and Engineering Co.; American Cyanamide Co.; Elephant Butte Irrigation District; Diamond Alkali Co.; Bureau of Land Management; White Sands Missile Range.