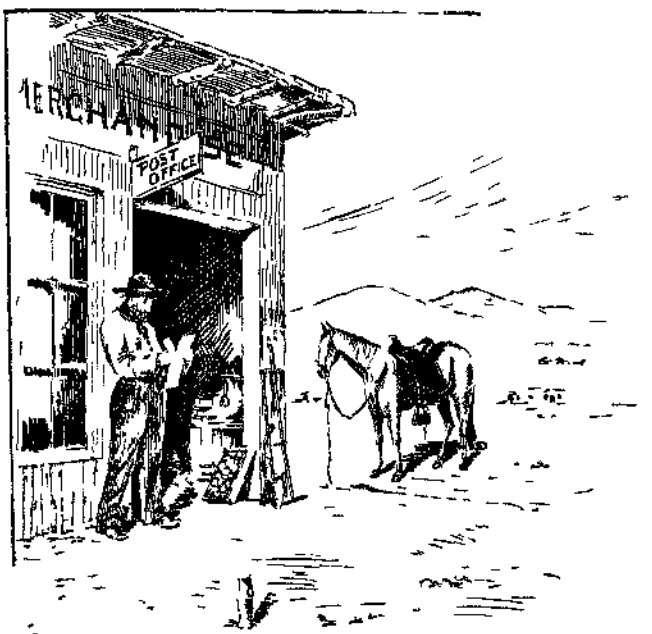
University of Arizona

Agricultural Experiment Station.

Bulletin No. 38.



Timely Hints for Farmers.

Collected, Edited and Illustrated.

Separately distributed from October 1, 1900, to July 1, 1901

Tucson, Arizona, July 20, 1901.

UNIVERSITY OF ARIZONA
AGRICULTURAL EXPERIMENT STATION

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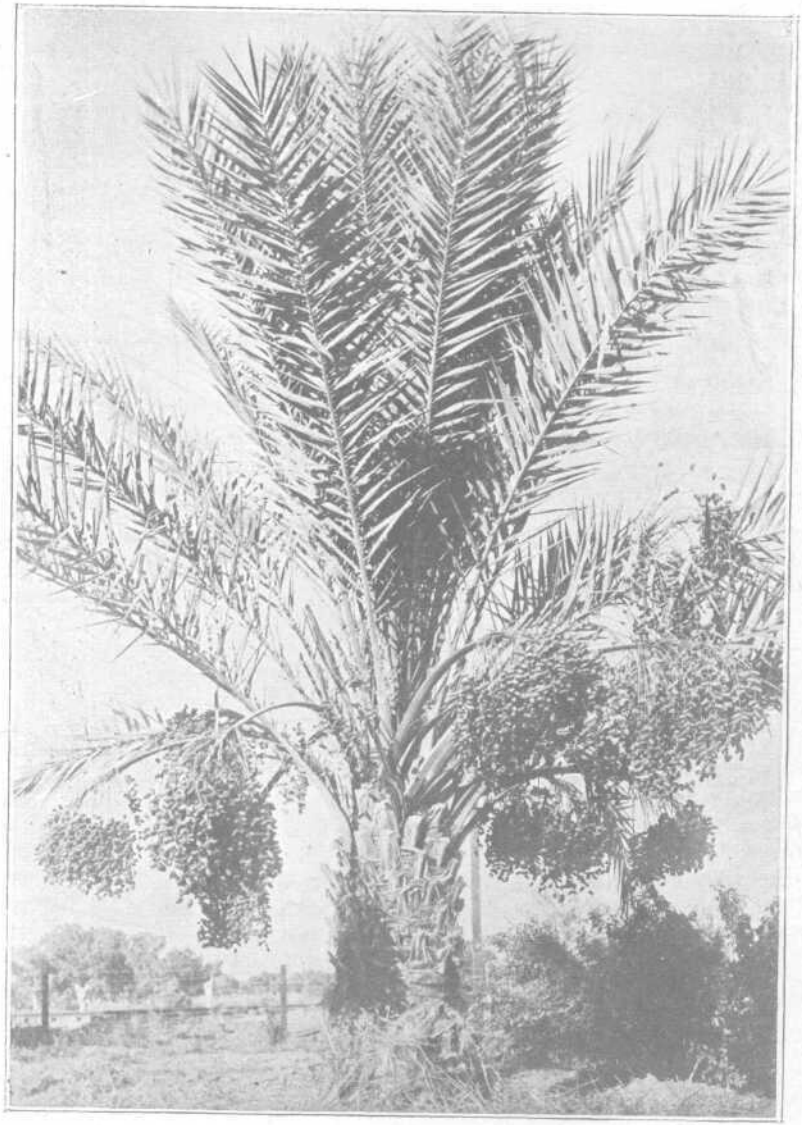

Amhat palm, on the Experiment Station farm, 10 years old, with 300 pounds of fruit, October, 1900 (see page 267).

TIMELY HINTS FOR FARMERS.

THE FARMER'S READING COURSE.

SEQUEL TO No. 19, OCTOBER 1.

Appreciating, in connection with the agriculture of a new and but partly developed Territory, the unusual value to the Arizona farmer of scientific information regarding the land of his adoption, the Station, last October, offered a small but carefully selected library for the winter's reading at cost price to those who desired.

As was suggested in the invitation to join the Reading Course, though Nature bestows her blessings with liberal hand upon the Arizona farmer, yet the perplexities which confront him are many. With the problems of irrigation, culture, behavior of plants and animals under new climatic conditions, the management of drouth and alkali, excessive heat and treacherous frosts, each day is likely to afford new food for reflection.

In this region, indeed, it is more than usually true that the farmer should understand those forces of Nature which are at work all around him, and should grasp those principles of the high art of farming which may be made to serve his welfare in a thousand ways.

In accordance with this plan, the following library was collected and issued to some sixteen subscribers to the course:

Principles of Agriculture, by L. H. Bailey.

The Soil, by F. H. King.

A Handful of Soil, by R. S. Tarr, in Cornell Nature-Study Quarterly No. 2.

Nature, Value and Utilization of Alkali Lands, California Experiment Station Bulletin 128, by E. W. Hilgard.

Salt River Valley Soils, Arizona Experiment Station Bulletin 28.

Balanced Rations for Stock, Cornell Reading Lesson No. 1.

A Farmer's View of Balanced Rations, Cornell Reading Lesson No. 8, by S. W. Fletcher.

Sample Rations for Milch Cows, Cornell Reading Lesson No. 9, by Leroy Anderson.

Milk and Its Products, by H. H. Wing.

The Feeding of Farm Animals, U. S. D. A. Farmer's Bulletin 22, by E. W. Allen.

The Dairy Herd, U. S. D. A. Farmer's Bulletin 22, by Henry E. Alvord.

Breeds of Dairy Cattle, U. S. D. A. Farmer's Bulletin 106, by Henry E. Alvord.

The total cost of this library, including postage was $2.91.

As will be seen from the titles, the collection affords information for various classes of farmers, while special emphasis is laid on certain matters of more than usual interest in Arizona.

Although the number of responses was small, this fact is not discouraging, and the experience in handling reading course work gained last year, will increase its usefulness in time to come.

Appreciation and profit, however, on the part of our readers has not been wanting. Writes one: "I am glad to say that the books you sent me last winter have opened up my eyes to a great many things that I should have been familiar with before;" and what is true of this one should be true of many hundreds of others.

It is intended, therefore, that this experiment with the farmer himself, shall continue, and next year, as last, with an improved collection of books to offer, we will renew this educational effort for his benefit.

R. H. FORBES,
Director.

STINKING SMUT OF WHEAT AND ITS PREVENTION.

No, 20, OCTOBER 15.

While walking through a stubble field in the vicinity of Tucson about a month ago, the writer chanced to pluck a few heads of wheat which had escaped the sickle. On attempting to

thresh out the grain every kernel was found to be destroyed by what is popularly known as "stinking smut." Further examination of the straw lying upon the ground revealed but few unsmutted heads. The foreman of the ranch reported that about one-third of the grain hay raised in this field had been smutted with this fungus for the past two years, the seed each season having been obtained from Indian sources. He reported still further that the seed sown had a very bad fetid odor, indicating, without much doubt, the presence of this disease.

After making inquiries of several responsible individuals regarding the prevalence of smutty wheat, a circular letter was addressed to the millers of the Territory, asking them for certain information upon the subject. Returns from these letters indicate that more or less smut is offered for sale at all the mills heard from, and that the quantity varies from 2 to 20 per cent of the total amount purchased. In one instance fully one-half of the flour ground is reported to be dark with smut One correspondent reports wheat to be injured to the extent of 50 per cent of its value for milling purposes, while another speaks of wheat offered for sale which he refuses to buy at any price. The returns show still further that all but one of the Indian tribes in the Territory invariably raise smutty wheat. Our own observations regarding crops raised from seed bought of them, indicate that there are some cases in which their crops are in a very deplorable condition indeed.

Smut is caused by a parasitic fungus, the spores of which may be found in the hairy ends of the kernels of smutty wheat. These spores germinate at the same time as the wheat, and send small tubes into the young plants. These develop and grow apace with the wheat the entire season, but cannot be seen, except by the aid of a microscope, until the berry begins to form, when the fungus distorts the kernel and fills it with a smutty mass of spores covered with a thin shell. When this shell is broken by threshing, the spores are set free and cling to the hairy ends of the healthy berries, where they are again ready to produce another crop of smut the next season.

There are many plant diseases, some of them occurring in Arizona, which have baffled every attempt of the investigator to

subdue. Some have received but little attention, and it is hoped future investigation may bring them under control. These facts, however, do not apply to the stinking smut of wheat, for it has been demonstrated repeatedly *that certain treatment will destroy the fungus which causes this disease.* There is, therefore, no good reason why the farmer should go on raising smutty wheat year after year, when a little time and patience will increase his crops and furnish him more marketable returns for his labors.

The remedy is simple and easily applied. Any farmer can, by the expenditure of a very small amount of money, treat his seed wheat m a manner that will insure his crop against an attack of this fungus. He needs for this operation, four things : bluestone or copper sulphate, a good quality of lime, some large vessels which will hold water, such as tubs or barrels, and a place to spread his wheat out to dry when he is through treating it. The operation is as follows : One pound of copper sulphate is dissolved in 24 gallons of water. The seed is soaked in this solution for 12 hours, after which the liquid is drained off and the seed again soaked for 10 minutes in limewater, made by slaking one pound of lime in 10 gallons of water. After drying, the wheat can be sown at any time without any danger from the effect of smut.

The process tabulated is as follows :

1. Soak seed for 12 hours in copper sulphate solution.
2. Soak seed for 5 to 10 minutes in lime-water.
3. Dry the seed
4. Sow the seed.

The only object in drying is to facilitate the scattering of the wheat. Where the acreage is small and the sowing done by hand, the drying can be dispensed with.

Enough of both copper sulphate and lime solutions should be used to thoroughly wet the grain. Piling the wheat on a barn floor and sprinkling it with the solutions will not give the desired results. It is better to fill a barrel two-thirds or three-fourths full of wheat and then pour in enough of the solution to more than cover the seed. The barrels can be arranged with a

plug near the bottom, by means of which the liquids can be drawn off at the proper time and used again in the treatment of another batch of wheat.

This method of treatment with copper sulphate and lime solutions is the one commonly practiced and usually recommended for the prevention of stinking smut. If handled according to the directions given above, there need be no fear of this disease. In this work, as in all others, the farmer should be thoughtful and clean in his operations. After the wheat is treated, it should not be put back in smutty sacks, nor in bins which have had smutty wheat in them, without first destroying the smut. This can be done by treating both sacks and bin with a copper sulphate solution of twice the strength quoted above, or by thoroughly soaking with boiling water. The seeder should also be thoroughly cleaned and the box and cups treated with either boiling water or a strong solution of copper sulphate.

It must be constantly borne in mind that copper sulphate is a poison. Care should therefore be taken that chickens and stock be not allowed to eat the treated wheat.

There is practically no danger in planting in ground which produced a smutty crop the previous year. If clean seed is planted, no smut will be raised.

There are many other species of smut, and doubtless some of them do considerable damage in Arizona; but this "Hint" is intended to cover the question of stinking smut only. Indeed, botanists recognise two species of stinking smut, but the treatment given above will destroy both.

DAVID GRIFFITHS,
Department of Botany.

THE USE OF CHEMICAL PRESERVATIVES IN MILK.

No. 21, NOVEMBER 1.

Late in the month of September, while the weather was yet warm, one creamery patron was heard to say to another, "What's that thing for?" indicating by a motion of his hand, a milk cooler standing near. Upon being told that it was a milk cooler, and

that both morning and evening milk was cooled by its use even day before sending to the factory, the first speaker replied: "What's the use of all that trouble? Get a little Preservaline, that will keep your milk all right and isn't half so much work," and in his reply expressed, I am sorry to say, the sentiment of many creamery patrons.

The use of preservatives in milk is the lazy man's substitute for cleanliness. The fact that it is deemed necessary to add something to the milk to keep it sweet until it reaches the factory is evidence of unclean or careless handling, while the fact that preservatives are added is evidence of criminal ignorance on the part of the persons using them.

It is possible to make good butter or cheese only when the souring of the cream or milk is under control of the manufacturer. If, then, milk comes to the factory so adulterated by the use of chemicals that it will not sour, it is impossible to make good butter or cheese from it. In butter making large losses of fat in the buttermilk have been traced to this cause, and we have known the entire make of a cheese factory for several days to be an absolute loss because a single patron used Preservaline in his milk.

But more important than these financial losses is the fact that the use of the preservatives renders the milk unwholesome and deleterious to health. The liquid preservatives most commonly used depend for their preserving power upon the presence of formic aldehyde of which they are in part composed. Concerning this disinfectant, A, S. Mitchell, chemist for the Wisconsin Dairy and Food Commission, made the following statement in Hoard's Dairyman in 1898: "During the last year a new and most powerful disinfectant has been foisted upon the market as being harmless. * * * * This substance is formic aldehyde, a substance in general use as a disinfectant and for preserving and hardening dead tissues. Doctors have been obliged to abandon its use as an antiseptic, in a very dilute form, for preserving ear washes and similar solutions, as continued contact in dilutions as high as 1 to 10,000 causes the skin to die and peel off."

The fact that a solution is strong enough to stop the development of bacteria in the milk should be sufficient to deter any in-

telligent man with a conscience from adding it to that which he sells for human food. Because some of the readers of this article have used Preservaline or Freezene in their milk during the past summer without, to their knowledge, having killed, or injured the health of any of the creamery's customers, is no argument for the continuance of its use. It should not be necessary to prove that the substance will cause direct injury in the closes in which milk is used in order to establish the fact that it is harmful. Many cases of sickness and death have been indirectly traced to the presence of chemical preservatives in milk.

The laws of twenty-six of our states make this adulteration of milk a crime punishable by fine and imprisonment. Unfortunately, our Territory has no law providing for the punishment of this crime. All creamery men should, then, be laws unto themselves and, standing together, unrelentingly refuse any milk suspected of having been treated with chemical preservatives or any other form of adulteration.

The use of chemical preservatives is the unscrupulous man's substitute for care and cleanliness, for by proper handling, milk may be kept sweet until delivered to the factory, even in an Arizona climate. A former Timely Hint dwelt somewhat at length upon the necessity of cleanliness in handling milk and we would now like to emphasize more strongly and specifically the necessity of paying proper attention to cooling the milk.

One morning in July the writer stood at the weigh can of a creamery and took the temperature and tested the acidity of each lot of night's and mixed night's and morning's milk delivered. If these lots of milk had all been handled with equal care as to cleanliness, the temperature at which they had stood through the night, as indicated by that taken at the creamery in the morning, might be reasonably considered as responsible for their acid condition at that time. The temperatures of the night's milk varied from 78 to 93° F., and while the variations in acidity did not conform exactly with those of temperature, generally speaking, the warmer the milk, the worse its condition. It is needless to say that the milk at 93 degrees was sour; it was so sour that particles of clabber stuck to the sides of the weigh can as the milk was drawn off, and yet, the driver insisted that the

milk was sweet and became profanely abusive when the weigher politely told him that milk in that condition would thereafter be refused. Other lots of milk with a temperature as low as 84 degrees were sour, indicating that lack of cleanliness had contributed to their souring.

As stated before, this condition of affairs is absolutely unnecessary. In our experience at the Experiment Station farm we have observed that by the use of the ordinary tin-drum milk-cooler filled with well water, which with us has a temperature of from 70 to 73 degrees, milk may be reduced in temperature ten degrees; that by running it over the cooler a second time the temperature may be brought down five degrees more; and that by wrapping the cans in which the milk stands over night in wet burlap or gunny sacks the temperature may be still further reduced to that of the atmosphere or lower. During the first fifteen days in July, including the hottest days and nights of the season and the hottest twenty-four hour period recorded since the establishment of the weather bureau in Phoenix, the average temperature of the night's milk in the morning, under this treatment, was 71 degrees, which was less than the average minimum temperature of the atmosphere for that period. On very warm nights the temperature of the milk went several degrees below that of the surrounding air. Under this treatment the increase of acid in the milk during the night was very slight. The average per cent of acid in the milk immediately after milking, during the first ten days after July, was .165 per cent, while the same milk on the following morning showed a presence of only .17 per cent of acid. Milk seldom smells or tastes sour when containing less than .3 per cent of acid.

With these facts to base conclusions upon we feel safe in stating that, with the exercise of reasonable cleanliness in milking and in the care of utensils, and by taking proper care in cool* ing, milk may be delivered at the factory in good condition, and that there is no excuse based on reason for what we deem the criminal adulteration of milk by the use of chemical preservatives.

GORDON H. TRUE,
Department of Animal Husbandry.

THE OPEN RANGE AND THE IRRIGATION FARMER.

No. 22, NOVEMBER 15. (Condensed.)

There is one aspect of the irrigating water problem, not often discussed and upon which, indeed, very little accurate knowledge exists, which is, nevertheless, of great importance in connection with Arizona agriculture.

This is, the relation between the open, grassy, range country and the water supply available to the irrigation farmer. For many years in the United States, and for a much longer time in Europe, the connection between forest soil-covers and the amount and regularity of the flow of streams has been observed and studied, but it may be stated with some confidence that the interests of irrigation in Southern Arizona and some other regions of like character, are affected more by the grassy, open range, than by forested districts. The peculiarities of this range country, therefore, as affecting the run-off of water and the flow of streams are to be critically considered, and any change which is being brought about in the ranges by the operations of stockmen, is of interest to the irrigation farmer in Southern Arizona. It is true that exact knowledge upon the past and present condition of the ranges is scarcely to be had; yet historical evidence and existing facts are such as to enable us to offer a fair judgment as to what is transpiring about us.

Especially instructive in this connection is the history of the cattle industry on the Gila watershed, with the associated changes in the grazing country. The Gila watershed above the Salt river junction, and including that portion in New Mexico, is some 25,000 square miles in extent For the most part, this great area consists of grassy plains, intersected from north to south by mountain ranges covered with forests on their higher slopes. Considerable areas of the plains themselves, also, are here and there sparsely covered with mesquite and other brushy growth. Taking this great drainage area as a whole, however, the prevailing vegetation is, or once was, grass, probably 90 per cent of the total area being mainly of this character. The watersheds of the Salt and Verde rivers, 12,250 square miles in extent, have a larger proportion of forest, but also contain great areas of grassy country.

In their original condition, these grassy plains are said by those who first came to Arizona, to have been rarely beautiful to the eye, and even yet, in remote districts, comparatively unchanged by the operations of cattlemen, evidence of the truth of these statements is to be found. In the swales and valleys of this country, and wherever water was more abundant, the great bunch grasses

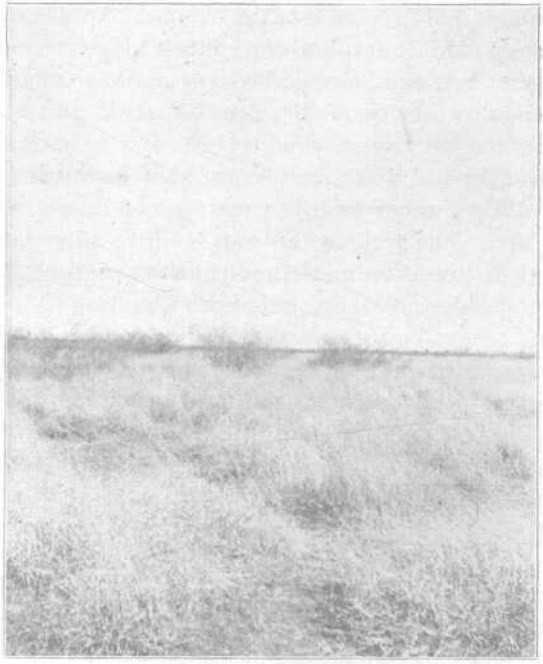

Fig. 1. Swale in the San Simon valley showing a heavy growth of galleta grass which will obstruct the flow of flood water and prevent formation of gullies.

grew luxuriantly. Sacaton and the galleta covered the ground thickly, affording an abundance of native hay in the dry seasons and quickly freshening up into green forage after a rain. In the same situations, also, were to be found a bewildering variety of quick-growing watergrasses which afforded most nutritious feed while they remained green. On the knolls and in the drier places,

the crowfoot grama and the six-weeks grasses, so-called, supplemented in the rainy season the more abundant forage of the lower levels When it rained upon these grass-covered plains, the water being obstructed in its downward course by the abundant vegetation, sank largely into the ground and very slowly made its way into the underflow of the great valleys, finally reappearing in the Gila river In so doing, much of it was utilized by growing vegetation, while the residue, gradually joining the main watercourses, insured a constant flow of water. When severe storms occurred, with their resulting floods, the abundant bunch grasses at the lower levels obstructed the flow to such an extent that the water, in its downward course, was spread laterally over great areas and its force dissipated. At the same time, the silt brought down from the higher levels, including quantities of fertilizing material, was deposited in these places, with the result that the bottoms of the valleys were kept level and were enriched and made the scene of an ever perpetuated growth of beautiful and luxuriant grasses.

It was into these lovely wild pastures that the cattleman, about 30 years ago, began to drive his herds. Although Arizona has been inhabited by the Mexican people for 200 years and more, the cattle industry was never developed for the reason that the hostile Indians made the maintenance of herds upon the open ranges impossible.

But shortly after the Civil War the establishment of military posts in Arizona and the issuance of treaty rations to the Apache Indians created a heavy demand for beef. Large herds were consequently driven in from Texas and, under the protection of newly established posts, the cattlemen gradually established themselves.

After the completion of the Southern Pacific railroad in 1881, small owners shipped in their herds from worn out districts in Texas and elsewhere, while still others, driving their cattle over land to California, stopped by the way.

The multiplication of small herds with their natural increase, together with restricted sales due to the low prices of cattle at times during the eighties, soon caused the range to be stocked to its utmost capacity, even in favorable years. In seasons of scarc-

ity, when feed was short, the cattle began to perish from starvation, devouring in their desperate struggle for existence, almost every vestige of growth upon the plains. Being compelled in their wanderings back and forth between the higher and lower grounds, to take twenty steps for a mouthful of food where formerly but one was necessary, they deepened their paths from place

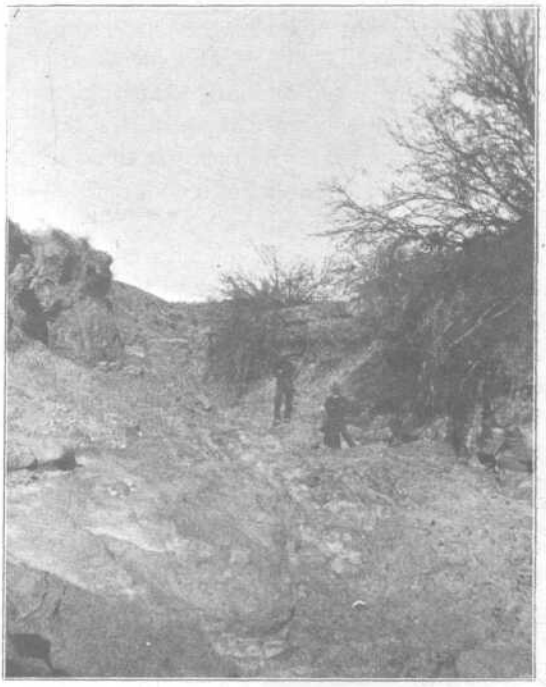

Fig. 2 *THE RUIN OF A VALLEY*—Wash five miles south of Solomonville in San Simon valley; formed in the last eight years, twenty feet deep and fifty feet wide, where was formerly a level plain.

to place; the prevailing winds blew the dust from these paths until they lay inches below the general surface, and then, upon a country prepared for destruction, came the rains. The water, collecting in the trails from the bared and devastated surface of the country, fell swiftly to lower levels, gullying the trails as it ran and gathering in destructive freshets in the larger valleys. The bunch

grasses, having been depleted by the starving cattle, were no longer able to withstand the rush of the floods, and the gullying process began on a large scale through the very heart of what were formerly the most luxuriantly grassy regions of the country. When these channels are once established through a given district, the water is thereafter destined to flow through them, no longer

Fig. 3. *THE RUIN OF AN INDUSTRY*—A familiar sight on depleted ranges, especially after a hard year.

spreading out over the level bottoms and no longer being available for the growth of the bunch grasses which formerly throve in these situations. In this way, when a valley has once been so gullied as to carry the water in streams, instead of spreading it out in broad floods, the very existence of the richest grazing districts is rendered impossible. A striking instance of this process of ruin

is offered by the San Simon valley. This once beautiful district has been despoiled and hopelessly ruined within the short space of some fifteen years. At Solomonville, the great barranca which has cut its way up the valley is about fifty feet across and from ten to twelve feet in depth. From this point it is stated to extend southward for sixty or seventy miles, with tributary washes and barrancas branching out to a yearly increasing distance on either side.

Let us consider this state of affairs in its bearing upon the various industrial interests of Arizona. In the first place, the stockraising industry itself has suffered in some localities almost to the point of extermination. The ruinous methods which seem to be inevitable upon a public range have so destroyed its value and have so changed the original condition of the country that in many sections, in spite of the present high prices for cattle, the ranges now carry but a tithe of what they once did. Definite figures are not at hand; yet even casual conversation with the stockmen of this depleted range shows it to have been commercially destroyed. In the San Simon valley alone, judging from the statements made to the writer by observers of its history for the past few years, it is judged that the number of cattle has fallen off from seventy-five to ninety per cent.

Furthermore, the operations of the stockmen upon the range watersheds of the Gila and Salt rivers intimately concern the welfare of the irrigation farmers along their banks. As previously stated, the vegetation on the range, especially the bunch grasses in the lower swales, at one time so obstructed the flow of water that the rainfall found its way but gradually over the surface of the ground to the main watercourses, while a large portion, sinking into the ground, joined the underflow and found its way down yet more slowly. The result was a constant and not excessively muddy flow of water, whose fluctuations were not extreme; but now, in the more denuded condition of the watershed, a heavy storm in an upper valley causes a tearing torrent to appear below.

The evil effects to the irrigator of a rapid run-off of water of this nature are two-fold in character. In the first place, a quick rush of water soon carries off the whole of the rainfall and leaves the stream-courses dry, so that the irrigation farmer is overwhelmed one week with floods and threatened next with prospective drouth.

In this way, it is either surfeit or starvation with him most of the time. Again, a washed and gullied country contributes enormous quantities of silt to its drainage water. This not only inconveniences the farmer, filling his ditches and embarrassing him in handling his water, but becomes a complicating factor in connection with the great storage reservoir propositions which have in recent years been discussed hopefully as a possible solution of the irregular supply of irrigation waters caused by the overstocking and mal-administration of the watersheds.

Appreciating the necessity for the acquisition of scientific knowledge concerning worn out range country and the ways and means for its reclamation, the Arizona Experiment Station has taken its first step towards the dissipation of our ignorance on this very important matter. About half a square mile of worn out range country near Tucson, has been fenced, with a view to studying its restoration to the original grass-covered condition. Looking to the future, however, it must be remembered that scientific knowledge of this subject must be coupled with legal ingenuity in order to be effective, and that the application of such knowledge over an occupied range of considerable extent is a problem which experience only can solve. Forestry reservation and administration presents similar difficulties, the actual work in this case being undertaken by the Government. The often discussed leasing of public lands to private parties, on the other hand, leaves the practical work of range improvement to individuals, The relative merit of these two general methods must, in part, be decided with the aid of fuller scientific knowledge of the subject than we now possess.

With this passing suggestion as to the administrative difficulties of range improvement, it may be stated in conclusion that the hoped for outcome of range study is: 1. The betterment of stock interests by demonstrating methods for reclaiming grazing lands ; 2. The improvement of irrigation interests, by showing how measurable control may be exerted upon the run-off of a given range ; and 3. By adding to the life of reservoirs in lessening the amounts of silt carried in flood waters.

R. H. FORBES,
Director.

THE VALUE OF A DAIRY HERD RECORD.

No. 23, DECEMBER 1.

In a previous Timely Hint concerning the selection of dairy cows, the necessity of testing and keeping a record of the product of the individual cows of the herd was strongly urged. In order to demonstrate this necessity when intelligent management of the herd is attempted, the writer has kept such a record of two herds during the past year, following the plan that he would recommend for general practice.

The milk was weighed and sampled at every milking and the samples tested twice a month, the writer testing the milk and keeping the record as his share of the work. The owners of the herds state that the extra time required to weigh the milk, record the weight and take the samples, did not exceed one minute per cow. The samples tested every two weeks were composite samples consisting of a part of the milk from each milking during the two weeks, and were kept in condition for testing by the addition of bichromate of potash and bichloride of mercury in about equal parts. The time required for testing each set of samples for the two herds was about a half day.

It was the original idea to secure herds fairly representing the different breeds used for dairy purposes, but the men owning Shorthorn and Holstein herds failed to co-operate when the time came to begin the test. Of the two herds of which records were kept, one consisted of twelve full-blood Jerseys, and the other of thirty-five cows of mixed breeding, some being high-grade Shorthorns, some grade Jerseys, and others of various admixtures of blood. Of this latter herd, thirty cows completed a year's record, which is given below. This record, we think, speaks for itself, and demonstrates what a similar record of any dairy herd will demonstrate, that *it pays to keep a record*.

In addition to the record of the pounds of milk and butter fat produced by each cow, we have calculated the comparative profits returned by the different animals, The gross receipts have been determined by multiplying the pounds of butter fat by twenty hundredths, twenty cents per pound being the average price paid for butter fat in the valley during the year The net receipts

have been calculated by substracting thirty-two dollars, the estimated cost of pasture and milking, from the gross receipts. The skim milk should pay for hauling the milk to the factory, at least No attempt has been made to determine the value of the calf for each cow. The bull calves and the heifer calves from the least valuable cows, would about pay the interest on the money invested in their dams, while the heifers from the best cows might be worth more.

A YEAR'S RECORD OF A DAIRY HERD.

NO. OF COW.	AGE.	DAYS IN MILK.	POUNDS OF MILK.	PER CT FAT.	POUNDS OF FAT.	GROSS RECEIPTS	NET RECEIPTS
1	5	357	7978	4.36	348.74	$69.75	$37.75
2	10	335	8727	3.66	319.13	63.83	31.83
3	7	315	7294	4.28	311.75	62.35	30.35
4	5	350	6614	4 45	294.82	58.96	26.96
5	7	365	6433	4.38	282.99	56.60	24.60
6	8	330	5863	4.84	258 96	51.79	19.79
7	5	333	5383	4 72	254 36	50.87	18.87
8	7	351	6351	3.98	253.31	50.66	18.66
9	15	288	7770	3.25	252 42	50 48	18.48
10	7	284	7052	3.4	239.85	47.97	15.97
11	5	365	5118	4.66	238.55	47.71	15.71
12	7	256	5305	4.5	238.38	47.68	15.68
13	4	291	4459	5.28	235.74	47.15	15.15
14	3	343	5862	4.02	235.74	47 15	15.15
15	5	315	4951	4.75	234 34	46 87	14.87
16	7	345	5940	3.73	221.27	44 25	12.25
17	5	365	4855	4 51	219.21	43.84	11.84
18	3	338	4327	5.01	217.02	43.40	11.40
19	7	228	4766	4.49	214.27	42.85	10.85
20	4	283	5434	3.89	211.12	42.22	10.22
21	7	344	4470	4.69	209 53	41.90	9.90
22	15	271	6727	3.07	206.31	41.26	9.26
23	6	311	5041	3.94	198.57	39.71	7 71
24	7	241	5838	3 36	196 19	39 24	7.24
25	7	285	4239	4.53	191.94	38.39	6.39
26	8	319	5420	3.53	190.51	38.10	6.10
27	4	365	3964	4.41	174.74	34.95	2 95
28	3	342	3741	4.39	163.70	32.74	.74
29	4	305	3559	4.43	157.87	31.57	— .43
30	5	335	3126	4.51	141.13	28.23	—3.77

In order to compare this herd with others intelligently, it may be stated that the average gross receipts per cow per month was $4.25. The average per cow for the Jersey herd tested was $4.66. There were one or two other herds supplying milk to the same creamery probably averaging higher than $4.25, and

possibly higher than $4.66, but the number of cows in milk was not reported for the twelve months, so that we are unable to calculate their averages exactly.

One herd reported for nine months, gave a monthly average of $1.49 per cow, and the fact is sad but true, that figures are available showing that there are too many such herds in the Territory. Eight herds reporting the number of cows milked every month, show the following averages per cow:

No 1	$4 25	No. 5	$3 61
No 2	3 94	No. 6	8.56
No. 3	3.85	No. 7	3.25
No. 4	3.77	No. 8	3 24

It seems as though it would be a good idea for the readers of this article who have dairy herds, to sit down and add up the amounts of their creamery checks for the year, divide the sum by twelve and then by the number of cows in their herds, compare the average with those given above, and ask themselves how many unprofitable cows they think they own, and how they think they are going to pick them out.

In connection with a study of the above table, we would like to emphasize the following points:

1. The value of a dairy cow is not determined by the blood she is supposed to possess, unless that blood is of ancestors that are known to have produced butter fat at a profit. The cow that heads the list in the table is a grade Jersey, while the one standing next is a high-grade Shorthorn. The best cow in the full-blood Jersey herd tested, gave a net return of $38.45, only seventy cents more than that of the best grade in the other herd. The cow standing second in the Jersey herd was outranked by three grades in the other herd, including a grade Shorthorn; and there were twenty-six grade cows better than one of the full-blood Jerseys.

2. The value of a cow is not to be estimated by the amount of milk she gives. While it will be observed that the heaviest milker in the herd is the second best cow, and the cow standing second in milk, ranks first in profit, it will also be seen that the cow standing sixth in the amount of milk given, is twenty-second in profit.

3. The value of a cow is not to be estimated by the richness of her milk. Eighteen cows tested higher than the best cow in the herd, this number including the four poorest ones; and twenty-four tested higher than the second best cow. It is pounds of butter fat and not per cent that count.

4. The comparative value of the cows in a herd is not to be based upon the gross, but upon the *net* receipts. Compare cows No. 1 and No. 27, No. 1 gave practically twice as much milk of about the same richness, and is therefore, you will probably say, twice as good a cow as No. 27. Is this true? Look at the net receipts. No. 1 returned $37.75 and No, 27, $2.95, from which it is easy to calculate that instead of being twice as good a cow as No. 27, No. 1 is between twelve and thirteen times as valuable Two cows, it will be observed, failed to pay expenses. How are such cows as No. 30 and some of her near neighbors on the list, to be weeded out of our herds, unless the individual record is kept? If there is one such cow in a herd averaging $4.25 per head per month, how many are there liable to be in herds averaging less?

In the matter of time, this Hint is certainly timely, coming as it does, just long enough before the end of the year to give every dairyman time to make plans for keeping a record during the coming year.

GORDON H. TRUE,
Department of Animal Husbandry.

THE USE OF THE BABCOCK TEST,

No, 24, DECEMBER 15.

The Babcock milk test is an outgrowth of the co-operative system of butter and cheese making. When the creamery and cheese factory first came to take the place of the home dairy, and the milk from a large number of dairies was brought to one factory for manufacture, it was a common practice to divide the proceeds on the basis of the number of pounds of milk or cream delivered by each patron, regardless of quality. Even if the milk delivered had not been tampered with by skimming or by water-

ing, this method, on account of the difference in the quality of milk, was clearly unjust. With a view to furnishing a means for overcoming this injustice the Babcock milk test, among others, was introduced, and today it is used as an arbitrator in practically every creamery and cheese factory in our country.

But the use of so valuable an accessory to the dairy industry was not to stop with the factory. The fact that milk from different herds varied in value, applied as well to the milk from different cows of the herd, and alert dairymen were not slow in taking advantage of this new means of helping themselves to an increased profit by using it in weeding out the poor cows of the herd. Today intelligent dairymen, not satisfied with herds "as good as the average," sell cows as well as milk by the Babcock test.

The following may be given as some of the reasons for the almost universal use of this test:

1. The first cost is not great and its operation is inexpensive.
2. The test is accurate and quickly made.
3. No knowledge of chemistry is necessary in its use.
4. The per cent of fat is measured directly upon the neck of the test bottle and no calculations are necessary.
5. Not only whole, sweet milk, but cream, skim milk, butter milk and whey may be tested by its use, and sour milk, as well, if accurately sampled.
6. But a small quantity of milk is used, and after the sample has been measured into the test bottle it need not be tested for weeks.
7. The machine is simple and does not easily get out of order.

The prices at which manufacturers list Babcock testers are as follows: Four bottle machines, $8.00; six bottle machines, $9.00; and eight bottle machines, $10.00. This includes everything necessary for testing whole milk, including a small amount of acid. Special bottles for use in testing skim milk and cream come extra, as well as the preservative for keeping milk when composite tests are made.

The following firms manufacture good machines and are reliable: Vermont Farm Machine Co., Bellows Falls, Vt.; Creamery

Package Mfg. Co., Chicago; Cornish, Curtis & Green, Fort Atkinson, Wis.; F. B. Fargo, Lake Mills, Wis.

Sulphuric acid which is used may be purchased at almost any drug store, but if a bottling establishment is available it is better to get your supply there; druggists sell so little of it that it is likely to be weak from long standing. The acid costs, in Arizona, from five to eight cents a pound and that amount is sufficient to test about fifteen samples.

The writer has found bichromate of potash a satisfactory preservative on account of its cheapness and efficiency, and the fact that it colors the milk lenders it unlikely to be used by mistake for purposes other than testing. It may be purchased (powdered) of druggists at ten cents per quarter of a pound; this amount should be sufficient for 250 to 300 tests. A 32-short cartridge with a wire handle makes a convenient measure and holds the right quantity for keeping a pint of milk a week.

In purchasing a tester it is always advisable to get a good machine. Cheaper ones than those mentioned above are on the market, but unless it becomes a question of a cheap one or none at all, it is not best to buy that kind. By all means do not get a machine having a friction gear. The accuracy of the test depends upon the speed at which the bottles are whirled and with a friction gear it is impossible to determine the speed.

The directions accompanying the tester, if followed, are usually adequate for its successful operation. The following points, however, should be carefully watched :

1. *Sampling the milk.* The milk from which the sample for testing is taken must be thoroughly mixed so that the cream is evenly distributed through it. Avoid shaking in such a way as to churn the butter fat.

2. *Strength of acid.* The acid should have a specific gravity of 1.82 to 1.83. This is determined by the use of a glass float which may be purchased with the machine at a cost of from 35 to 75 cents. Acid is weakened by the addition of water.

3. *Temperature of milk and acid.* The temperature of the milk and the acid should be from 60° to 75°F. If you have no thermometer buy one with your machine. No dairyman should try to get along without one. The writer has found it conve-

nient to cool the milk for testing by allowing the test bottles, into which the samples have been measured, to stand over night and then test in the morning. If you do not have ice, wrap a damp cloth about the bottles at night and they will be cool enough when morning comes.

4. *Pouring acid into the test bottles.* Hold the bottle in a slanting position so that the acid will run down the side and not through the milk.

5. *Adding hot water.* The water should be hot, too hot to bear the hand in it. Soft water is to be preferred where it is available.

6. *Measuring the fat.* The fat must be in a liquid condition when the readings are made, and the measurement be from the very top to the bottom of the column of fat.

7. *Speed of the machine.* A machine ten inches in diameter (from the bottom of one bottle packet to the bottom of the opposite one) should be given 1075 revolutions per minute; a fourteen-inch machine 910 revolutions. Count the number of the revolutions of the bottles to one of the crank and thus determine the rate of turning for yourself.

While the operation of testing milk by the use of the Babcock test is simple, care must be exercised in its use; inaccurate results will surely follow careless work.

GORDON H. TRUE,
Department of Animal Husbandry

PLANT-LICE.

No. 25, JANUARY 1.

Plant-lice (*Aphididæ* of entomologists) are soft-bodied insects of small size, which suck the sap of plants by means of a long beak, the tip of which is thrust into the tissue of the plant. They are allied to the scale-insects (*Coccidæ*) and are especially abundant in temperate regions, the scale insects taking their place to a great extent in the tropics. In the cooler parts of North America, plant-lice are exceedingly numerous and destructive, but as we go south they are less noticed, although some kinds affect even the

sub-tropical fruit-trees oi Florida. In Salt River valley, in accord ance with this general law, plant-lice are not particularly troublesome in the hot weather, but in the late winter and early spring they flourish exceedingly, the same cool and mild weather which permits the growth of garden vegetables being exactly suited to their taste. In the Mesilla valley of New Mexico the winter and early spring are too cold for the vegetables or lice, and the summer is hot, so here plant-lice are not much in evidence. It results from these tacts that we have a region to the north and again one to the south, troubled by plant-lice and capable of growing certain crops, while an intermediate region has fewlice and is less suitable for the crops in question.

From a popular standpoint, plant-lice may be divided into three groups:

1. Naked lice.
2. Woolly lice.
3. Lice living in galls.

The last mentioned are commonly seen on cottoawood trees, their globular or oval galls being very conspicuous on the twigs OT leaves. If one of these galls is broken open, the lice are found within. These gall-lice do no serious injury, but if the galls are considered unsightly they may be cut off and burned in the early summer.

One of the gall-producing kinds is the famous Phylloxera of the vine. This creature has done enormous damage in Europe, but in America, where it is native, it is not regarded with any fear. Dr. J. B. Smith says: "I have seen vineyards in New York and New Jersey in which almost every leaf showed these galls, yet withal no real injury had been done. In other words, most of the native American vines are able to sustain the attack of the species."

The woolly lice are known by their secretion of a white wool-like substance, really consisting of minute waxy threads, so that they look like little patches of mildew. The commonest ot such lice is the woolly louse of the apple, or *Schizoneura lanigera* (See figures 4 and 5). This creature is probably a native of Europe, although in England it is known as "American Blight." It is certainly not a native of Arizona, but has been brought there on

young trees, and is now very widely distributed in the apple orchards. It has two forms, one which lives on the branches of the trees, the other upon the roots. The former, although naturally the most conspicuous, is much the least harmful.

Many experiments have been made for the destruction of the woolly louse of the apple, and the results are well summarized by Mr C. L. Marlatt in Circular 20, Division of Entomology, U.S.D A.

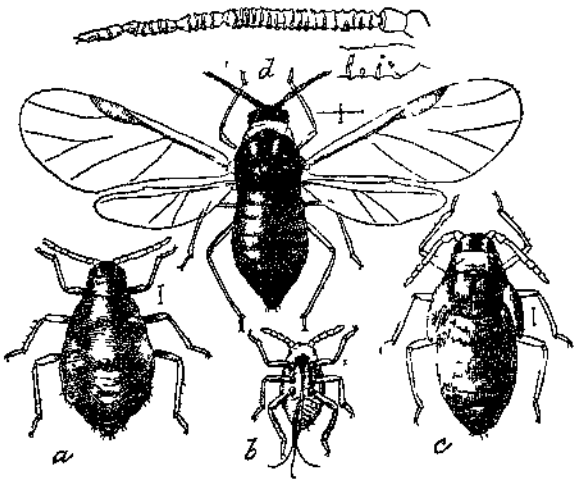

FIG 4. Woolly louse of the apple —a, Agamic female, b, young louse, c, pupa, d, winged female, with antenna enlarged above All greatly enlarged, and with the waxy secretion removed Marlatt, Circular 20, 2nd Series, Div Entomology, U S. Dept. Agriculture)

The form which occurs on the branches can be killed by a spray of kerosene emulsion or soap wash, best applied warm. It can also be destroyed by applying kerosene to the colonies by means of a paint brush. This should be done, if possible, early in the year.

The root form is not so easily got rid of, but the following remedies have succeeded :

1. Hot water may be applied about the roots of the trees, the surface soil having been first removed.

2. Finely ground tobacco dust may be applied about the base of the trees, first removing the soil to a depth of 4 to 6 inches.

For large trees, two to five pounds of the dust may be used. Mr. Marlatt says: "The tobacco dust kills the aphides by leaching through the soil, and acts as a bar for a year or so to reinfestation. The dust is a waste product of tobacco factories and costs about 1 cent per pound, and possesses the additional value of being worth fully its cost as a fertilizer."

FIG. 5. Woolly louse of the apple — *a* Root of young tree showing deformation produced by the lice; *b*, piece of root with lice upon it; *c*, female louse *a* and *b*, natural size; *c*, enlarged (Marlatt, Circular 20, 2nd Series, Div. Entomology, U. S. Dept Agriculture

3. Bisulphide of carbon can be applied in two or three holes about the tree to a depth of six inches to a foot, and not closer than a foot and a half to the tree. An ounce of the bisulphide should be put in each hole, and the hole immediately closed. This does not prevent later reinfestation, and is thus inferior to the tobacco dust.

Another woolly louse is that of the elm, named *Schizoneura americana* by Riley. I have found this at Mesilla, New Mexico, and it is not unlikely to occur in Arizona wherever elms have been planted.

The naked plant-lice (mostly of the genera *Aphis* and *Siphonophora*) are very numerous in kinds, and infest very many different plants. They are noted for their rapid increase, which approaches the miraculous. Professor Huxley calculated that the produce of a single aphis would, in the course of ten generations, supposing all the individuals to survive, weigh more than the whole population of China. Of course the individuals never do all survive; on the contrary, most of them perish, and for this we

have to thank their numerous parasitic and predaceous enemies. Observe the flies hovering over a cabbage patch ; these are the syrphus-flies which lay their eggs among the lice ; and from these eggs hatch maggots which feed voraciously upon the lice, and ultimately turn into other flies like their parents. So also the little red beetles, so common wherever plant-lice abound, are the lady-birds which destroy more lice than we can count. Ignorant people sometimes are alarmed at the numbers of red lady-birds, and even think that they are the parents of the lice, but they could not make a greater mistake.

As regards the remedies for naked plant-lice, much depends on the kind of louse, the plant attacked, and the time and place. A good deal of work needs to be done in Arizona before we know what plant-lice occur there, much less how to deal with them. But in a general way, various suggestions may be offered.

Much may be done against most kinds, especially those living on fruit trees, by a spray of kerosene emulsion. The lice are soft and naked, not protected like scale-insects, so they are readily destroyed. Dr. J B. Smith says : "As a general insecticide, nothing is better than kerosene emulsion, which, when diluted ten times with water, kills all the young forms and adults of the green species. It has been found by experiment that the black or brown species are much more difficult to destroy, and one part of emulsion in six or eight parts of water is more likely to be effective." *(See note).*

The grey cabbage-louse, so well known to all raisers of vegetables, lives during the winter on old cabbage stumps. It is therefore of the utmost importance to remove them from the field and burn them, as well as all sorts of loose trash and weeds,

NOTE—*Kerosene emulsion, milk formula*—kerosene, 2 gallons; sour milk, 1 gallon.

Heating is unnecessary; churn three to five minutes, or until a thick, buttery consistency results. Prepare the milk emulsion from time to time for immediate use, unless it can be stored in air-tight jars; otherwise it will soon ferment and spoil.

How to use the emulsion—For summer applications for most plant-lice and other soft-bodied insects, dilute with 15 to 20 parts of water; for the red spider and other plant mites, the same, with the addition of one ounce of powdered sulphur to the gallon; for scale insects* the larger plant bugs, larvae and beetles, dilute with 7 to 9 parts of water.

For subterranean insects, such as root lice, root maggots, "white grubs," etc., use either kerosene emulsion or resin wash, wetting the soil to a depth of 2 or 3 inches, and fallow with copious waterings, unless in rainy season. *Year Book, U. S. Dept Agriculture*

Spray Pumps—Full information about spray pumps, styles, cost, and where obtained will be supplied on application to THE EXPERIMENT STATION, Tucson, Arizona

The Arizona Strawberry-louse (scientifically called *Myzus fragæfolii*) is a pest of strawberry plants at Jerome and other places, and is quite destructive. It is very pale yellowish or greenish; the wingless forms, examined with a microscope or strong lens, are seen to have many knobbed hairs on the body This plant louse swarms in great numbers on the leaves and stems, and even invades the blossoms, with the result that the fruit is defective. At present it has been found only on the cultivated strawberry; we have kept it in the laboratory on this plant, and have found that it will also live upon the wild strawberry of the mountains, but it refuses to attack beans or violets which are growing in the same box. This experiment indicates that it will probably feed only on the strawberry and its nearest allies; a fact of some importance, because if it should live on weeds near the strawberry beds, the difficulty of getting rid of it would be greatly increased.

In fighting this insect, it is of great importance to secure clean plants, and plant them where no infested strawberries have been. It may be well to give an infested field over to some other crop, and plant fresh strawberries in another part of the ranch. The plants about to be put in should be carefully examined, and it will be well to dip them in diluted kerosene emulsion or fumigate them with hydrocyanic acid gas. The ground which was infested should be plowed deeply,

T. D. A. COCKERELL.
Consulting Entomologist.

SUGGESTIONS CONCERNING DATE CULTURE,

No. 26, JANUARY 15.

Dates being now grown in several parts of the Territory, and definite information as to their culture being lacking, it is deemed wise to furnish present and prospective growers with brief suggestions along this line. Letters received from various parts of Arizona and elsewhere indicate a growing demand for information relative to the culture of this fruit.

It seems to be now fairly well established that dates of good quality and in commercial quantities can be produced in the warmer parts of Arizona During the past year, three imported trees at the Experiment Station farm near Phoenix bore over 500 pounds the fruit ripening between August and January The portion placed upon the market sold at 25 cents per pound wholesale, at Phoenix Thousands of pounds could have been sold at this price Packed in neat labeled boxes, they retailed at 50 to 70 cents per pound.

The seedling date trees in various parts of the Territory bore last year 40 to 200 pounds per tree Those of a good quality sold for 25 cents a pound wholesale, at Phoenix For some years yet, the principal part of the dates grown in the region will be on seedling trees

To secure the setting of the fruit ot date trees and to bring it to maturity, it is important that certain precautions be exercised. To begin with the winter season, trees should be permitted to remain without water and to keep as nearly dormant as possible during the coolest months, that they may be subjected to the danger of frost as little as possible. About the first of March irrigation may begin, water being applied copiously until the trees bloom. An abundance oi water about the roots is said to stimulate blossoming When they have put forth their cluster of blossoms, water should be withheld until the fruit has set.

In order to bring about the setting of the fruit, it is essential that the female blossoms be pollenated. Date trees, unlike most other fruit trees, bear the two essential parts of the flowers on different trees. Hence it is necessary either that pollen-bearing trees be grown near fruit-bearing trees, or that pollen be brought to the latter. Last year a large quantity of dates failed to fill out properly because of a want of information on this point, or because of the inability of the owners of the trees to secure pollen at the proper time. If pollen-bearing trees do not grow within 30 or 40 feet of fruit-bearing ones, it will be necessary to cut away clusters of the pollen-bearing flowers and hang them in the fruit-bearing trees. This must be done very soon after the female flowers appear, or it will be too late for fertilization to take place. If pollenated too late, the result often is the development of a few of the

later-blossoming flowers, while the rest remain undeveloped and seedless It is not necessary to depend upon the pollen produced the same year that it is desired to pollenate the female blossoms, since pollen may be kept from year to year and dusted upon the clusters of female flowers at the proper time.

After having made sure that the female flowers have been adequately pollenated, the date trees will require little attention, except occasional watering, for several months As the dates approach their full size, it is important that the trees be supplied with an abundance of water, it being impossible to give them too much water from the time the fruit begins to ripen until it is fully matured. A good way to insure a thorough soaking of the soil about the roots of the trees is to make a basin 15 to 25 feet in diameter, by excavating some of the soil and throwing up a circular ridge, and then to fill this basin with water about once a week.

As the dates begin to ripen, they will be devoured by various species of birds, the cactus-wren and the Gila woodpecker being the most destructive about Phoenix. In order to save their dates from these depredations, some have resorted to a procedure that has resulted in the wasting of much fruit—the removal of the clusters from the tree that they may be taken to a place of safety. Green dates once severed from the tree do not mature properly. In order that the tannic acid with which they are abundantly supplied may all change to the sugar that is so desirable and which causes them to be so delicious, it is necessary that an abundance of water reach the fruit. And this cannot take place if the bunches are removed from the tree, and thus cut off from their water supply. If the ends of the cut stems are placed in a vessel of water and the cluster treated as a bouquet, the unripe dates will wither more slowly and more of them will come to maturity. Or the clusters may be enclosed in an air-tight box, and loss of moisture from the fruit thus checked, the water in the large stem commonly being sufficient to enable the necessary chemical changes to take place. But in no case will the flavor be equal to that of those ripening naturally upon the tree.

A better way to save the fruit from the ravages of the birds is to cover the cluster with cheese-cloth. This can be easily and cheaply done by making sacks of the proper size, slipping one

over each cluster, and tying the mouth securely about the stem, the leaves that might interfere with the work being first cut away. Besides preventing the depredations of birds, this cover keeps off bees and other insects, and catches the ripe fruit as it falls.

After being removed from the tree, dates require little treatment to preserve them Most varieties contain sufficient sugar to keep them indefinitely. Those ripening during late summer and early autumn may usually be packed at once, the need being to prevent them becoming so dry that they cannot be eaten. If, however, they are placed in air-tight receptacles, they will often mould some. Those ripening during late autumn may need a little drying before being packed away.

The greatest drawback to the preservation of dates is the work of larvæ that hatch from moth eggs deposited upon the fruit before it is packed. In our experience, untreated fruit is always ruined within a few months by these insects The best preventative we have found thus far is carbon bisulphide; but better methods of treatment will no doubt be developed as the industry becomes more important. To treat them with the bisulphide, they are placed in an air-tight box, a few ounces of the liquid poured into a dish sitting above the fruit, and a tight cover placed over all. In a few hours the cover may be removed and the gas permitted to escape, when the fruit will be ready to pack.

We still receive so many inquiries concerning the possibility of securing suckers from imported date trees, that it may be well to repeat what has already been stated in a previous bulletin—that there will be no suckers available from any American source for at least three or four years. The only source of these suckers at present is the date-growing regions of the Old World, The quickest way to secure dates at present is to plant seed. They may be planted at any time from now until next July, but will not germinate until warm weather comes. The seeds may be planted where the plants are to remain, or the latter may be transplanted when a year old. Although adult trees endure considerable alkali, the experience of the past year at the date palm orchard south of Tempe indicates that date seeds will not germinate freely in alkaline soil, and that young seedlings are injured by the presence of much alkali, A fairly good place to plant the trees 5s along ditch banks,

although the supply of water cannot be controlled there. As has been stated in previous bulletins, there is no certainty as to what the character of the fruit of these seedlings will be. Like that of the seedlings of most other fruits, it is pretty sure to be inferior to that of the established varieties. Besides this uncertainty, a half of the seedlings are likely to be males. The only way to secure date trees of a definite sex, bearing fruit of a definite character, is by suckers.

A. J. MCCLATCHIE.
Department of Agriculture and Horticulture

THE SPRING VEGETABLE GARDEN.

No. 27, FEBRUARY 1.

While there is no time of the year when it is not possible to have some vegetable or vegetables growing and furnishing something for the table in Southern Arizona, the spring is the season of the year when vegetables are grown most easily. Spring begins here during the latter part of January or during early February. During the first ten days of the latter month, more vegetables may be planted with a reasonable hope of a successful outcome, throughout most of Southern Arizona, than during any other ten days of the year. Those who contemplate growing their own vegetables should, if they have not already done so, begin work on the vegetable garden as soon after the receipt of this bulletin as practicable. The longer the work is delayed, the less chance there will be for success.

For the spring garden a warm situation and soil should be selected, If the latter is not already rich in decayed vegetable matter, a heavy dressing of well-rotted stable manure should be given. The manure should be turned under when the soil is as moist, from irrigation or from rain, as possible. After being thoroughly harrowed and, if clods are present, rolled, the soil will be ready for seeding.

The piece of land selected may be divided into sections, each being devoted to vegetables that should be sown at the same time and in similar manner. The sections may be situated end to end

in the direction the irrigating water is to run, or they may be side by side. In either case, it will be well to leave between them space to walk upon when irrigating, cultivating, or gathering the vegetables. In deciding the direction in which the water is to run, the fact should be kept in mind that too much fall is as undesirable as too little. A slope of two to three inches to the hundred feet is about right for most vegetables.

Beets, carrots, lettuce, parsnips, peas, radishes, spinach and turnips should be sown as early in February as possible. During most winters in most parts of Southern Arizona seeds of several of these vegetables will germinate readily at this time of the year without irrigation if sown in moist soil. This is especially true of beets, parsnips and peas, the size of the seed making it possible to cover them sufficiently to prevent the soil drying out before germination occurs. Seed of these vegetables may be sown in level ground, and not furrowed for irrigation until the plants have attained a considerable size This method may also be pursued with radishes, spinach and turnips, if the soil is fairly retentive of moisture and the weather not too warm and dry. In the case of the smaller seed, such as that of carrots and lettuce, it will be safer to provide an irrigating furrow before the seed is planted, and sow the latter along the margin of it. Water can then be run through the furrow and the soil about the seed thereby nourished. The radish and turnip seed should germinate within four to eight days; the beets, lettuce, peas and spinach in seven to twelve days; the carrots and parsnips in about two weeks, or a little more.

Of some of the above vegetables it is important that varieties adapted to the region be sown. Of beets, all varieties thrive here, the ones most commonly sown being the Blood Turnip and the Long Blood. Of carrots, Danver's Half-long, the Ox-heart and the Short-horn are the most popular. All varieties of lettuce will grow at this time of the year, but some are much more desirable than others. At the Experiment Station farm the Golden Queen has proven to be the earliest variety. The standard heading varieties, the most desirable ones to grow, are Hansen, Wonderful, and Henderson's New York. In most sections only early varieties of peas should be sown at this time of the year. The

most satisfactory varieties are the American Wonder and Little Gem. Where the hot weather does not come for three or four months, the later varieties, such as Yorkshire Hero, Horsford's Market Garden and Stratagem may be sown. The French Breakfast and the Scarlet Turnip are among the earliest varieties of radishes. Of spinach, the Prickly seeded and the Long-standing are good varieties. All varieties of turnips are successfully grown here.

Potatoes should also be planted as early in February as possible. The more growth they are permitted to make before the hot weather of early summer, the heavier the yield will be. They should be planted in soil as moist as possible, in just the same manner as they are where irrigation is not practiced. We have found the best method to be to open furrows, four to six inches deep, drop the seed promptly and throw the soil back again with the same turning plow, before the soil has had time to dry. The field is then harrowed level, and given no further attention until the young potatoes show the need of water, or weeds appear. We have found the most profitable distance to be about one foot in the rows, with the rows about thirty inches apart. The Early Rose is the most suitable variety for this region, of which the seed is available.

If good cabbage and cauliflower plants have been grown or are available, early varieties, such as Early Jersey Wakefield, Winningstadt, and All Seasons cabbages and Burpees Best Early cauliflower may be set out. Late varieties will not mature from spring setting.

Tomato seed may be planted outdoors in all the warmer parts of Arizona during early February. We have found the most satisfactory method to be to plant the seed in hills where the plants are to remain Furrows are run about four feet apart and the seed planted along their margin in hills three to four feet apart. If the soil is kept moist by running water through the furrows, the young plants will appear in about two weeks and will endure all the frosts that commonly occur. Tomato plants grown this way produce fruit earlier and more abundantly than if grown in beds or boxes and transplanted. The Dwarf Champion is the most satisfactory variety to grow in Southern Arizona.

During February corn and summer squashes may also be planted. Each is planted along furrows, the former three to four feet apart each way and the latter four to six. Adams Early and Adams Extra Early are the most satisfactory varieties of corn to grow. The common Mexican variety is productive. None of the varieties of sweet-corn or field-corn yield satisfactorily if planted at this season of the year.

During March beans, cucumbers and melons may be planted in the warmer parts of Arizona, as also a second sowing of beets and radishes. None of the standard varieties of string-beans are easily grown in the warmer valleys of Arizona. The easiest one to grow is the common Mexican pink bean. The small early Lima beans will also produce fairly well, and may be sown even earlier than March Of cucumbers the Long Green and the White Spine are among the most satisfactory varieties. All varieties of melons thrive here, earliness and quality being the most important considerations. The Augusta and the Florida, Favorite and Fordhook First are good, early varieties of watermelons. Other desirable varieties are Georgia Rattlesnake, Sweet Heart, and Kleckley Sweets. Of muskmelons the Rockyford is the most popular.

With a fair amount of care, the spring vegetable garden may be made to produce something for the table from early April until after the Fourth of July. But if it is to do this, it must be given immediate attention.

Seed may be procured of the Texas Seed and Floral Company, Dallas, Tex., and of the Germain Fruit Company, Los Angeles, Cal.

A. J. McCLATCHIE,
Department of Agriculture and Horticulture.

SOME TREES AND PLANTS FOR BARREN PLACES.

NO. 28, FEBRUARY 15.

It is often a perplexing matter to beautify a Southern Arizona home with its appropriate setting of green, The wide daily and yearly range of temperature makes the number of available

trees and plants much less than in the more even climate of Southern California; while the aridity of the air and the scarcity of water makes drouth-resisting forms to be preferred.

The experience of several years past on the University grounds has shown some things especially suitable for an arid mesa underlaid with the limy hardpan commonly known as caliche.

Trees. Among trees, the pepper stands not far from first for such a situation, being a graceful evergreen, a rapid grower, and thriving on relatively little water. This tree, sweeping the ground with its lower branches, may serve admirably as a screen, but may also be trimmed up into a taller and more shapely form. The Arizona ash is a slow grower, but never sulks; prospering when water is abundant, maintaining life and waiting for its opportunity when water is scarce. The Bagote, a species of Palo Verde, is an attractive oddity, evergreen, graceful and covered with a wealth of yellow blossoms for three weeks in the spring. One tree on the University grounds has thriven for three years past without irrigation, but is slightly damaged by our coldest winter weather, say 20 degrees P. The date palm is highly ornamental and when well watered takes strong hold on rocky soils. When ornament alone is considered, however, *Phœnix canariensis*, closely resembling the date palm, is perhaps preferable. It is a more vigorous grower and does not put forth the troublesome growth of suckers which must be removed from the date. The native cottonwood, too, though it has its enemies, is an excellent thing to plant—next year. This year you should watch the trees in your neighborhood and mark the males—those which produce pollen-bearing blossoms and no cotton. Switches from this source will produce clean trees free from the annoying nuisance of cotton. Perhaps the handsomest trees on the University grounds are three cottonwoods, about nine years old, but 50 feet high and with trunks 16 to 20 inches in diameter. All of these trees will force sufficient root room for themselves in caliche, if properly irrigated.

The olive, the umbrella tree and the Washingtonia palm are less hardy in the hardpan soil of our location, being occasionally subject to a destructive root rot where, apparently, the health of

the tree is impaired by adverse conditions. In most cases, it is desirable to prepare root room in a hardpan soil by blasting, as a growing tree will otherwise soon become cramped for room. When caliche is found within two or three feet, it is well to drill three or four feet further and shake things up with a stick of No. 2 Giant on top of a large handful of black powder,

Hedges. The pomegranate takes vigorous hold of rocky ground, as does also the California privet (*Ligustrum japonicum*) but both require attention with regard to water in the hot season. The privet is especially beautiful for this purpose, evergreen, vigorous and easily and cheaply propagated by cuttings from the established plants.

Vines. On a south exposure the trumpet creeper thrives, yielding a mass of green foliage and orange-red blossoms in summer, but rather bare and unsightly in winter. The Virginia creeper will also endure our summers, but its near relative, *Ampelopsis Veitchii*, is a handsomer and cleaner vine with an ivy-like leaf. *Ampelopsis Veitchii* does best in shady places. The honeysuckle (*Lonicera japonica*) also thrives on south exposures, as does the English ivy in sheltered places, but the latter is perhaps less adapted to this climate even when protected from the heat.

Lawn plants. Bermuda grass, perhaps, heads the list as a summer-grower and drouth-resister. Its harsh texture, and the difficulty of killing it, however, do not make it many friends. Alfalfa makes a beautiful summer-green, stands prolonged drouth when once established and will force its roots deeply into hardpan soil, thus preparing them for subsequent planting. "Sour" clover (yellow sweet-clover, bitter melilot) fulfills the same purpose, but grows in winter. A very promising plant for lawns in this section is *Lippia repens*, a near relative of heliotrope and verbena. This plant is a rapid grower, matting closely to the ground and spreading like a strawberry plant, striking root from the joints as it runs. It is evergreen, full of bloom in summer, is a drouth-resister, prospers best in the hottest places, and stands the frosts of this locality fairly well. The lawn of the future, however, is doubtless to be composed of native grasses. In the most interesting struggle for existence between two or three score

grasses and clovers on the University lawns, the natives are making an excellent showing, being decisively conquered by Bermuda only,—but more of this, perhaps, another year.

Where water is scarce or costly, or where a home is abandoned during the hot summer season, a selection of drouth-resisters may be made which will beautify barren surroundings with minimum cost and care. The pepper tree, the Arizona ash, and the Bagote ; the native *Larrea* or creosote bush, agaves and yuccas ; native grapes and honeysuckles ; native grasses, and possibly, also, *Lippia repens* for lawns, is a selection which will go far in the reclamation of barren surroundings.

But beware of the traveling agent who wishes to sell you an ornamental foreign tree that "will grow without water." The chances are against the purchaser, and such selections can be made far more safely from native trees.

A few more seeds of the Bagote may be obtained of the Experiment Station, and Dr. F. Franceschi of Santa Barbara, Cal., has *Lippia repens* and other plants and vines suitable for Southern Arizona.

R. H. FORBES,
Director,

THE USE OF HAND SEPARATORS ON THE FARM.

No. 29, MARCH 15.

Climatic conditions over the greater part of Arizona practically necessitate the use of the cream separator where home dairying is practiced ; the best of care is required to get milk to the creamery in good condition, while the conditions necessary to a satisfactory separation of the cream from the milk by setting are practically unattainable.

The writer has found that in certain localities in another state where well water at a temperature of 50 degrees is available for the deep setting of milk, the average loss of butter fat in the skim milk is about one per cent, or from one-fifth to one-third of the total fat. This loss of one pound of butter fat in every hundred pounds of skim milk in a herd of five cows, each giving 4000 pounds of milk, would in a year amount to fifty dollars.

Even where butter is made at the factory, the use of a separator on the farm is of a distinct advantage to the farmer. Instead of having the whole volume of milk to cool down for delivery to the creamery, only the cream, amounting to ten or fifteen per cent of the whole milk, demands that attention; the skim milk, still warm from the cow, is in the best of condition for feeding to young stock, both morning and evening; and, at the usual rate of ten cents per hundred pounds for hauling to the factory, the farmer with the herd of five cows would pay out during the year $3.00 for hauling cream, instead of $20.00 for hauling milk.

The best hand separators on the market, properly operated, should leave not more than one-tenth of one per cent of butter fat in the skim milk. Every additional tenth of a per cent means one pound of butter fat in a thousand pounds of skim milk, or about $5.00 per year in our herd of five cows. The best separator is the cheapest, and a poor one is expensive at any price.

In using a separator the directions accompanying the same should be carefully followed. When setting up the machine it should always be borne in mind that it must be *level* 011 a *solid* foundation. In operating, three points should be given most careful attention—the temperature of the milk, the rate at which the milk is fed to the machine, and the speed of the separator bowl.

Milk is in the best possible condition for separation when fresh from the cow; it should not be allowed to cool down below 85 degrees.

Skim milk should be tested to ascertain whether the machine is skimming clean or not when fed at a given rate. Never guess at the speed, but count the revolutions of the crank and know. When directed to give 45 to 50 turns per minute it is safe and best to give 50 turns.

Do not neglect to fill the bowl with water before starting, as, in all cases, it may be gotten up to speed with less vibration when this is done, and in some cases it prevents much cream from sticking to the inside parts.

One should never try to regulate the thickness of the cream by the rate of turning—there is a cream screw for that purpose.

Sample No. 24 below is an illustration of what may be expected where thin cream is gotten by slow turning.

The following table will give the reader an idea of the success with which hand separators are used upon the farms in the Salt River valley. This is not supposed to show what the different machines are capable of doing under the best conditions, but what they are actually doing at every day work in the hands of farmers. While the skim milk was tested by the writer, in every case the samples were taken by the farmers themselves and each sample tested was composed of skim milk from a number of different skimmings:

Sample	*Kind of Separator*	*Per cent of fat in skim milk*
1	De Laval	.05
2	United States	.06
3	Kneeland Omega	.06
4	De Laval No. 3	.07
5	De Laval No. 1	.08
6	De Laval No. 3	.08
7	De Laval No. 2	.10
8	United States	.11
9	De Laval	.11
10	De Laval	.12
11	De Laval No. 3	.12
12	United States No. 5	.14
13	United States No. 5 (improved)	.14
14	De Laval No. 3	.15
15	De Laval	.20
16	United States (improved)	.24
17	United States No. 5	.30
18	Kneeland Omega	.32
19	United States	.42
20	Kneeland Omega	.44
21	De Laval No. 3	.46
22	American	.68
23	De Laval	.96
24	De Laval No. 3	1.20

The writer was unable to learn that more than one of the owners of separators had taken the trouble to test the skim milk, though some were in the habit of setting it to see if any cream would rise. That this is not a sufficiently accurate method of testing skim milk is shown by the fact that samples contained as high as three-tenths of one per cent of butter fat where the own-

ers were unable to get any trace of cream upon the milk when allowed to stand.

As stated above, this should not in any sense be taken as a report of results of a test of the different makes of separators The results given show this : That close skimming can be done with hand separators when properly operated; that excessive losses result from careless handling ; and that every owner of a hand separator should run a Babcock tester and test the milk from his separator as well as from his cows.

GORDON H. TRUE,
Department of Animal Husbandry

WELL WATERS FOR IRRIGATION.

No. 30, APRIL 1.

As the number of artesian wells, and those from which water is pumped for irrigation, increases, interested inquiry is made as to the probable effects of these waters upon the soils to which they are applied.

In answering questions of this nature for irrigating waters in this region, three factors must be considered : 1, the silt which they carry; 2, the various soluble "alkaline" salts; 3, soluble plant foods, especially nitrates.

Silt is, of course, absent in all well waters. In river waters this material, containing organic matter and mineral plant foods, is of great value to the lands upon which it is applied. The deficiency of silt in well waters, however, is not without advantage, since these waters are more uniformly wholesome for stock and dairy purposes, the offensive character of river waters at flood time being a matter of common observation.

Alkaline salts in solution vary greatly in amount in different localities. In irrigated districts, well waters are usually heavily charged with salts, originally contained in solution in irrigating water or leached from the soil, and carried down to ground water level by drainage. In Salt River valley, the average for thirty-six wells, from fifteen to 146 feet deep, was 169 parts of soluble salts in 100,000 parts of water. In some instances these solubles

were in part composed of carbonate of soda, or "black alkali," but for the most part chiefly consisted of chloride and sulphate **of** soda. Wells drawing- their supply from the underflow of mountain washes are, on the other hand, of far purer character. A sample from the underflow of Agua Fria contained but 30 parts of salts in 100,000 of water; while the University well near Tucson, probably fed by the drainage from the mountains to the eastward, contains only 26 parts.

The artesian waters of Southern Arizona form a class by themselves, being uniformly more or less black alkaline, but varying widely in the amount of salts in solution.

The following is a statement of analyses of the least and the most saline artesian waters thus far examined :

	Parts in 100,000		
	Total soluble solids	*Commonsalt*	*Carbonate of soda*
1	16	1 1	7.5
2	212	130	7.2

The amounts of the various soluble compounds proving injurious to crops depends upon the nature of the compound, the kind of soil, and the crop grown. Of the common soluble compounds, carbonate of soda is most injurious, common salt next. and sulphate of soda least.

Speaking of barley, Dr. Hilgard of the California Station, states that, while a full crop was obtained on land containing 25,440 pounds of soluble salts per acre in the surface four feet, it refused to grow in soil containing 32,480 pounds. The same author also remarks that leguminous plants (clovers, beans, etc.), crucifers (mustard, kale, etc.), and citrus trees are more sensitive to alkali than barley. On the other hand, Bermuda and certain salt grasses, the salt bushes, pomegranate and pear, the date palm, and certain root crops (including sugar beets), will thrive in soils containing much greater quantities of salts than barley will tolerate.

Now, reckoning on three acre-feet of water a year for mixed farming, at least which is necessary in Southern Arizona, a sup-

ply containing 100 parts by weight of soluble salts per 100,000 parts of water, would carry on to the land 8167 pounds of salts per acre in one year.

Comparing this amount with the injurious quantities mentioned above, it is evident that in a very few years such a water would bring harmful amounts of alkali upon the soil, provided

Fig. 6. Typical artesian well 6 miles southwest of Pima, Arizona.

that they all remained. This depends largely on the character of the soil. A light, sandy soil, well drained, will retain but a portion of the alkali from the irrigating water; but a dense adobe, holding a large amount of water, bringing water by capillary action from greater depths to the surface where it is evaporated, and draining with difficulty, accumulates much larger quantities of salts. With waters of stated composition, and soils of a cer-

tain character, therefore, a rough judgment may be formed as to the probable future of a certain district. Speaking for California, Dr. Hilgard says that "when • • • • a large proportion of the solids consists of carbonate of soda or of common salt, even a smaller proportion of salts than 40 grains per gallon (=68 parts per 100,000), might preclude its *regular* use, depending upon the nature of the soil to be irrigated."

Nitrogen in the well waters of this region may also augment their value for irrigation, this important plant food being commonly deficient in our soils.

In irrigated districts, well waters nearly always contain appreciable amounts of nitrogen apparently derived from the seepage from irrigating water, which contains important quantities of the compounds of this element, derived from decaying animal and vegetable matter.

Thirty-six wells of Salt River valley averaged 1.24 parts per 100,000 of sodium nitrate, which is 16.35 pounds of nitrogen in three acre feet of water,—a significant amount when it is remembered that 50 bushels of wheat require not far from 59 pounds of nitrogen from the soil.

But in some cases well waters are nearly or quite free from nitrogen, and this fact, in connection with the lack of nitrogen in our desert soils, must make it necessary to supply this ingredient to lands irrigated from such supplies. In farming operations this is done by means of alfalfa and other crop plants of the clover tribe, which gather nitrogen from the air, and thus supply the deficiency. For gardens and house grounds irrigated by means of windmills, horse-power pumps, etc., the manure pit is a most excellent device. This is an excavation of convenient area and depth, into which compost materials are thrown as they come to hand. In the University barn lot a pit 10x12 and 3 feet deep receives the manure from two or more horses, leaves, rubbish, and occasional unfortunate cats and dogs,—all of which are in time reduced to rich compost most useful in our tree holes and gardens.

This is certainly a neater and more profitable method of disposal than to laboriously haul off and throw away, or leave an unsightly pile of offensive rubbish exposed where the sun and rain will dry it out or leach it of its valuable properties.

In greenhouse work, or for the fertilization of citrus and other valuable trees, commercial fertilizers containing nitrogen may be used, such as Chile saltpeter, tankage, etc. But it would be wise to make use of the waste from the farm before purchasing expensive fertilizers for these purposes

R. H. FORBES,
Department of Chemistry

HOME-MADE FERTILIZERS.

No 31, APRIL 15.

It has been well said that "a thrifty farmer may be judged by the size of his manure pile." This should be modified, however, for quality as well as quantity should be taken into consideration. How often do we hear the statement made by farmers that "*I* applied a certain number of loads of barnyard manure per acre to my field," which means very little indeed unless the quality of the manure applied is taken into consideration, I have seen barnyard stuff put upon land when it was not worth the labor of hauling, owing to the fact that nearly all of the plant food which it originally contained had been allowed, by improper care, to escape. This, naturally, leads to the question of the losses to which manure is subject. Barnyard manure is a very complex substance and undergoes very fapid changes, by which much of its value may be lost if it is not properly cared for. Loss is due to two chief causes. First, fermentation, of which there are two kinds, one of which, for its growth, requires an abundant supply of air, while the other grows without air and will die when exposed to it. The first of these ferments is the most active and destructive.

The second source of loss is by leaching or weathering. The leaching, of course, is not the serious problem in Arizona that it is in the more humid regions; yet serious loss of soluble plant food may occasionally occur in this way. It is necessary, however, that the manure be kept in a fairly moist condition; the destructive fermentation spoken of above is thereby held in check, while the coarse stuff, as straw, etc., is decomposed, and the plant food which it contains made more available.

To demonstrate that this loss does occur, a few experiments were conducted with this end in view. A sample of horse manure was thoroughly moistened with water, then allowed to drain over night and samples analyzed, both before and after treatment. It was found that, with an almost minimum amount of leaching, the loss in total nitrogen was about 5 per cent,—a small figure in itself, but when applied to a pile of manure representing tons, and a proportionally larger amount of water, the result is significant. Another lot of barnyard manure was divided into portions and one part exposed to the sun in July, 1900. A second part was loosely placed in a covered barrel and kept under a shed, protected from sun and rain, but with free access of air. These samples were left undisturbed until March, 1901, at which time an analysis showed that 22 per cent and 27.7 per cent, respectively, of the total nitrogen had been lost.

So much then for the loss, the question being, how to prevent it. The means of doing so are comparitively simple, the method of application, however, depending largely upon circumstances It is very true that the Arizona small farmer can not afford any great outlay, while on the large dairy farms of the East they deem it of sufficient importance to build special buildings for keeping and preserving manure. Probably the very best plan for this region is that of placing the manure in pits. The method has several advantages. It is cheap; and the pit can be made of such size as the number of animals demand, yet readily enlarged to accommodate circumstances. It can be so arranged that it is a comparatively easy matter to get water upon the contents, which, as before mentioned, is necessary, although an excess of water is to be avoided. The pit, as it is gradually filled, can be more or less protected by boards, or even a covering of straw will prevent the contents drying out too rapidly. Such a a pit has been dug in the stable yard at the University and serves an admirable purpose.

Another source of plant food frequently allowed to go to waste is bones and slaughter-house refuse, a certain amount of which collects around every farm, and when properly prepared is a most excellent fertilizer, much sought after by eastern farmers and orchardists. Such a product is valuable for its high percent-

age of phosphoric acid and nitrogen, and is worth in the eastern market from $25.00 to $35.00 per ton. This waste matter should be collected and kept until sufficient quantity has accumulated to make the handling practicable. For this purpose, also, a covered pit is a cheap and easy means of storing it. In order that the plant food in these materials may be easily available, it is necessary that it be either decomposed or reduced to a very fine condition. This may be accomplished in several ways. Treatment with acid, or grinding, are the two methods employed by manufacturers of fertilizers. The acid treatment is impracticable on the farm, but where the supply of material is sufficient to warrant it, the grinding is not. Mills for such a purpose may be found advertised in agricultural journals; and even though coarsely ground, bones then more readily yield their nitrogen and phosphoric acid to the orchard trees or valuable crop plants to which they may be applied.

Another way of decomposing bones is by means of unleached wood ashes This method, however, is to be advised against, owing to the fact that the ashes contain a high percentage of carbonate of potash, very similar to the "black alkali," whose injurious effects are too well known to need further comment.

The Station has from time to time received considerable correspondence in regard to the fertilizing of orange trees, which indicates the need of more concentrated fertilizing materials in the citrus orchards of Southern Arizona. Our arid region soils are deficient in nitrogen and organic matter, but rich in potash. This deficiency has frequently been made apparent by the condition of the trees, the yellow color of the leaves, or "frenching," probably indicating lack of nitrogen.

In applying fertilizing materials, therefore, it should be the aim to supply these deficient elements of plant food. Field observation also warrants the above belief; for, where green-manuring has been practiced, as well as where some good nitrogenous and phosphatic fertilizer has been used, the improvement in fruit. foliage and trees has been very marked. Ground green bones and tankage, supplemented if need be with a little potash, make a very desirable fertilizer for this purpose, A fertilizer of about the composition given below has frequently been advised by the

Station for fertilizing orange orchards, and is believed to be in every way suited to the purpose. It should be applied at the rate of from 500 to 1500 pounds to the acre, according to age of trees and quality of soil, and "plowed in deeply at the edge of the branches, about the beginning of the growing season."

Formula.

6 per cent nitrogen, from organic material,
1 per cent nitrogen, from nitrate of soda,
1½ per cent potash, from sulphate oi potash,
6½ per cent available phosphoric acid,—

which in certain cases can be compounded with economy by the farmer himself from the following materials :

1000 pounds 10 per cent bone tankage,
140 pounds nitrate of soda,
60 pounds sulphate of potash,
800 pounds dissolved bone (16 per cent available phosphoric acid).

A home-made fertilizer resembling this in composition would result from the accumulation of bones, carcasses and slaughter-house refuse, dried, worked up and preserved, as suggested, and would result in saving at least a part of the expense of chemical fertilizers.

W. W. SKINNER,
Assistant Chemist.

WILD BARLEY.

No. 32, MAY 15.

There is now maturing in Southern Arizona the seed of a grass that should be destroyed as promptly and as thoroughly as practicable. It is known in this region most commonly as "fox-tail." There are about a dozen grasses in the United States known as foxtails, but the one called by this name in Arizona is not so called in many of the other parts of the world to which it has spread from Europe, the place of its origin. It belongs to the same genus as our common cultivated barley, and is simply a wild barley. Cultivated barley was called *hordeum* by the Ro-

mans, and is now known among botanists as *Hordeum hexastichon*, which is simply the Latin for "sixrowed barley." The botanical name of the troublesome weed is *Hordeum murinum*, the Latin for "wall barley." Since we call the corresponding species of oats "wild oats," this weed is very properly called "wild barley."

But whatever its correct common name, or whatever it is to be called, it is certainly a very troublesome pest It is by far the most noxious weed of the Salt River valley, the writer receiving more inquiries concerning it than concerning all other weeds combined. The inquiries have been especially numerous during the past year, indicating that the weed is becoming more common and troublesome. The fact also that Professor Toumey in Bulletin 22, "Something About Weeds," issued only a little over four years ago, does not mention this one, indicates its recent introduction, or at least that it has only recently become troublesome. It is now the most widely spread and most common winter and spring weed of at least the Salt River valley It is everywhere, along roads, fences and ditches, and in fields.

Wild barley is an annual that grows from seed just as cultivated barley does. It starts to grow in the fall or early winter, at about the same time that barley is commonly sown, and matures in the spring or early summer, as does cultivated barley. Like the latter, it grows readily with alfalfa during winter, making the most of its growth while the weather is too cool for alfalfa to grow rapidly. It is in alfalfa meadows and pastures that it is the most troublesome. When young it is eaten quite freely by cattle, but as it approaches maturity, it is avoided by them, and thus gets an opportunity to produce seed. Even when grazed quite closely, it manages to produce short-stemmed heads that cattle avoid. The reason it is allowed to mature seed in pastures, as cultivated barley would not be, is that the grain is very small and the beards very rigid and very irritating to the mouths of stock. Consequently the wild barley succeeds in producing a good crop of seed with which to sow the ground for the coming season.

Not only does the wild barley have the objectionable beards of the common cultivated barley, but its heads break up into

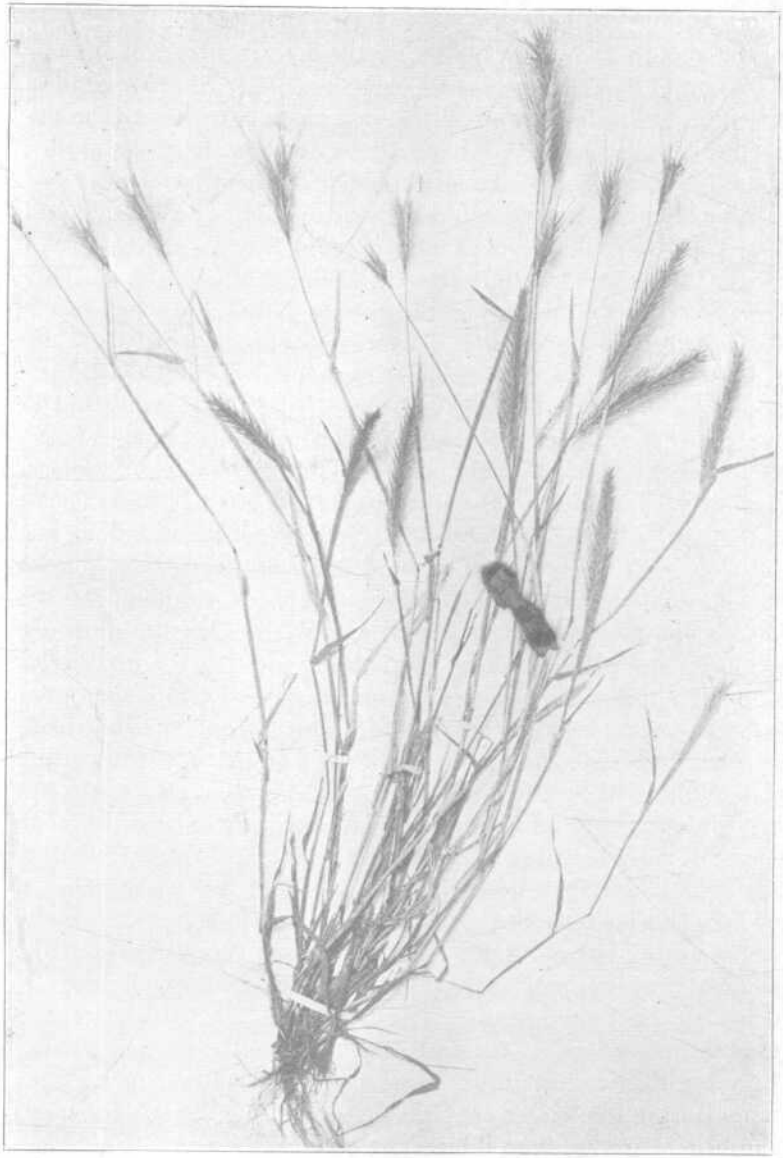

Fig. 7. Wild Barley, *Hordeum Murinum*, ⅓ size.

short sections with sharp piercing points that work into the lining of the mouth and other parts of the digestive tract of animals This causes this pest to be very objectionable in alfalfa meadows, where it approaches maturity just in time to be cut with the first crop of hay. Its presence in alfalfa hay causes an annual loss of thousands of dollars to the farmers of the Salt River valley. A combined effort that would destroy the pest, or so reduce its numbers that it would no longer infest meadows and pastures, would be worth a large sum to Arizona.

To eradicate this weed will be no easy task, but much can be done to check its spread and to decrease its prevalence. If all the wild barley seed that is maturing this month were destroyed, there would be much less of it next season. It would be impracticable to destroy it all, but much of that growing along roads, fences and ditches can be cut and burned. This is what every farmer in Arizona should do. It will be useless to attempt to eradicate it from fields, if that which grows elsewhere is permitted to mature and seed the fields. The heads, as has been stated, break up into short sections that cling to animals, to clothing, or are carried along by wind or irrigating water. To prevent this distribution of seed, it would pay a farmer to destroy the wild barley growing along fences and ditches of his neighbors, if the latter failed to do so. Every farmer should at least see that the public roads adjacent to his lands are cleared at once of the seed now maturing.

While seed destruction should be the present procedure, the prevention of seed formation should be the aim during the coming season. Plants are more easily destroyed when small than at any time late in their development. As this grass is the principal one that makes its appearance along fences and in other waste places during fall and winter, all young grass should be destroyed as rapidly as it appears, with whatever implement will best accomplish the desired result. In alfalfa fields the disc harrow is the best implement for the destruction of the grass when young. Running this implement over pastures and meadows one to three times during the winter does much to destroy the wild barley, and benefits rather than injures the alfalfa.

A. J. McCLATCHIE,
Department of Agriculture and Horticulture.

THE AUSTRALIAN SALTBUSH IN ARIZONA

No. 33, JUNE 1.

The saltbushes of Australia are very numerous as would be expected from the alkaline and arid conditions which prevail over large areas of that island continent. Many of them have been introduced into this country, and have been received with varying degrees of favor in the several arid sections of the western United States. However, only one (*Atriplex semibaccata*) has been universally appreciated. For this reason one is allowed to speak of this plant as *the* Australian saltbush.

Although spoken of as a "bush," it forms under favorable conditions for its development, large quantities of quite succulent forage which is readily eaten by either horses, cattle or sheep It is much less woody than the common "sages" of Southern Arizona, to which it is closely related ; and furnishes a much larger as well as a much more succulent growth. Like them it is a perennial and therefore does not require reseeding except at long intervals, unless it be pastured too closely. At the same time, it produces an abundant supply of seed that germinates readily in this region at any time of the year when there is sufficient moisture and in any but our coldest weather. One plant has been known to produce a "bush" one to two feet high and three to five feet jn diameter in a single year. When it first appears above ground, it has two small elongated leaves at the extremity of a short stem which is often tinged with red In this stage it closely resembles the troublesome pigweeds to which it is not distantly related. But it may soon be distinguished from these by the subsequent leaves, which are somewhat oval in outline and have sparsely toothed margins, as well as by the red pulpy fruit which is abundantly produced from August to December The accompanying illustration will give an excellent idea of the habit of the plant.

The experiments which have been conducted with this plant in this Territory are quite encouraging, and at least warrant further investigations. On the University campus at Tucson, where the caliche comes within 12 to 18 inches of the surface of the ground, it has made quite a respectable growth during the past year without artificial watering. The conditions here give it

rather a severe test, for it thrives best, according to all reports, in a deep loamy soil. It is highly recommended for ditch banks where the soil washes badly, as its prostrate stems growing in a thick mat on the ground interfere quite effectually with the erosive action of water.

Mr. J. T. Hildreth, of Safford, Arizona, has had remarkable success in growing this plant. In a recent letter in answer to an

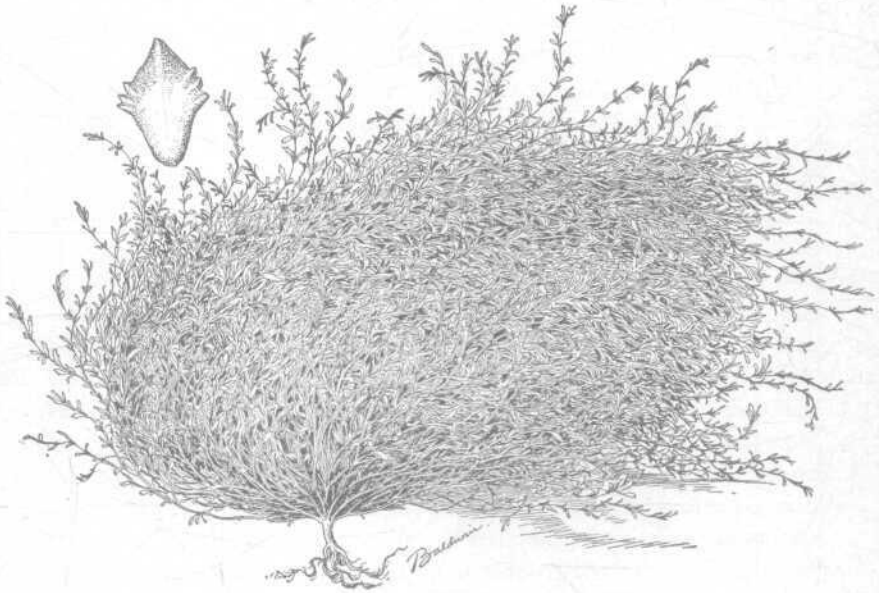

Fig. 8. Australian saltbush, *Atriplex semibaccata*.
(Bull. 108, U. S. Department of Agriculture, Division of Agrostology.)

inquiry, he expresses the belief that it is far superior to anything yet introduced in his locality for the improvement of the range. He has already seeded nine acres and will put in considerable more the coming season.

This Station planted a little less than an acre in January. This is now up and looking well. Of course these experiments are simply indicative, and by no means prove that this plant will be a valuable one in this Territory. They are, however, encouraging, and suggest that the rancher may improve his native range by a judicious introduction of this dry land saltbush.

In view of the necessity of finding some crop which will produce winter and spring feed, it has been thought wise to offer the ranchers and farmers an opportunity to determine for themselves what this plant will do in their immediate vicinity. We now have reason to believe from Mr. Hildreth's experiments and our own that the plant will be a valuable one for the vicinity of Safford, but it is well known that the conditions in the Territory are very diverse, and it will be necessary to test the matter in many localities before any extended recommendation can be made The Station can test the matter only to a limited extent, and is doing so now in eight localities in Southern Arizona , but a plant of such promise should be further investigated.

This Station is able to offer seed of *Atriplex semibaccata* to all who apply for it. No attempt will be made to furnish any individual with enough seed to make any great quantity of pasturage. On the contrary, we will furnish such a quantity as will enable the rancher to determine the value of the plant for his particular locality, and, if he chooses, after a year's observation, he can collect his own seed. About one-fourth of a pound, or enough to seed one-fourth of an acre, will be distributed to each individual who applies.

It is recommended that the seed be sown during the summer rains. It should be covered very lightly with a fine tooth harrow or if preferred it can be dropped in hills and pressed into the soft earth by pressure of the foot. In any case care should be exercised not to cover it too deeply.

DAVID GRIFFITHS,
Department of Botany

MILLETS.

No. 34, JULY 1.

The number of inquiries received concerning the culture of millet indicates considerable interest in this forage crop. While there is probably no section of the Territory where it should be made a primary crop, yet as a catch crop or a supplementary crop it has a place in Arizona agriculture. A crop may be se-

cured in so short a time after seeding, that a farmer may often utilize a piece of land that might otherwise grow up to weeds, and supplement his supply of forage without interfering much with the growing of the regular staple crops

There are a great many varieties of millet grown in the United States, each possessing certain merits Some are better adapted to dry regions than others, and some will make a crop on land too poor for other varieties. These varieties may be arranged into three groups· Foxtail millets, Barnyard millets, and Broomcorn millets. The most of those grown in the United States belong to the first group, characterized by having compact, bristly, foxtail-like heads. To this group belongs Common Millet, German Millet, Golden Wonder Millet, and Hungarian Millet. The Barnyard millets have branched heads and are closely related to the grasses that grow in summer along irrigating ditches and in other moist places, and known in Southern Arizona as "water grasses." To this group belongs the ''Ankee'' grass of the southwest, Shama Millet or Jungle Rise, and Sanwa Millet. The second variety is simply a cultivated form of the grass with leaves banded with purple stripes that grows so luxuriantly along Arizona ditch banks during warm weather The Broomcorn millets have bushy heads, resembling more or less those of broomcorn. The seeds of this group are white, yellow or red. The varieties are numerous, the best known in the southwest being the Manitoba, California Beauty, French, Turkish and Hog Millet.

Millets are grown for two purposes ; for forage and for the seed. The forage is fed to both cattle and horses, but principally to the former. The seed is used for both human food and food for stock. The use of the seed for human food is confined to the Old World, almost exclusively. For seed for stock feed the Broomcorn millets are the principal ones grown in this country

The Foxtail millets are the ones grown most extensively in this country, and of this group, the one most generally grown in Arizona is German Millet. These millets not only endure excessive heat and bright sunshine, but will make a crop with less water than others. The Common millet is the hardiest of the group, and endures drouth the best, German Millet gives a

heavy yield under favorable conditions, but requires more water The hay is coarser than that of Common Millet The Hungarian Millet does not endure drouth as well as Common Millet, but under most favorable conditions usually gives a heavier yield For a crop of seed the Golden Wonder Millet is the best of the Foxtail millets, the forage being coarse. This variety endures less drouth than any of the Foxtail varieties mentioned

Millets prefer a rich, mellow, loamy soil, thriving in neither heavy clay or adobe soil, nor in a light, sandy soil. While it is better to prepare the soil well, millet may be sown on quite rough land. Where the soil is not too compact or the surface covered with too rank a growth of weeds, it may be simply "disked" in This method is especially applicable to stubble land, after the grain is off.

Millet is a warm weather plant, thriving in heat and sensitive to cold. In Southern Arizona it may be sown any time from the first of May to the end of September While it may be sown early in the summer, it is not usually advisable to do so, as the month of June is apt to be very trying on it, irrigating water commonly being short as well as the air dry. The most favorable time is during July and August, the exact date advisable depending on the weather, the water supply, and local conditions. The time that the forage is desired may also be a factor in deciding upon the time to sow. The varieties vary considerably as to the length of time required for growth, but the average time is about two months. As it is quite sensible to frost, it must be sown early enough to reach the stage desired before there is danger of freezing. Thirty to forty pounds of seed of the Foxtail or Broomcorn millets is the usual amount sown per acre, and fifteen to thirty pounds per acre of the Barnyard varieties. Rich, well prepared land requires less seed than poor or rough land. Sowing too little seed is likely to result in coarse-stalked hay Most varieties of millet enjoy plenty of water, hence there is little danger of irrigating the crop too heavily during July, August or September.

Millet should be ut before the seed begins to ripen, especially if it is intended for horses. But it should not be cut too

green, as the hay is liable to have a somewhat laxative effect upon stock. Less harm results, however, from cutting it too green than cutting it too ripe. The best time to cut it is considered to be when the majority of the heads have distinctly appeared. It should not be permitted to become entirely dry in the swath, but should be raked when partially dry, and allowed to cure in cocks

Instead of cutting the millet, it may be pastured within a month or so after being sown Varieties that make second growth from the roots, such as Common Millet and Hungarian Millet, are best suited for pasturing. Poor alfalfa pastures may be much improved during the hot weather of summer by "disking" in millet seed, where the supply of irrigating water makes it possible.

A. J. McCLATCHIE,
Department of Agriculture and Horticulture