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Agricultural Experiment Station.

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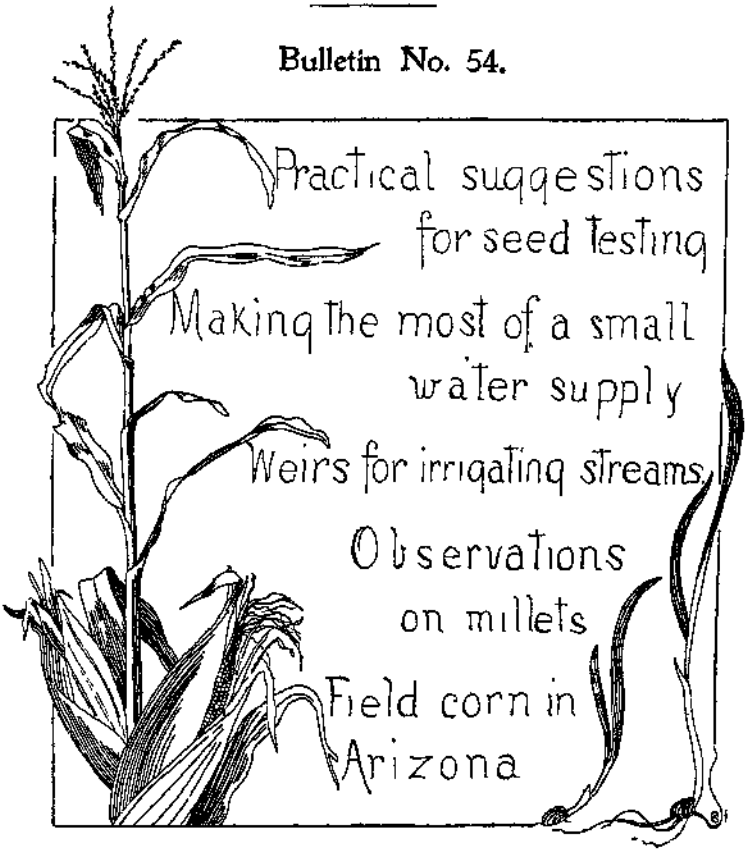

Timely Hints for Farmers.

Collected, Edited and Illustrated.

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Tucson, Arizona, November 26, 1906.

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AGRICULTURAL EXPERIMENT STATION.

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The Bulletins, Timely Hints, and Reports of this Station will be sent free to all who apply. Kindly notify us of errors or changes in address, and send in the names of your neighbors, especially recent arrivals, who may find our publications useful.

Address,

THE EXPERIMENT STATION,

Tucson, Arizona.

TIMELY HINTS FOR FARMERS.

SOME PRACTICAL SUGGESTIONS CONCERNING SEED TESTING.

No. 55. SEPTEMBER 10, 1905.

The practical planter buys, plants, and grows seeds for profit, and hence, it is the best of economy for him to test them for their percentage of germination, and, where desirable, for their purity before sowing them.

For the ordinary planter, the well-known "dinner plate" tester made with two soup or dinner plates, and one or more moist strips of sterilized cotton goods, preferably cotton flannel, will be found to answer all purposes. The cotton strips are sterilized in boiling water to destroy spores of moulds and other fungi present, folded twice upon themselves, and placed in one of the plates, the seeds are now laid between the folds of cloth so as not to touch each other, and the second plate is inverted over the first, this forming a moist, aerated and more or less sterile chamber. The cotton strips must be kept well moistened, but not saturated, preferably with water that has been sterilized by boiling, and allowed to cool before using. Two or three lots of seeds may be tested in the germinator at one time, but each should be contained in a separate cotton strip, and numbered to avoid error.

When, however, it is desirable to make several germination tests at one time, or when many varieties are to be tested, instead of duplicating the plate germinators already described, the writer found the following germinator, suggested by Dr. Volney Spaulding, formerly of the University of Michigan, to be superior: A deep granite bread pan six or eight inches wide was obtained in which was kept about one-fourth inch of water; cotton flannel strips of any convenient length, two or three yards, and of the width of the pan, were tucked crosswise at intervals of five inches; short galvanized wires about an inch longer than the width

of the pan were inserted through these tucks and gathered together, thus forming the cotton strips into numerous folds or loops which were suspended in the pan above the water, by means of the supporting wires. The ends of the strips being left sufficiently long to touch the water in the pan, the entire piece of cloth composing the loops, in which the seeds are placed, is kept uniformly moist. The cloth should be moistened before beginning the experiment, and, it is needless to add, sterilized.

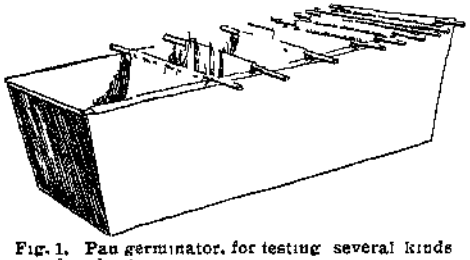

Fig. 1. Pan germinator, for testing several kinds of seeds at once.

A definite number of seeds taken as they come from an average sample are counted out for each germination test. For seeds in rather small lots, as garden seeds, fifty to one hundred will answer, while for the cereals, grasses, clover, and others used in extensive cultural operations, about two hundred should be used and the tests duplicated when any doubt exists about the results. The tests should be examined from day to day, and the sprouted ones removed and counted, the number being recorded on a sheet of paper.

The length of time required for germination is dependent upon several factors, chief of which are moisture, temperature, vitality, and varietal differences, six to ten days being sufficient for most kinds. When tests are made during the winter or early spring months, at which time it is usually most convenient, the germination should be conducted in a moderately warm room, so that the temperature will not fall below fifty degrees F. at night, and remain between seventy and eighty degrees F. during the day. In the case of alfalfa and certain others of the clover family, a small percentage of the seeds will remain apparently sound at the close of the germination test. Allowance is usually made for these, one-third being counted as viable—i. e., capable of growth.

No test can be made with reference to the stock of seeds. Cauliflower, cabbage, turnip, and beet seeds of poor stock—i. e., run out, are just as viable as those of good stock. The only means of remedying this defect is to use selected, home-grown seeds, or to buy the best stock of reliable seed houses.

The careful planter will often find it desirable to make the purity test for seeds. For this purpose, a definite quantity of seeds by weight is taken from an average sample, and separated by hand into the following lots: (1) pure seed of the variety desired; (2) inert matter, including dirt, chaff, injured seeds, etc.; and (3) foreign seeds, including weed seeds. The amount of pure seed in a pound or bushel is now easily estimated and after its germination test has been made, the planter knows its exact value. By the purity test, also, the introduction of noxious weeds will be lessened, since one will not knowingly sow foul seed, and samples suspected of containing harmful weed seeds should be referred to the Experiment Station for examination.

The following purity and germination tests were taken from a series of experiments in seed testing carried on in the botanical laboratory during the last two years, the samples of seeds used being collected from various markets in southern Arizona:

		Purity test.					Germination test.			
		Seed used.	Pure seed.	Inert matter.	No. weed seeds.	Percentage purity.	Seeds used.	Seeds sprouted	Seeds unchanged.	Percentage sprouted.
Alfalfa	No. 1	5gm.	4.53gm.	.46gm.	6	90.6%	200	188	10	95%
Alfalfa	No. 3	"	4.32 "	.68 "	0	86.4%	200	190	9	96%
Alfalfa	No. 4	"	3.58 "	1.42 "	3	71.6%	200	187	12	93%
Alfalfa	No. 6	"	4.47 "	.53 "	0	89.4%	200	189	10	98%
Alfalfa	No. 7	"	3.64 "	1.36 "	0	72.8%	200	151	33	81%
Sorghum	No. 1	30 "	29.18 "	82 "	0	97.2%	100	88	0	88%
Wheat	No. 3	30 "	28.78 "	.94 "	10	95.9%	100	92	0	92%
Rye	No. 1	30 "	29 55 "	.45 "	0	98 5%	100	96	0	96%
Barley	No. 2	30 "	29.76 "	.24 "	0	99 2%	100	99	0	99%
Oats	No. 1	30 "	28.32 "	.59 "	298	94.4%	100	94	0	94%

It will be noted from the data that the sample labeled "alfalfa No. 1" contained 90.6 per cent pure seed, of which 95 per cent was viable, or 86 per cent of the total sample, while of sample labeled "alfalfa, No. 7" only 59 per cent is capable of growing—i. e., 81 per cent of the pure seed was viable, and 72.8 per cent of the sample was pure seed. Sample No. 1 sold on the Phoenix market last year at 16c a pound, and sample No. 7 sold on the Tucson market at 15c a pound. It is quite apparent in this case that the highest priced seed is the cheapest for the planter. Alfalfa samples Nos. 3 and 4 also sold on the Phoenix market at 16c a pound, though No. 4 contained 29 per cent inert matter. In every case it is to be noted that the samples of alfalfa seed were remarkably free from weed seeds, though a few have contained seeds of other species of clover. Good alfalfa seed should not contain more than five per cent inert matter, and should give a germination test of 95 per cent. With the exception of sample No. 7, the germination tests ranged between 95 per cent and 96 per cent. From the above data it is readily seen why poor stands of alfalfa are of common occurrence, though the usual amount of seed may have been sown.

The samples of rye and barley which were tested were practically free from inert matter and weed seed, and gave a good germination test, as the results show, while in the wheat there was on an average ten weed seeds in every thirty grams of wheat, or about nine thousand weed seeds for every bushel of wheat. The test for oats is submitted as an example of grain foul with weed seeds, there being no less than ten varieties of weeds represented by two hundred and ninety-eight seeds. It is needless to add that the sample is unfit to sow.

J. J. THORNBER.

MAKING THE MOST OF A SMALL WATER SUPPLY.

No. 56. FEBRUARY 10, 1906.

By reason of their small initial cost and the ease and economy with which they are operated, windmills are a popular means of securing household and stock-water supply. Small gasoline engines also are being set up in increasing numbers. Though more expensive to install and operate, the amount of water raised by gasoline engines is greater in proportion to their cost, and they are not subject to the uncertainties of inconstant winds. Other devices—hydraulic rams, hot air engines, small steam engines and various animal-power machines are to be observed, as convenience, taste, or ingenuity of their owners may provide.

With any of these machines, however, the amount of water pumped is limited, especially when, as is frequently the case, it must be raised from fifty to one hundred feet or even more. Tanks varying in capacity from two to ten thousand gallons are very generally used to store water thus pumped, this arrangement providing against intermittent winds or discontinuous use of an engine.

Economical distribution: In this semi-arid region, with its long, hot seasons, a group of trees about the home offers refuge from the fierce heat, relief to the eye, and often, indeed, decides between comfort and misery for those in residence. But a tree once planted must in this climate be tended and watered faithfully or be lost. It is of importance, therefore, to arrange a means of distribution not only saving of water, but also saving of labor. These facts were impressed upon the writer in the course of a long, hot summer during which, with buckets and hose he laboriously kept growing a score or so of recently planted trees. In casting about for a better way various devices were experimented with. Ditches are necessarily wasteful of water, seepage along intermediate spaces between trees causing considerable loss. On irregular

ground, also, irrigation through open ditches is impracticable. Pipe lines with hydrants and hose connections are economical of water, which is by this means applied exactly where it is wanted; but a great deal of time is required in dragging the hose from tree to tree and in irrigating by this method.

A method combining convenience and economy of water was finally observed in use along one of our city streets, although for certain reasons not giving satisfactory results. This idea consisted, simply, in delivering water through small orifices bored at proper intervals in a small pipe line laid along the tree row desired to be irrigated, and connected with a suitable water supply.

*Theory**: If a horizontal pipe line connected at one end, under pressure, with a water supply, be punctured at intervals with orifices of uniform size, a series of streams will issue from these orifices, lessening in the amount of water delivered with distance from the supply. Various factors influence the amount and distribution of discharge and, consequently, the number of orifices in action, in such a system. Roughly speaking, with a given pressure the discharge tends to vary with the square of the diameter of the orifice. Large openings, therefore, sooner exhaust the capacity of the line and the length of the system is lessened. Also, the capacity of the pipe line tends to vary with the five halves power of its diameter. A 4-4ths or 1 inch pipe, therefore, in comparison with a 3-4ths inch pipe tends to carry a little more than twice as much water. With a certain size of orifice, therefore, a larger pipe line greatly lengthens the series of discharges.

The pressure or head, of water at the initial end of the system also affects its length. Through both pipe line and orifices the discharge tends to increase directly with the square root of the head or depth of water supply. The net result of an increase in the supply head therefore is an increase in the length of the line of discharges. In other ways friction affects efficiency. If the orifices are rough, friction is increased, delivery lessened, and the system lengthened. If the pipe line is rough inside,

*These paragraphs on theory, have been vised by Prof. G .E. P. Smith.

and contains bends and elbows, friction is also increased, but in this case the supply is lessened and the system made shorter. Grade also is influential. Running down hill, increases the head and tends to increase the length of the system. Running up hill has an opposite effect.

TABLE OF DISCHARGES FROM A 3-4THS. INCH PIPE LINE WITH SETS OF ORIFICES OF DIFFERENT DIAMETERS.

3-32 in. orifices		4-32 in. orifices		5-32 in. orifices.		6-32 in. orifices.	
Initial head 20 ft. 8½ in.		Initial head 19 ft. 4 in.		Initial head 18 ft. 9½ in.		Initial head 16 ft. 4 in.	
Distance from hd in feet.	Disch'g gals. per hour.	Distance from hd. in feet.	Disch'ge gals per hour.	Distance from hd. in feet.	Disch'ge gals. per hour.	Distance from hd. in feet.	Disch'ge gals. per hour.
15.3	38.3	15.5	59.0	15.5	75.6	15.5	108.9
33.0	30.5	32.2	49.5	32.2	67.6	32.2	90.0
48.3	31.9	47.1	49.5	47.1	57.8	47.1	71.0
63.5	30.2	64.0	43.2	64.0	55.9	64.0	55.9
80.3	25.2	79.2	38.9	79.2	49.2	79.2	47.7
95.8	24.8	94.8	32.7	94.8	33.5	94.8	37.8
113.2	21.6	112.2	29.8	112.2	33.0	112.2	32.0
128.5	20.2	127.6	23.7	127.6	25.8	127.6	25.2
142.1	19.8	141.3	23.1	141.3	24.6	141.3	25.2
157.2	15.5	156.4	16.2	156.4	22.2	156.4	22.7
170.6	15.5	169.9	14.4	169.9	17.9	169.9	18.0
184.2	14.4	183.6	16.9	183.6	16.5	183.6	20.2
197.7	14.8	197.1	15.8	197.1	16.5	197.1	19.9
214.9	12.4	214.4	15.8	214.4	14.0		
232.4	12.7	231.9	12.9	231.9	14.4		
247.9	10.8	249.3	14.4	249.3	14.4		
267.5	10.8	267.2	11.5	267.2	11.5		
285.2	9.5	285.1	11.1				
303.2	8.5	303.1	10.1				
317.3	8.1	319.2	12.2				
335.3	8.3	335.2	10.1				
348.8	7.5						
367.5	6.6						
383.4	5.9						
408.5	6.1						
427.1	5.9						
445.4	5.7						
464.0	4.7						
482.4	5.9						
500.7	4.5						
519.2	4.1						
537.4	3.4						
557.4	2.0						
Residual head 3 in.		Residual head 3½ in.		Residual head 2 in.		Residual head 2in.	

Observations on discharge: With a view to ascertaining, under ordinary conditions and with practicable apparatus, the efficiency for irrigating purposes of a pipe line with orifices, the following experiments were conducted: A line of 3-4ths inch galvanized pipe was placed about 3 feet above ground on trestles, and made perfectly level. One end was connected by means of a 1 inch pipe to a 50,000 gallon tank of water giving from 16 to 20 feet of head to the system. Stand pipes were provided at each end of the line, in which the head of water could be measured. The lengths of pipe, which averaged 16.9 feet, were connected by couplings which had orifices bored perpendicularly through their sides. The orifices were directed sideways and slightly down, and, water being turned on, each discharge was caught, measured, and calculated to gallons per hour. Four sizes of holes were used, and in each case the system was worked to its full capacity, from 2.0 to 3.5 inches head, only, remaining at the outer end of the system. The preceding table of results presents irregularities due to various causes—varying distances between orifices, irregularities in orifices, slight undulations in pipe line, and different heads in the several experiments; but gives an excellent idea of the working efficiency of such systems under the conditions stated, which are like those ordinarily dealt with.

Without entering into technical discussion, it is evident from this table that the smaller orifices give longer systems. All systems show great inequalities of discharge. This suggests the advisability, in practice, of partially plugging the more copious deliveries of a system in order to equalize and extend the flow. The more gradual character of the irrigation from the smaller holes is also evident.

The experimental plant. During the past three years the writer has used this system for irrigating his own trees, many practical points having suggested themselves meantime. The facilities employed are a well in which the water stands at 90 feet depth; a 3x14 inch pump cylinder operated by a 12-foot geared windmill of a type adapted to the light winds of the

region; a 5000 gallon storage tank on a stand 18 feet high; and perforated pipe lines laid along the lines of trees to be watered. These pipe lines are connected both with the storage tank and directly, at the surface of the ground, with the column delivering water from the pump cylinder to the tank. This connection at the surface of the ground does away, when desired, with the extra lift of about 25 feet to the top of the tank, and, especially in time of light winds, increases the amount of water delivered at the surface to the irrigating pipe lines.

Fig. 2. Irrigating an olive tree through a 3-4ths inch pipe line and a 3-32 inch orfice.

These lines are of 3-4ths inch ordinary black iron pipe laid, with as few bends as possible, up and down hill with the grade, along the lines of trees to be irrigated, and at a distance of one to two feet from them. Each branch of the system is controlled by a valve next to the supply. Opposite each tree a bored coupling is placed in the line. The orifice used is the smallest practicable size, which is 3-32 of an inch. With a little practice, using a vise, a brace, and ordinary twist drills, anyone can make the borings. This work may be reduced more than half by filing a notch midway and crosswise of the coupling with a three cornered file, and boring in the bottom of the notch. The complete pipe line, with bored couplings, is buried 2 or 3 inches below the surface for protection, being exposed in the shallow irrigating

basins around the trees. If the line is deeply buried in the soil the orifices cannot be cleaned and are liable to be choked by roots. For convenience of access the orifices are laid to discharge horizontally, toward the trees. For flushing the line a removable plug completes each branch of the system, making it possible to remove rust, moss, or other obstructions getting into the water supply and choking the holes.

When it is desired to close an orifice in order to increase the discharge farther along the line, an ordinary round wooden toothpick is inserted, this device being as effective and convenient as an expensive stopcock. To equalize and lengthen the system, partial obstructions may be introduced at the points of greatest discharge.

Thus arranged, when it is desired to irrigate a row of trees, the valve is turned at the head of the line, the water is slowly delivered, without waste, where wanted, and after one to several hours the supply may be shut off again.

Delivered in this manner in small, slow streams, the water penetrates deeply into the soil, inducing deep root systems, and lessening loss by evaporation. With the system described above, and a head of about twenty feet of water, the writer satisfactorily irrigates as many as twenty trees at a time along a 3-4ths inch line 600 feet long. With a 1 inch pipe and the judicious use of toothpicks, twice to three times as many irrigations could be made along one line.

Use of mulches: In order to lessen surface evaporation, various mulches have been tried. The trees experimented with all stand in shallow basins 4 to 6 feet across and 3 to 6 inches deep, which is a convenient arrangement for mulching. Cultivating the soil about the trees after each irrigation is laborious and not so economical of moisture as a mulch of fine chip dirt or barnyard manure. Either of these loose mulch materials, spread to a depth of two or three inches in the basin around a tree, takes irrigating water readily, does not pack when wet and require cultivation, and greatly restricts subsequent evaporation. To the root system of

shallow rooted plants also, these mulches are a protection from the excessive heat of the sun in summer. Aeration of the deep root systems which the small-stream method of irrigation tends to create may, where needful, be accomplished by putting down a hole two to five feet deep, near the tree, with a common post

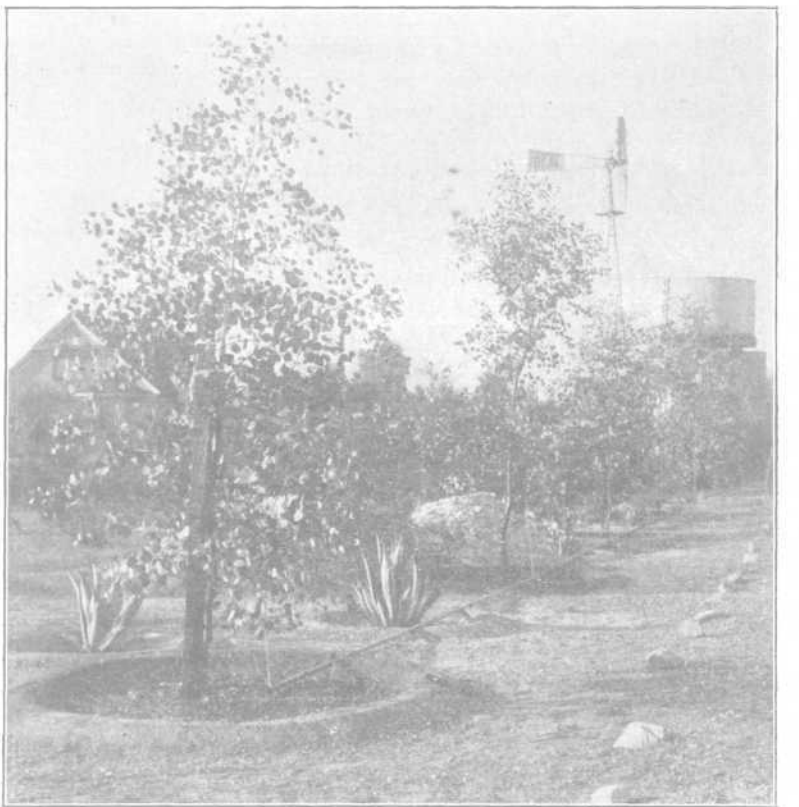

Fig. 3. Row of two-year old, "pipe-fed," *Eucalyptus polyanthema*. Pipe line exposed and 3-32 inch jets turned up for display. Windmill and supply tank in background.

hole digger, then placing a joint or two of old stovepipe in the hole to make it permanent. This device secures aeration with comparatively little exposure of the soil to evaporation.

In situations where the soil is rocky or underlaid with hardpan, tree holes of ample size, must, of course, be excavated and filled with good soil. A good practice, in such situations, is to dig a hole four feet square and deep and blast three feet deeper, using a combination of black and giant powder, to rend and lift the bottom.

Results: Planted, mulched and irrigated in the manner described, trees in this climate, with its long growing season, make most satisfactory growth with a minimum water supply. The efficiency, under working conditions, of these methods of distributing and conserving a small water supply may be judged by the following statement of the results obtained in practice. The water pumped by the plant described above, the region being one of light winds, furnishes domestic supply the year round to one house and irrigates:

61 olive trees	19 pomegranates
2 cottonwoods	1 fig
8 pepper trees	2 *Eucalyptus crebra*
4 bagotes	7 *Eucalyptus polyanthema*
1 date palm	1 ash
4 grape vines	9 miscellaneous-ivy, agaves, oleander and wild cane,

making a total of 87 useful trees, mostly fruit bearing, and 32 vines and bushes,

Although the trees and plants listed above are yet small it is evident from this showing that a far more effective use can be made of a small water supply than is customary. The great value of trees for shade and fruit in this climate warrants the expense of pipes, amounting to about one dollar and a half a tree in the system described.

Useful trees for the region: Incidentally, the list given is an excellent one from which to select ornamental and fruit trees for spring planting. Most of them are evergreen and resist drouth well, while the olive, date palm, pomegranate and fig are additionally valuable for their fruit. It should also be stated that olives, peppers, bagotes, the

two eucalypti, date palms, and figs, are limited in this region by a winter temperature of about 10 to 15 degrees Fahrenheit; while the two eucalypti are also unfavorably affected by the extreme heat of the warmest localities in the Southwest.

Besides the irrigation of house grounds this system is applicable to city streets and parks in this region and of especial value on irregular grades where ordinary ditches may not be used. It is not impossible, also, that with the more valuable sorts of trees, such as olives or date palms, and with the invention of cheaper distributing pipes, this method of irrigation may be found of commercial importance.

R. H. FORBES.

WEIRS FOR IRRIGATING STREAMS.

No. 57. APRIL 20, 1906.

The questions, "Why should irrigating waters be measured?" and "How can they be measured?" are often suggested to the mind of the irrigator. Ordinarily, however, they do not meet with a satisfactory solution and the matter is deferred to a more convenient season.

Reasons for measuring irrigating streams: There are at least two strong reasons which should urge the owner or user of an irrigating stream to make frequent measurements of the quantity of water carried in his ditches. First, without such measurements the appropriator of water can never make any definite assertion as to how much water he actually uses and in the event of question he can furnish no satisfactory proof as to his established appropriation. The irrigating waters of Arizona are of far greater value than the land upon which they are used, and it is indeed strange that while land is measured with precision, the quantity of water used upon it should for the most part be only roughly estimated. In legal cases involving water rights the evidence is usually of the most chaotic and contradictory character, composed of much prejudiced speculation with little or no real evidence.

The second reason why an irrigator should know the amount of water received through his ditch is because of the advantages offered in the management of his property. The duty of water, that is, the amount required per acre per year or, preferably, per month, should be determined. The duty of water varies greatly on different kinds of soil and with different crops, and information regarding it will assist in determining the more profitable course of farming to be followed. This argument should appeal especially to those who pump water for irrigation, for the cost of pumping often leaves a very small net profit. In many instances, also, measurements have proven the existence of an excessive loss by seepage from ditches, and the loss, once discovered, has been properly remedied. Other advantages of equal value will result from a careful record of the ditch waters.

It is usually assumed that water measurements are too difficult for the rancher and that the task must be left to an engineer. This feeling is unwarranted. It is possible for the rancher, with proper directions, to make his own measurements with little outlay of time and expense. The purpose of this Timely Hint is to afford the required information.

Devices for measurement of small streams: Of the various methods of measuring water, the miner's inch box has long since fallen into disrepute, and for good reasons. The use of current meters is too expensive for general use, and rating flumes are open to the same objection, as the rating itself is difficult and expensive. But in weirs we have a method which is both cheap and simple.

Weir boards: What constitutes a weir? Briefly, it is a notch cut in the side of a wide board which is then set on edge in the channel so that the stream of water passes through it and falls into the ditch again on the lower side. Of several forms of notches the trapezoidal is to be preferred. It has a level crest and the sides are inclined to the vertical with a slope of one to four. For example, a twelve-inch weir is twelve inches wide on the crest and if it be eight inches deep, the width at the top is sixteen inches. This gives the correct side slopes. An eight-

een-inch weir ten inches deep is eighteen inches wide on the crest and twenty-three inches wide at the top of the notch.

For measuring a small stream, such a weir can be made of a redwood or pine board eighteen inches wide and six feet long. The board must be placed crosswise of the stream with its ends held in place by earth and boulders or by stakes. The following precautions should be observed:

First.—The weir must be set high enough to give a free fall of several inches on the downstream side. This will back the water upstream for a short distance. It is best, therefore, to select a point on the ditch which has considerable grade.

Second.—The notch should be bevelled away from the inner edge so that the water shall touch along the edge and no more. The inner edge should be carefully laid out and cut with a sharp tool so as to be smooth and true to the intended dimensions.

Third.—The crest of the weir, that is, the bottom of the notch, must be laid level. This can be accomplished with the aid of a spirit level.

Fourth.—If the approaching waters are turbulent, they must be made calm and free from waves and eddies by laying brush or a board on the water surface ten or twelve feet above the weir.

Fifth.—The stream should be broader and deeper for a few feet on the upstream side, that is, it should form there a miniature lake. Otherwise the water approaches the weir with so great a velocity as to increase the flow. This increase may be computed for any particular case, but it is not worth while to do so, when a little shovelling will usually suffice to form the quiet pool, as is desired.

Sixth.—Leakage under the weir board must be prevented. This is sometimes best accomplished by packing sods, weeds, or straw around the board. These substances are easily held in place by banking up with earth. A water tight packing can be made of clay or adobe, and some gunny sacking is often of material assistance.

Briefly, the conditions are these. The water must approach the weir calmly and slowly, must touch the notch on the inner edge only, and must have a free fall on the downstream side.

Such a weir is not recommended to be left permanently in place, though it might be so fixed that it would not be washed out in a long time. But it can be put in place for a half hour, long enough to determine the discharge, and then carried to another portion of the ranch and used again, or stored in a dry place to be used at another time.

Weir boxes: If a daily record of the flow is desired, then a permanent weir box should be constructed as shown in the following figure. The weir board is seen to be situated between the

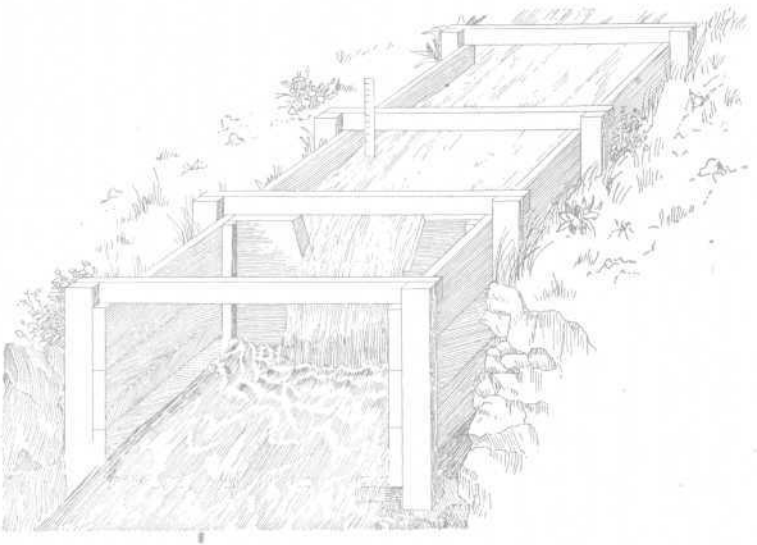

Fig. 4. Trapezoidal or Cippoletti weir box with 12 inch notch, showing construction and depth measurement. The scale is placed with the zero end at the level of the crest

first and second panels. The sides and bottom of the weir box are built of two inch rough plank, and the yokes or frames are cut from two inch by four inch sticks. The distances from the

sides of the notch to the sides of the main box should be about three times the probable depth of water on the crest, and the depth of the box below the crest should be an equal amount.

The dimensions for a given case are to be determined from the following table:

Quantity of water in miner's inches (40 inches equal one cubic foot of flow per second)	Width of notch	Depth of notch	Length of box	Width of box
	Feet	Inches	Feet	Feet
Between 15 and 50	1	7	8	3
" 30 " 180	2	10	10	5
" 40 " 360	3	12	16	7
" 60 " 550	4	13	16	8
" 80 " 750	5	14	18	10
" 100 " 1000	6	15	18	11

Thus, for thirty miner's inches the smallest size is the best. For one hundred and eighty miner's inches the three foot weir is preferable though the two foot size will suffice.

The cost of the one foot weir with redwood lumber at $45 00 per thousand is about $9.00 for lumber and about $5.00 for nails and labor. The cost of any other size is easily computed after making a bill of the material required.

The same precautions in setting are to be observed as for the simple weir board described above. On account of the danger of undermining, it is well to set a wide board on edge under each end of the weir box. If the box can be set in and packed with plastic clay or adobe, there is very little danger of its being washed out.

A more durable weir box can be made of concrete construction. The same general dimensions should prevail. With a good quality of cement a one-two-four mixture should be used and the walls and bottom should be six inches in thickness. The surface should be covered with a one-three sand mortar and troweled off smooth. The notch can be cut in redwood or in quarter inch plate iron. In either case it should be bolted on the inner side of the box and not set in the center of the concrete as was noted recently in a weir at a pumping plant. It is safer and

better to have the assistance of a man experienced in the mixing and packing of concrete.

How to determine the discharge: After the weir has been properly placed, the only measurement required to be made is the depth or head of water on the crest. It can be measured with a foot rule reading to sixteenths of an inch.

The "head" may be defined as the height of the free water surface above the crest of the weir. Since the surface is lowered considerably near the weir notch, this measurement should be made about two feet up stream from the notch. In the case of a weir board, a stake should be driven in the bottom of the ditch at this point until its top is just level with the crest, and the foot rule held upon it to measure the depth of water. In case a weir box is used a strip may be nailed to the side of the box two feet back from the notch and level with it, and the depth of water determined by resting the rule upon this strip.

The formula for computing the discharge is:

> The discharge in cubic feet per second is equal to 3.367 times the width of the bottom of the notch, times the head, times the square root of the head. If this product be now multiplied by forty it will give the discharge in miner's inches.

To avoid the necessity of making this computation each time, a table has been prepared giving the discharge over a one foot crest for heads varying from one inch to nine inches. The discharges are given in cubic feet per second, but are easily reduced to other units. If the discharge in miner's inches is desired, multiply the quantities in the table by forty. If the number of acre-feet per day is desired, multiply by two; if gallons per hour, multiply by 26930.

The discharges for any larger weir may also be easily computed from the same table. The discharges over a two foot weir are twice those given in the table, those for a three foot weir are three times those in the table, and so on for other sizes.

TABLE OF DISCHARGES FOR A ONE FOOT CIPPOLETTI WEIR.

Head	Discharge	Head	Discharge	Head	Discharge	Head	Discharge
Inches	Cubic feet per sec.	Inches	Cubic feet per sec.	Inches	Cubic feet per sec.	Inches	Cubic feet per sec.
1	.081	3	.421	5	.906	7	1.500
1 1/8	.097	3 1/8	.447	5 1/8	.940	7 1/8	1.540
1 1/4	.113	3 1/4	.474	5 1/4	.974	7 1/4	1.581
1 3/8	.130	3 3/8	.501	5 3/8	1.009	7 3/8	1.622
1 1/2	.148	3 1/2	.529	5 1/2	1.044	7 1/2	1.663
1 5/8	.167	3 5/8	.557	5 5/8	1.080	7 5/8	1.705
1 3/4	.187	3 3/4	.587	5 3/4	1.116	7 3/4	1.747
1 7/8	.208	3 7/8	.617	5 7/8	1.153	7 7/8	1.789
2	.229	4	.648	6	1.190	8	1.832
2 1/8	.251	4 1/8	.679	6 1/8	1.227	8 1/8	1.875
2 1/4	.274	4 1/4	710	6 1/4	1.265	8 1/4	1.918
2 3/8	.297	4 3/8	.742	6 3/8	1.303	8 3/8	1 962
2 1/2	.321	4 1/2	.774	6 1/2	1.342	8 1/2	2.006
2 5/8	.345	4 5/8	.806	6 5/8	1.381	8 5/8	2.051
2 3/4	.370	4 3/4	.839	6 3/4	1.420	8 3/4	2.096
2 7/8	.395	4 7/8	.872	6 7/8	1.460	8 7/8	2 141
3	.421	5	.906	7	1.500	9	2.187

The use of the table may be illustrated as follows:

Suppose that in a measurement on a three-foot weir the depth of water on the crest is found to be 5 and 3-16 inches. What is the discharge in miner's inches, and how many acres can be irrigated by the continuous flow of the stream for 24 hours? Referring to the table we find the discharges given for heads of 5 and 1-8 and 5 and 1-4 inches and the discharge for 5 and 3-16 can be taken as the average between them. The average between .940 and .974 is .957. This is, however, the discharge over a one-foot weir and hence, multiplying by three, we obtain 2 87 cubic feet per second as the discharge over the assumed three-foot weir. Multiplying 2 87 by 40, the discharge in miner's inches is found to be 115. Multiplying 2.87 by two gives 5.74 as the discharge in acre feet per day, and we know thereby that the stream is sufficient to give 11 and 1-2 acres a six-inch irrigation or 17 and 1-4 acres a four inch irrigation, in twenty-four hours.

G. E. P. SMITH.

OBSERVATIONS ON MILLETS.

No. 58. June 15, 1906.

During the season of 1905, observations on millets were continued, especially with reference to certain valuable characters of this class of forage plants. The particular points investigated were: Season for planting, comparing early summer and midsummer planting; rapidity and vigor of growth of different kinds; resistance to dryness of air and partial drought, effectiveness in shading the ground with a view to keeping down weeds, especially purslane; and palatability to stock.

German millet: Two crops were put in. The earlier one, planted May 13, came up well and made a fair stand; but the plants grew to be only half an inch or less high, perishing then from the excessive dryness of the air and from a shortage of irrigating water.

The second crop, put in August 1, behaved very differently. The air was then more humid and irrigating water abundant. With these conditions and the very warm weather usual at that season of the year, this variety grew very rapidly and was ready for harvesting in about six weeks, instead of two months which is its stated period of growth in the East. In fact, it began heading out in less than four weeks from planting. It was not cut until September 28, however, and was then turning yellow with ripeness.

Seed of this variety from three different dealers was planted. Two of these did well; but one lot germinated very poorly making only here and there a plant over the plat. This experience emphasizes the well known importance of making a germination test of seeds before planting.

Hungarian millet: This is not especially well adapted to our climate, not making so good a growth here as in the East. On our plats it yields about two thirds as much as German millet, in comparison with which it showed a slight and steady falling off in height during the period of growth. The Spring planting,

made May 13, did not germinate at all. The midsummer planting, made August 1, began heading out in three and a half weeks and when cut September 29 was partly ripe. Seed from two sources was compared, one lot giving a fair stand, but the other on an adjoining plat giving only two-thirds of a stand.

Hog millet: This belongs to the broomcorn class of millets. These are more drought resistant than the foxtail millets, to which German millet and similar varieties belong. Our early planting of this variety was made June 24 and the plants received scant irrigation. In spite of this the crop attained a height of 2 to 2½ feet. It was cut August 30 at which time it was nearly ripe. Another plat sowed August 1 gave similar results.

Hog millet, Red Voronezh and Red Orenburg, which were all tried, all looked much alike, except that the Red Orenburg is not quite so leafy as Hog millet, and all did about equally well. They all headed out at about 3 weeks from planting, when only 3 to 4 inches high.

Japanese millet: This is a stiff, coarse plant that looks like common barnyard grass, of which it is only an improved variety. It is quite drought resistant. It is considerably later than the varieties already remarked upon.

Texas millet: This grows a little taller than German millet; but it is straight stemmed and rather sparsely leaved. In these characteristics it somewhat resembles quack grass. It does not have the appearance of being so thick on the ground as German millet, being more erect in its habit of growth. During its earlier stages Texas millet does not grow as fast as some other varieties. At the end of its first month, when foxtail millets were heading out, this was mostly overtopped by purslane in spite of a good stand. The earlier planting, made May 13 and cut August 30, was not worth harvesting. It was only a few inches high although ripening, and the stand was very scattering. As a consequence the plat was very weedy.

Pearl millet: This is a rank coarse-growing forage whose chief recommendation is that it will stand more heat and drought than most other kinds of forage. It will also make a crop on

land too poor for corn; but in Arizona this is not a consideration.

While Pearl millet will stand a good deal of drought, like most other drought-resistant crops it requires a good deal of water to make a heavy yield. For example, our first plat of this variety, planted May 13 and cut August 30, received more water at the upper end of the plat than at the lower, because of a scant water supply. In consequence, the stalks nearest the ditch were 6 to 7 feet high while those a short distance below were only 2 feet high.

The midsummer planting, made August 1, had sufficient water and the crop made a rapid and even growth. The first heads were just putting out when the plat was harvested, September 28.

The coarseness of Pearl millet makes it difficult to harvest with a mowing machine, the coarse stubble also being objectionable.

Effectiveness of different millets in keeping down weeds: The worst weed to contend with on the Station farm at the season of the year when millets are grown is purslane, and in cultivated ground this is omnipresent.

In the incidental matter of keeping down weed growth Pearl millet is most effective of the varieties tried. It has a large corn-like leaf and when broadcasted makes quick, dense growth, which completely smothers all foreign plants. German millet and Hungarian millet are also effective. Sowed in the right season, they germinate quickly and grow rapidly. A good stand of German millet keeps out practically all weeds, and Hungarian most of them. Japanese millet does not grow so fast as German millet and therefore does not keep down weed growth as well.

Hog millet, Red Voronezh and Red Orenburg millets are not effective in keeping weeds down. These varieties run more to stem and make a relatively small leaf growth, hence a good deal of light penetrates between the plants as they stand in the field, thereby providing conditions for the growth of other plants between. Also, they do not grow rapidly in their early stages and for this reason weeds keep up with or even outgrow them for a time.

Texas millet is the poorest of the varieties tried for keeping down weeds. It does not grow vigorously in its early stages and hence it is overtopped by them. One month after our midsummer planting was put in, the plat looked to be a plat of almost pure purslane. As a matter of fact there was a full stand of millet which came on later and made a good crop. Our earlier planting of this variety was not worth harvesting on account of the great number of weeds. Further, Texas millet runs mostly to stem and does not have a sufficiently branching leaf growth to keep down foreign plants. The fact that Texas millet permits the growth of so many weeds is in our experience an objection to the planting of this variety.

Palatability of the different varieties to live stock: Tests were made to see whether cattle liked one kind of millet better than another. Small lots of the hay of each kind were set out in a corral side by side and three dairy cows recently up from alfalfa pasture were turned in. These cows showed decided preferences. They liked Pearl millet hay best, German millet next, and Hungarian millet about as well. All of the cows ate Japanese millet and the broom corn millets (Hog millet, etc.), but did not relish them. Not one of the cows would touch Texas millet.

The Pearl millet fed may have received such preference because it was young and tender, only beginning to head out. The longer Pearl millet stands in the field the less tasteful it is to stock. On the other hand the German millet and Hog millet fed, had begun ripening when cut, which, of course, counted against their palatability. German and Hungarian millets, at their best, are probably most relished by cattle.

Summary: All things considered German millet is the best variety for our climate Pearl millet will grow in very hot and dry locations; but sorghum does as well or better. The broomcorn millets stand more drought than foxtail millets, but do not yield so heavily and are not so well liked by stock.

V. A. CLARK.

FIELD CORN IN ARIZONA.

No. 59. June 30, 1906.

Essential differences between corn growing in Southern Arizona and in the East are in season of planting and in irrigation. The planting season is about July 15 to 20, although at the Experiment Station Farm we have matured yellow dent corn planted as late as August 7. At higher elevations, as in Graham county, planting time is about the middle of June. In the high mountain valleys, as around Prescott, corn is planted in the spring as in the northern states. Planting should be done as late as may be without endangering the crop by frost before it is ripe.

A good yield is from 40 to 50 bushels of shelled corn to the acre, though as high as 75 bushels have been made. Corn planted in the spring in Southern Arizona does not, in most localities, do as well either for grain or forage.

Corn requires considerable water and should be irrigated often enough to keep it growing well. One successful grower remarks that the number of irrigations should be about five. For grain the seed is planted along a water line and while the corn is small it is irrigated through the planting furrows. After it is well started a single furrow is run between the rows. Occasionally a grower omits furrowing entirely and floods the corn like wheat and alfalfa. Of course, corn should be cultivated after each irrigation.

For forage the seed is broadcasted very thickly, harrowed in and irrigated by flooding.

Three special difficulties arise in corn growing in southern Arizona: Non-filling of the ears, commonly attributed to drying out of the pollen or silks; smut; and corn ear-worm. These special difficulties limit the selection of varieties. For details relating to the varieties enumerated in the next succeeding paragraphs, see the notes on varieties at the end of this Timely Hint. It should be mentioned that there is much confusion of names of

varieties of corn and hence one is not always certain of having the same variety when seed of the same name is obtained from different sources, as was a part of ours.

The difference between varieties in resistance to a dry, hot climate, as shown in the filling of the ear, is great, ranging from perfect filling, as in White Mexican Flint and a few other varieties, to the setting of practically no kernels at all, as in the King of Illinois. The varieties which ranked low in filling in our tests were as follows: Canada Yellow Dent, Calico Dent, Early Eureka, Prairie Chief, Yellow Dent, Golden Beauty, Grimes Beauty, King of Illinois, Boone County, White Cap Dent, White Rockdale, Compton's Early, Rhode Island White Cap, White Flint, Wills Jehn and Giant Long Flint. It will be noticed that this list includes several of the small early varieties from the extreme northern range of the corn growing area.

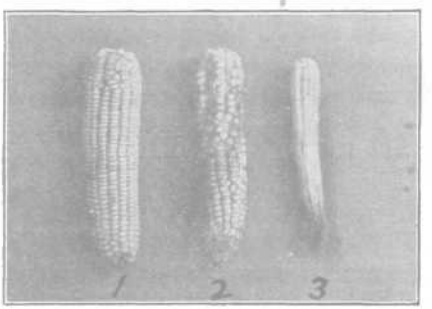

Fig. 5. 1. Normal ear of White Dent corn, grown near Yuma.
2. Same variety planted in April, about half a pollination effected.
3. Ditto, with but one grain of corn on the ear.

The following varieties were most badly smutted in our tests: Canada Yellow Dent, Calico Dent, Prairie Chief, Yellow Dent, Golden Surprise, Gold Mine, High Protein Content Corn, King of Illinois, Nebraska Yellow Prize, Reed's Yellow Dent, Waterloo Extra Early, Boone County Special, Silver Mine, Snow White Dent, Rhode Island White Cap and Wills Jehn.

The following varieties were badly attacked by the corn ear worm: Canada Yellow Dent, Early Butler, Golden Beauty, King of Illinois, Boone County Special, Silver Mine, Snow White Dent, White Cap Dent, White Rockdale, Large White Flint, Large Yellow Flint, White Flint and Wills Jehn.

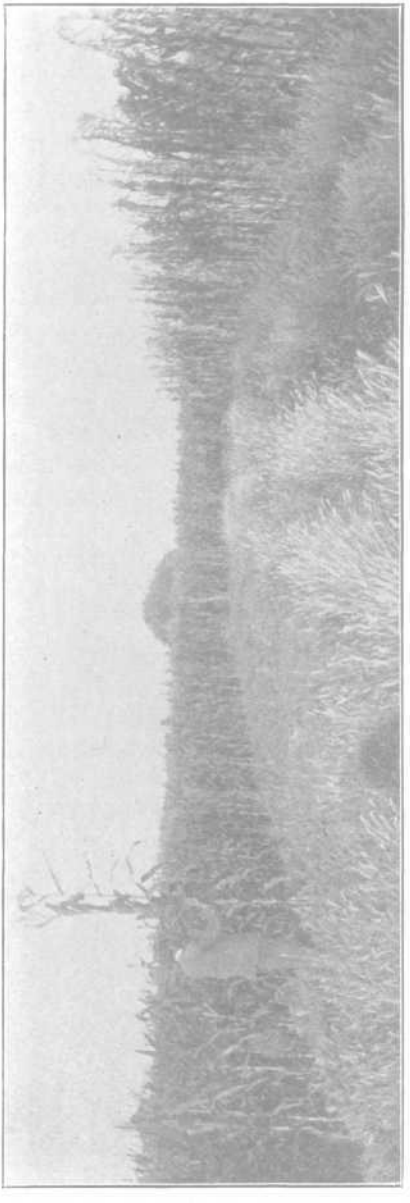

Fig. 6. Two crops of White Dent corn from Texas, grown near Yuma, Arizona. On the right is the first crop, planted in April, producing a scanty crop of grain. On the left is the second crop, planted early in August, producing an abundant crop of grain.

A few varieties did not set many ears, most notably Iowa Gold Mine, Wood's Northern and Hickory King (from one dealer). But Hickory King from another dealer made an average showing. Iowa Gold Mine developed only one ear in the entire row and this was very scatteringly fertilized.

In tests herewith reported, 150 feet of row of each of 60 varieties was planted. This quantity is so small that no attempt was made to measure the yield, the relative productiveness of the varieties being merely estimated. In our tests the varieties which appeared to be the best adapted to our conditions, all things considered, and were among the most productive were: Chester County Mammoth, Large Yellow Dent, Queen of the

Prairie, Griswold's Bronze, Mexican White Flint, King Philip, Kellogg and Blue Squaw. Four of these eight are flint corns and the other four yellow dents. Perhaps the best variety, all things considered, for this section is Mexican White Flint. This variety has been grown here for quite a number of years and has become acclimated. The ears fill very well, some of them being entirely capped over, and it is little attacked by worms or smut. Another point in its favor is that blackbirds do it relatively little damage, partly because the husks are tightly closed over the ends of the ears but more because, as a flint, the kernel passes so rapidly from the dough stage to the stage of hardness that the period is very short in which birds can attack it.

It is interesting to note that varieties of corn best adapted to the dry and hot climate of western Kansas are among those best adapted to Arizona. These are Kellogg and Blue Squaw, both flint varieties which are planted in western Kansas when it is so dry and hot that dent varieties fail. The only points against them that we noticed are, that they do not grow very large and therefore are only moderately productive.

Needless to say, the native squaw corns are well adapted to this climate; but they are very small and very early and make small ears. In our trials several samples of squaw corn tried did not fill as well as some other varieties. But perhaps this was due to the fact that these early varieties came to the silking stage while the weather was still quite hot.

One reason for the popularity of squaw corns in the Southwest is that they are soft and are easily ground in the Mexican handmills or *metates*.

Most bronze varieties distinguished themselves by their fine performance. Among such are Griswold's Bronze, Queen of the Prairie and King Philip, the last being about the second best variety tested. The ears were long and uniformly well filled and hardly attacked by worms or smut. But Iowa Gold Mine, a bronze yellow, did very poorly.

The high bred strains of corn which are now being grown in the East for special chemical composition proved to be more sus-

ceptible to attacks of worms and smut and are more liable not to fertilize than are the less specialized and less highly selected varieties from the same region. It would seem that, hand in hand with increase in protein content has come a decrease in ability to withstand untoward external conditions. This statement is not meant to imply, however, that high protein content corn might not be developed under Arizona conditions, were there adequate occasion.

Some varieties tend to make many small ears on the stalk, the most notable of these being Snow White Dent and Dewdrop Flint. To this class White Cap Dent also belongs, which in our test was fairly productive but on account of the time required to handle so many more ears for the same amount of grain, would not be profitable.

The large southern white corns as White Rockdale and Mosby's Prolific did not as a class prove to be well adapted to our climate; and this in spite of the fact that the stalks were, perhaps, the tallest in the test. But this rank growth of stalk is a merit when they are grown for forage.

A few varieties, most notably Hickory King, showed a tendency to sprout in the husks in wet weather, even with the small rainfall which we have in November.

NOTES ON VARIETIES GROWN AT THE STATION FARM.

YELLOW DENTS.

Calico Dent. Very early, very small, very poorly fertilized, much smut. Very unproductive.

Canada Yellow Dent. Very early. No ears entirely filled out and many ears have only scattering kernels or none at all. Very smutty, some ears being decayed from smut with even the small amount of wet weather in southern Arizona. Very wormy.

Chester County Mammoth. Ears generally well filled. Some smut, and wormy at the tip or sometimes more. Quite productive. A relatively good variety for southern Arizona.

Early Butler. Well filled out. Considerably worm eaten. Rather productive.

Early Eureka. Ears generally not well filled. Not attacked by worms except at extreme end of ear. Only moderately productive.

Early Longfellow. An early variety and not very productive. Ears filled only moderately well. Not much affected by worms or smut.

Early Mastodon. Rather early. Not very productive, generally well fertilized, not much attacked by worms or smut.

Early Yellow Dent. Rather early and small. Rather productive. Majority of the ears fairly well filled out. Little damage by worms and smut.

Extra Early Huron. Ears filled rather well. Not smutty and not attacked by worms except at the tip of the ear. Moderately productive.

Funk's Ninety Day. Most ears nearly filled out but some only partly filled. Some smut and worm injury.

Funk's Prairie Chief. Fertilization poor for a dent corn, no ear being more than three-fourths filled out and most ears less. Ears smutty with some worm injury.

Funk's Yellow Dent. No ear entirely filled out, and most ears very poorly fertilized. Considerable smut and some worm injury. Many nubbins.

Golden Beauty. A small per cent of the ears well filled out, the majority being about two-thirds filled. Some ears showed only scattering kernels. Considerable worm injury but no smut.

Golden Surprise. Rather early and not very productive. Fertilization fairly good. Of average resistance to worms but quite often too smutty.

Gold Mine. Fertilization fairly good. Some worm injury and very smutty. Many nubbins.

Gold Standard Leaming. No ears completely filled out and some ears but slightly fertilized. Some smut and worm injury and some nubbins.

Grimes Beauty. Not well filled out. Not smutty but all ears wormy at least at the tip. Not productive.

Griswold's Bronze. A yellowish bronze dent. Ears large and generally solidly filled for two thirds or more of their length. Little affected by smut or worms. One of the best varieties tested for southern Arizona.

High Protein Content Corn. Sample received from Iowa Experiment Station. Ears rather small and not very well filled. Considerably affected by smut and worms.

Hundred Day Bristol. Large ears and quite well fertilized. Somewhat affected by worms.

Iowa Gold Mine. Only one ear set in our whole row of this variety and this ear had only a few scattering kernels on it. Entirely unadapted to Arizona if our seed was representative of the variety.

King of the Earlies. An early variety fairly productive as such. Not much affected by worms or smut.

King of Illinois. Scarcely fertilized at all. Considerable smut and worm injury. Very unproductive.

Large Yellow Dent. Well fertilized. Slightly attacked by worms. Rather productive. Has many relatively large and well filled ears.

Leaming. Generally well filled out. Not badly affected by worms and no smut. Moderately productive.

Leaming Improved. Most ears well filled out. Not much affected by worms and no smut.

Legal Tender. Some ears well filled out, others only partly fertilized. Little smut and no worm injury. Rather productive.

Mastodon Yellow Dent. Fertilization poor. Considerably attacked by worms.

Mastodon Dent. Most ears quite well fertilized. Rather wormy and smutty.

Minnesota Corn. A small early variety. The lower part of the ears well fertilized but the rest not.

Nebraska Yellow Prize. Ears generally filled about one half to two thirds of their length. Badly smutted.

Pride of the North. Rather early but only moderately productive. Fertilization good. Slightly attacked by worms.

Queen of the Prairie. Kernels bronzed on the sides but yellow on the top. Fertilization good, some ears being perfectly filled. Almost no worm injury or smut. Ears of good size. Quite productive. A good variety for southern Arizona.

Reed's Yellow Dent. Ears generally fertilized only at the butt or not at all. Very smutty but no worm injury.

Waterloo Extra Early. A small, early variety. Fairly well fertilized but quite wormy and smutty. Some ears decayed from smut and wet weather.

Wisconsin Dent. A small, early variety. Not very productive. Fertilization rather good. Little smut and no worm injury.

WHITE DENTS.

Boone County. Ears but little fertilized. Not much attacked by worms.

Boone County Special. Ears partly filled out but none completely. Some smut and worm injury.

Early White. Fertilization generally fairly good but no ears entirely filled out. Little smut or worm injury.

Hickory King. This variety from one dealer produced only a few good ears in an entire test row. Quite a percent of the stalks produced no ears at all. The few ears produced were generally quite well fertilized. Not much attacked by worms. The same variety from another dealer showed up somewhat better but not well. In this variety the kernels near the butt sprouted in the husk in wet weather.

Iowa Silver Mine. Some ears perfectly fertilized and well capped over at the tip of the ear, the rest of the ears being generally fertilized in the lower half.

Kellogg. Ears long and thick and generally well filled. No smut, and wormy only at the tip. Quite productive. A good variety for southern Arizona.

Mosby's Prolific. A tall variety bearing the ears high up on the stalk. Generally not well fertilized and some ears not fertilized at all. Wormy but not smutty.

Silver King. Only moderately well fertilized. Quite smutty and slightly wormy at the tips of the ears.

Silver Mine. Not very well fertilized. Quite wormy, with considerable smut.

Snow White Dent. This variety made many small ears which generally were not fertilized at all or only slightly. Quite wormy and smutty.

White Cap. Well fertilized and hardly affected by worms. Ears small. This variety from another dealer was poorly fertilized and quite wormy.

White Rockdale. A tall variety with ears high up on the stalk. Not a single ear completely filled out and many showed only scattering kernels or none. Quite wormy but no smut.

Wood's Northern. Fertilization poor. Rather badly attacked by worms. Not productive, a good percentage of the stalks having no ears.

EARLY NORTHERN FLINTS.

Compton's Early. A small, early variety, generally not well fertilized and not very productive. Not badly affected by worms.

Dew Drop Flint. A very early variety. There was not a good ear in the row and a large majority of the stalks produced no ears at all.

Large White Flint. An early variety generally not well fertilized and considerably attacked by worms. Not very productive and not recommended.

Large Yellow Flint. Rather small early variety and not very productive. Generally well fertilized but rather badly affected by worms.

Rhode Island White Cap. An early small variety very poorly fertilized. Badly affected by smut. Not productive. Not recommended.

White Flint. Early. Not very productive. Generally poorly fertilized or not at all. Considerably affected by worms. Not recommended.

Wills John. A very small, early variety, poorly fertilized. Wormy and very smutty. Not recommended.

WESTERN FLINTS.

Blue Squaw Corn. Stalks very dwarf. Ears slim and long. Kernels deep blue. Fairly well filled. Very little smut or worm injury.

Giant Long Flint. Fertilization poor. A little smut and worm injury. Some stalks produced no ears at all. Not very productive.

Improved Creole. A tall southern variety, bearing the ears high up. Large part of ears well fertilized. All ears wormy at the tip, but no smut noticed.

King Philip. A deep bronze variety with long shapely ears well filled out. Very little worm injury and no smut. One of the best varieties tested.

V. A. CLARK.