

BULLETIN No. 100.

U. S. DEPARTMENT OF AGRICULTURE,

OFFICE OF EXPERIMENT STATIONS

A. C. TRUE, Director.

IRRIGATION DISTRICTS INVESTIGATIONS IN CALIFORNIA

1901

BROWNS VALLEY IRRIGATION DISTRICT.

Browns Valley irrigation district is located in Yuba County, Cal., in the lower foothills of the Sierra Nevada Mountains, at an average altitude of 300 feet above the sea. It comprises about 44,500 acres, and was organized September 19, 1888, under the Wright irrigation law.

On October 27, 1888, an election was held for the purpose of voting on an issue of bonds to the amount of \$110,000, which resulted in favor of the bond issue. In March, 1892, a second election was held to vote on the question of issuing additional bonds to the amount of \$30,000, which was also carried. Both issues of bonds sold for 90 per cent, or a total of \$126,000. On August 27, 1893, an election was held to decide whether a special tax of \$10,000 was to be levied on the district. One hundred and ten votes were cast, 73 being in favor of the special tax.

In November, 1899, construction was commenced on the main ditch and the principal branches. They were completed in 1893, and cost about \$175,000. The main ditch is 48 miles long, the first 7 miles being flume, and 2 miles of the balance being short flumes. It takes its water from the North Fork about 2.5 miles above the junction of the North and Middle Yuba. The original crib dam was about 28 feet high and 168 feet on the crest. This dam has since been raised, it being at present 37 feet high and 168 feet on the crest. The water was turned into a flume, which carried it down the north bank of the river to Colgate. This flume was 4 by 5 feet, with a uniform grade of 9.6 feet per mile, and is claimed to have had a capacity of 3,000 miner's inches. From the end of the flume the water was carried to the Campbell Divide in a ditch 7 feet on top, 5 feet on the bottom, and 3 feet deep; grade, 9.6 feet to the mile, with a capacity of 3,500 miner's inches. From the Campbell Divide it was carried to the vicinity of Browns Valley in a ditch 7 feet wide on top, 5 feet on the bottom, 2.5 feet deep, upon the same grade. Besides this main ditch there are five principal branches which distribute water to the different *parts* of the district. The capacity of the system was limited to about 2,200 miner's inches. The main ditch was gauged on the west side of Dry Creek August 15, 1900. It contained 750 miner's inches. It would not carry more than 2,000 miner's inches at the present time.

Between the Campbell Divide and Dry Creek there is a drop of 296 feet, which is used to develop power by the Bay Counties Power Company.

During September, 1890, the district purchased from the Forbestown Ditch Company 29 miles of ditch, with a crib dam 12 feet high and 50 feet long in Dry Creek, and about 1 mile northwest from the Oregon House. Of the 29 miles of ditch 10 miles have been allowed to get out of repair. Twelve miles of ditch from the Finamore Ranch have been enlarged to 7 feet wide on top, 5 feet on the bottom, and 2.5 feet deep, and made part of the main line, and 7 miles comprise what is now known as the Sicard Flat Ditch. The price given was \$7,700 in bonds worth 90 per cent.

In August, 1896, the district leased to Frank Page for fifty years the use of all the water which the district claimed (10,000 inches) for mechanical purposes, not inconsistent with the Wright irrigation law and its amendments, and not to interfere with the irrigation uses of said water. In return for these privileges said Page agreed to pay the Browns Valley Irrigation District \$100 a year in two equal payments and keep the main ditch in repair and filled to its original capacity. Page repaired the main ditch, spending about \$12,000 on it, but he did nothing to develop power. In October, 1897, he transferred the lease to John Martin, who built a small power house. John Martin transferred it to the Yuba Power Company on October 29, 1897. February 4, 1899, the Yuba Power Company transferred it to the Yuba Electric Power Company. The Yuba Electric Power Company, on May 25, 1900, transferred it to Andrew S. Morally; Andrew S. Morally on June 8, 1900, to Bay Counties Power Company, which holds it at present.

By reason of the scarcity of water this year, due to the reconstruction and enlargement of the flume below the headworks and the serious litigation now pending, actual irrigation is almost at a standstill. Of the 44,500 acres in the district, 10,500 are above existing distributing ditches. Of that portion below these ditches, the irrigable area is from 5,000 to 8,000 acres, of which only about 600 acres are actually irrigated, as outlined on the map of this district, which accompanies this report.

PRACTICE OF IRRIGATION. DUTY OF WATER.

It is not possible to determine the duty of water with any degree of accuracy in the district, *by* reason of the inaccurate methods of measuring water. J. H. Perkins, in the town of Browns Valley, successfully irrigates 4 acres in clover and grass, and one-half acre in addition, covered with an orchard, with 7 inches of water used once a week for twenty-four hours. This is equivalent to the continuous use of 1 inch. This land has a slope of about 4 feet to 100, and no water runs to waste. The crops are as large as any in the valley, if not the largest. The opinion of most of the people of the district is that 1 inch to the acre, running continuously during the irrigating season, should be used on large tracts of grass and alfalfa. For orchards, about 1 inch to 3 or 4 acres is considered necessary. The duty of water in this district will always be low, because of the shallow soil and rapid evaporation, due to high temperature and dry atmosphere.

Alfalfa is the principal crop irrigated, there being about 300 acres of alfalfa under irrigation at the present time. Besides alfalfa the other crops irrigated are citrus and deciduous fruits, garden truck, and corn.

IRRIGATION OF ALFALFA.

There seems to be some difference of opinion in regard to the best time to sow alfalfa. Some claim if it can be got in and up to a height sufficient to resist the winter frosts, that late fall or early winter is the best time to sow, thus taking advantage of winter rains. Others think that early in April or May is the proper time. Many sow the alfalfa with grain, using the grain for a shade to the tender alfalfa.

The first crop reaches maturity in three or four months, and is generally light. From three to four weeks are required for the second crop and from six to seven for the third. Four crops could be cut, but the fourth crop could not be cured on account of the winter weather; so the field *is* generally pastured or cut and fed green.

The crops are generally about two tons to the acre cured, or six tons to the acre per year. The alfalfa has to be renewed about every six years, due to the growth of water grass and weeds, the seeds of which are introduced in the irrigation water.

Alfalfa is irrigated *by* flooding—that is, ditches are led along the highest parts of the field, from which water runs down in thin sheets over the adjoining surface. The winter rains are sufficient to produce one good crop of alfalfa, but in order to get more than one crop it must be thoroughly irrigated every ten or twelve days during the dry season. The first crop generally requires two irrigations, the second crop three, the third crop four, and the pasture crop two or three, making a total for the year of eleven or twelve irrigations. It may require a few more, or less, depending on the character of the season, slope, and depth of soil, etc.

Cost of raising alfalfa per acre.

Preparing land, plowing, harrowing, cross harrowing, and making ditches \$5.00

Seed, 25 pounds at 8 cents 2.00

Sowing, harrowing and brushing in 50

Labor of irrigating (11 irrigations) 2.00

Water at the rate of 1 inch to 3 acres, at \$2.50 per inch 83

Total 10.33

To this is to be added the cost of harvesting the crop. Alfalfa is generally worth \$5 a ton in Browns Valley.

IRRIGATION OF ORCHARDS.

The following fruits do well: Peaches, apricots, plums, prunes, oranges, figs, pears, almonds, and olives. All of these would yield better if more skill and care were taken in cultivation and irrigation. The orchards are generally very poorly kept. They are cultivated once a year and

nothing more is done till the following year. In many of the orchards the grass and weeds are 2 feet high.

The method of applying the water that is most generally used is as follows: A ditch is dug along each row of trees and the water allowed to run along the ditch; most of the water runs through the ditch and finds its way into the nearest creek, carrying a small percentage of the soil with it.

Another and better method which was observed in use in a few orchards was to plow the ground so the furrows would be parallel. The ditches were dug along the ridges and in some instances were dug along each row of trees. From the ditches the water was turned into the furrows, and by this method the ground was given a good wetting.

Most trees require to be irrigated every three or four weeks, oranges every twelve or fourteen days. Irrigation of orchards generally commences in early June and lasts until the fruit is gathered or the first rain comes.

IRRIGATION OF HAY AND GRAIN.

Hay and grain are not usually irrigated in this district, although the opinion seems to be that it would pay to do so. In those instances where grain has been irrigated two or three times during the season the crops have been better than those on unirrigated land. There are about 4,000 acres of volunteer hay and grain which is cut for hay in the district. An average crop is 1 ton to the acre.

IRRIGATION OF CORN AND STRAWBERRIES.

Corn and strawberries do well. The furrow system of irrigation is used, and they are irrigated every ten or twelve days.

METHOD USED BY SAM SING COMPANY.

The following method is in use *by* some Chinamen for irrigating vegetables, such as sweet potatoes, etc.:

The vegetables are planted in parallel rows. The ditches are made along the ridges, which run at right angle to the furrows. These are successively filled. This is continued until the whole garden is gone over; by that time the water in the first furrow has all soaked into the ground. Then, if necessary, they go over the whole garden again. This method is very thorough and no water is wasted.

LOSS BY SEEPAGE AND EVAPORATION.

Because of the character of the soil and the location of the main or lateral ditches, there is very little loss by seepage. Most of the flumes have been lately replaced, and leakage is reduced to a minimum. Owing to the carelessness in the construction of the distributing ditches the loss by

seepage is considerable, the ground being wet on both the upper and lower sides for some distance.

There is no data in regard to the loss of water from these ditches due to evaporation, but it must be considerable, especially in smaller ditches, owing to the extreme heat of the summer.

LOSS BY UNSKILLFUL IRRIGATION AND INSUFFICIENT PREPARATION OF LAND.

Evidences of the losses due to unskillful irrigation are visible almost everywhere. All the creeks and ravines have running water in them through the summer, though before irrigation commences they are dry. When irrigation is in progress, waste water can be seen even in the roads. With the exception of that used by one or two farmers who utilize the water flowing in the ravines, it all runs to waste; most of them do not realize that surplus and waste water can be used the second time.

The waste from insufficient preparation of the ground is considerable. It is due to lack of experience, insufficient means, and the indifference begotten by prolonged litigation and clouded titles. The owners do not feel justified in making large expenditures on land that might be taken away from them at any time.

MEASUREMENT.

The standard of measurement is the miner's inch under a 6-inch head. The method of measurement is as follows: A box with a gate in it is set in the side of the ditch. When the ditch tender wishes to turn into a distribution ditch, say, 4 miner's inches of water, if the water in the main ditch is about 7 inches above the bottom of the box, he raises the gate of the box (a 4-inch box) 1 inch. If the water is more

than 7 inches above the bottom of the box, he shuts down the gate till he thinks he has about 4 miner's inches running through. It is the intention to deliver the number of inches purchased at the ranch line. So if the water has to run some distance from the ditch, as it frequently does, the ditch tender guesses at the loss by evaporation and seepage and adds that amount to the amount purchased. If the farmer thinks • he is not getting as much water as he is paying for, he goes to the ditch and helps himself to all he thinks he is entitled to. It is the custom along some of the ditches to open the gate so that the number of square inches in the opening is equal to the number of miner's inches purchased, the ditch tender claiming that the head averages) about 6 inches, being below as often as it is above.

SEASON OF IRRIGATION.

There is only one season of irrigation. It commences in April or May and ends with the first rain. It may commence somewhat earlier or later, depending on the amount and lateness of the winter rains.

SOIL.

With the exception of the extreme western edge of the district, where there is more or less gravel, the soil is nearly all red clay, containing some adobe and overlying a cemented gravel called hardpan. This clay ranges from 1 to 5 feet deep, although in many places the bed rock appears on the surface. This bed rock is slate. The soil absorbs water slowly and dries out quickly, owing to its shallowness. To be worked successful^ it has to be plowed at just the right degree of wetness, otherwise it will not pulverize. This is a strong inducement in favor of small ranches. On a large ranch there is a possibility that there will not be enough days in the year when the ground is in good condition to put in proper till for crops.

EFFECT OF IRRIGATION ON SOIL.

The water used in irrigating the district has all been previously used in mining, therefore it is always more or less charged with fine sand or sediment. From this fact the water is especially beneficial in irrigating shallow soil. It is the general opinion of the irrigators that muddy water is beneficial, except when applied to the stems of very young plants, or when alfalfa, etc., are flooded too deeply, leaving a sediment that stock do not like.

EFFECT ON HEALTH.

There seems to be no ill effect on the health of this community that can be traced to irrigation.

VALUE OF LAND.

It is impossible to determine the value of land in the vicinity. The district has been involved in litigation for some time, and the titles to all the land in the district have become involved. There has been no sale of land for several years. The opinion of the people of the various parts differs as to the value of the land. From \$20 to \$30 per acre seems to be the value placed on good land susceptible of irrigation and not under cultivation, where it is under the ditch and water can be got on it. The same class of land above the ditch is worth from \$5 to \$7 per acre. If the conditions were such as to remove the doubts as to titles the price of land would rise. It was the custom, before the district leased the mechanical privileges of its water, to allow the residents to do the work necessary to keep the system up. They were paid in water at the rate of \$1.50 per day, the water being sold at \$2.50 per miner's inch, running continuously through the season.

METHOD OF DISTRIHUTING THK WATER.

The method of using the water is different in different parts of the district. It seems to depend somewhat on the friendliness of the farmers to one another. Some buy as large a head as they desire to use, and it is kept running continuously whether used or wasted. In some parts of the district several farmers will combine their rights to water and use the entire head in turn, the length of time varying in proportion to each contributor's share. For instance, if the combined head was 24 inches and A furnished 4 inches and it was decided to irrigate every 12 days, A would have the use of 24 inches for two days in every twelve. The reason of this is that one can irrigate better and more economically with a large head than with a small one. A very few make some attempts at storing water.

The district owns no service reservoirs. There are a number of sites for such reservoirs, as yet undeveloped.

Distribution of water is arranged as follows: At any time a purchaser wants water he informs the secretary of the district, who orders the ditch tender to turn it on. The district charges a uniform price of \$2.50 per inch per season, whether irrigation is started at the beginning of the season or not. But the district does not guarantee the delivery of the water.

There is no surplus water to be purchased by landowners outside of the district, but ordinarily, and particularly this year, there is a deficiency.