

Bulletin 123

January, 1908

# The Agricultural Experiment Station

—OF THE—

Colorado Agricultural College

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## THE PLAINS

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## SOME PRESS BULLETINS

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PUBLISHED BY THE EXPERIMENT STATION  
FORT COLLINS, COLORADO  
1908

# The Agricultural Experiment Station.

FORT COLLINS, COLORADO

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\*After March 1, 1908.

# THE PLAINS

## PRESS BULLETINS

This bulletin is made up of a number of press bulletins relating to the Plains, and giving advice to Plains settlers. They have been reprinted under this form for convenience. They consist of:

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## ADVICE TO PLAINS SETTLERS.

BY J. E. PAYNE.\*

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We recognize it as a fact that many new settlers have taken up residence in the Plains region during the last few months who have merely enough capital to put up houses, break a few acres of sod, and live during the first six months.

The people cannot wait for results promised by the exploiters of "Scientific Soil Culture." They must have results this season. It is to this class of people that we would address the following suggestions:

First. If you have a milch cow give her the best care possible, and get as many more as you can. Sell cream, or make good butter or cheese. Sod cowhouses are within the reach of all who can work.

Second. Keep as many hens as you can take care of. Feed well and protect from coyotes and other beasts of prey. If you can raise turkeys and geese they will pay. Turkeys and geese may be herded by children, and turkeys are the best grasshopper exterminators known.

Third. For field crops on sod, plant early amber cane, yellow Milo maize and corn. The seed used should be grown in the vicinity if possible, if not, choose some early variety. If you are able to do so, prepare a small field for fall wheat.

Fourth. Plant a garden. If you have no well, plant a small plat near the house and water it with the waste water. Bury every drop of waste water beside some vegetable by making a furrow beside the plants and after the water has sunk away fill the furrow with dry dirt. Old tin cans sunk in the ground by the side of hills of cucumbers aid in watering them economically. Punch holes in the bottoms of the cans.

If you have a well, plant a large garden but plant all garden stuff in rows so that it may be cultivated with horse power. Use the water with the same economy that you would if using only waste water. Never flood the ground purposely. If any should be flooded, stir it thoroughly as soon as it is dry enough.

It is a common mistake with beginners in irrigation to try to make water take the place of cultivation. The result is failure. Another

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\*The writer has fought grasshoppers and drought in Eastern Colorado for many years. Besides early training in Kansas, he was in charge of work on the Plains for the Colorado Experiment Station from 1896 to 1904, as Superintendent of the Sub-station at Cheyenne Wells, and as Field Agent for the Experiment Station. Is now in the employ of the U. S. Department of Agriculture in the Dry Land Division, to be located at Akron, Colo.

common mistake is to plant a larger area than can be watered from the well. Better begin with only a few square rods and extend the area as experience dictates.

In case you cannot irrigate from a well, select a small patch of ground upon which you can turn the flood water from the prairie by means of furrows. If you can make a small reservoir above the patch, do it. The reservoir may hold a few barrels of water until you have time to direct it to the plants which need it. Cultivate thoroughly and keep all weeds down.

Besides the small truck, a good patch should be planted to Mexican beans, early cow peas, watermelons, muskmelons, stock melons, pumpkins, squashes, popcorn, sweetcorn and potatoes. These will sometimes bring good crops without irrigation. Enough should be planted so that a plentiful supply of winter food for the family will be assured. Stock melons are very productive, and if stored in sod buildings, above ground, they will furnish green food for the milch cows during winter. I have grown stock melons at the rate of 20 tons per acre. I have kept ordinary watermelons until the last of November by packing them in hay and storing them in a room where they kept cool but did not freeze. There are varieties of winter watermelons and muskmelons which are good from Christmas until March.

By planting the following seven varieties of sweetcorn on the same day—and often near the last of May—I have had roasting ears from July 26th until September 26th. The varieties were: Cory, Black Mexican, Perry's Hybrid, Stowell's Evergreen, Country Gentleman, Mammoth Evergreen, and Egyptian. The large varieties may be dried for winter use or allowed to ripen to be used parched. Parched sweetcorn is a luxury, but one which is within the reach of the poorest settler. White Pearl and Queen's Golden popcorn have done well for me, and my family have had many meals consisting only of whipped cream and popcorn.

Potatoes, squashes and pumpkins may be grown successfully by keeping up a constantly successful fight against potato beetles and squash bugs. This means to battle almost daily with the pests from the time the potatoes are up until the middle of August, and from the time the squash plants are up until the squashes are ripe. To describe methods of fighting these pests would require volumes, but we advise you to use your ingenuity in killing them. I preferred to kill them with clubs.

Grasshoppers are the worst enemies to field crops, but by keeping plenty of poultry, the grasshoppers will be kept down.

To produce crops of any kind may require an amount of labor which seems enormously out of proportion to the market value of the produce, but we assume that people who have settled here desire to build up homes and they have come here because they failed to get homes elsewhere. It may be a comforting thing to remember that you may not be working any harder here while trying to establish independence than you would be if working by the day for some one for just enough wages to support yourselves.

## CROPS FOR UNIRRIGATED LAND.

BY J. E. PAYNE.

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After seven years of experience in Eastern Colorado we feel justified in making some recommendations for the use of those who may try crop raising there without irrigation.

*Soils.* We have never seen any good crops grown without irrigation upon adobe or very heavy clay soils. But upon sandy loam, sandy and medium and light clay soils, we have seen crops raised on a paying basis nearly every year when given especial attention.

*Seeding and Culture.* The natural vegetation of the country shows that thin seeding is necessary. The buffalo grasses are thin where they do not get the use of the rain which falls, and thick in locations which catch extra water, as in low lands partly surrounded by hills. All crops should be planted thinly, so that they will not need too much water to make the growth high enough to harvest. All crops should be thoroughly cultivated, so as to give them the benefit of the largest per cent of the rainfall. Thorough and clean culture should be pursued until August 1st, whether rain falls or not, as the crop is thus kept in good condition to use rains which fall late in the season; while if the crops are not kept clean, no amount of cultivation after the late rains will take the place of the cultivation which should have been given before. The most important thing—next to water—is doing the work at the proper time.

Ground intended for planting in May should be thoroughly disced in March or early in April so as to hold the early moisture.

These remarks refer only to crops which are recommended in this bulletin, and to crops usually planted in rows and cultivated.

*Crops to Depend Upon.* Eastern Colorado is mainly a stock country, and the needs of the country demand rough forage for wintering stock.

We have found that the sorghums and a few acclimated varieties of corn produce paying crops, taking an average of five year's crops as a basis for estimates. Very few of the sorghums ripen seed in North-eastern Colorado, so if one wishes to produce seed of either *corn* or *sorghum*, he should be careful to plant seed which was grown in the vicinity.

The following table gives the most important facts concerning the varieties best known.

Name.	Sweet or Non-Saccharine.	Produces Seed.	Fodder.	
			Quality.	Quantity.
Early Amber.....	Sweet	Abundantly	Good	Large
Early Orange.....	"	Sparingly	"	"
Kansas Orange.....	"	"	"	"
Colman.....	"	"	"	Medium
Collier.....	"	"	"	"
Folger's Early.....	"	"	"	"
Red Kaffir Corn...	Non.-Sac.	"	"	"
White Kaffir Corn..	"	"	"	"
Jerusalem.....	"	Abundantly	Poor	Small
Yellow Milo Maize	"	Sparingly	Good	Medium
White Milo Maize..	"	"	"	"
Brown Durra.....	"	Abundantly	Poor	Small

*Broom Corn.* Broom corn is usually easily raised. The market price of good brush makes its production profitable or unprofitable and not the amount which can be produced. The fodder and corn always have a ready home market, but broom corn must be sent out of the country.

*Mexican Corn.* A flint variety grown in Northern Lincoln, Western Kit Carson, and Central Arapahoe counties. Very rich in protein. Some years the ears merely stick out of the ground and the tassels may not be more than two feet high.

There are several other varieties of corn which do well, but they are confined to small neighborhoods and we cannot be sure that much seed could be had.

*Planting.* Planting should be done with a lister drill. Use from two to five pounds of seed per acre—according to quality of seed.

*Cultivation.* This should be done as long as possible with the harrow. Then follow with the weeder, and if it seems best, with the cultivator. *Careful* and *thorough* culture must be given. If planted on sod, it may be planted by a special planter drill. If planted on land broken years ago and left unused during recent years, it will not be likely to produce a good crop unless the season is very favorable.

*Time of Planting.* May 1st to June 10th, according to the conditions. Sorghum does not grow much until warm weather, but it should be planted while the early moisture is in the ground.

With up-to-date tools and plenty of horses one man can plant and cultivate 160 acres in corn or sorghum. He must use gang listers, large harrows and gang weeders in order to do this, but by working in this way the cost of producing feed may be reduced considerably.

The sorghums are as sure to make a paying crop in Eastern Colorado as corn is in Eastern Kansas.

It is the hope of the author that he can help the people to make two steers grow in Eastern Colorado "where one grew before."

## DAIRY WORK FOR PLAINS SETTLERS.

H. M. COTTRELL.

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Thousands of families are coming to Colorado this spring to locate on farms. Many of them are locating in the dry land sections of the state, often on land on which a furrow has never been turned.

The methods of handling the soil, the varieties of seeds used and the handling of the crops after seeding are entirely different from those found profitable in Eastern States. Experienced men who have farmed in two or more states and under widely different conditions do not expect to meet expenses for crop raising the first year while they are learning what methods and varieties are most profitable in a new location.

Many of our new settlers have a limited amount of capital, and a failure of crops this year would bring suffering to a large number and financial hardship to others.

To those settlers whose means are not sufficient to carry them through a year of crop failure and have sufficient left to grow a crop the second year, we would advise the breaking up of a small area only, not over 40 acres on a quarter section, and if money is quite limited, not over 20 acres.

Write to the Experiment Station, Fort Collins, Colorado, for advice as to the best methods of preparing the soil, the best crops to plant varieties to use and the best method of treating the crops after seeding. This advice will be given gladly and freely.

The new settler should consult the successful farmers who are his neighbors, asking them the same questions that he asks the Experiment Station. Then utilizing the advice from his neighbors and the Station, handle his 20 or 40 acres in such a way as to get the largest yield from them. He will learn more from cultivating this small area well than he will if he puts all the land he can into crops and is obliged to do the work poorly.

While learning how to raise profitable crops under his new conditions, the farmer will need an income to support his family. One of the best ways of securing this is by milking cows and selling the cream to a factory.

Range cows selected for milking qualities and fed on the native prairie pastures of Colorado alone will produce through the summer from \$2 to \$5 worth of milk per head a month. All the creameries pay cash at least once a month, and some of them pay daily. The farmer, if he cultivates a small area only, will have the help to milk from 10 to 15 cows, and these will give him a cash income of from \$20 to \$75 a month, depending on the number and quality of the cows milked.

Selling the cream to the creamery will require much less outlay for building and equipment than will be needed if butter is made on the farm, and will make the work much lighter for the housewife,



whose work is already hard enough when starting in a new home.

The calves should be sold for veal as soon as old enough, and the work saved in not raising them by hand can be put on the crops and in making improveemnts.

The warm separator milk can be fed at a good profit to pigs and poultry, giving another source of cash income to the new settler.

Sorghum should be sown broadcast to be fed in the fall to keep up the flow of milk.

In selecting range cows for dairy work the grade short-horn has been usually found the most satisfactory. The cow should be selected for four dairy points—a good udder, prominent hip bones, a sharp bone at the top of the shoulder and large stomach capacity. The writer selected a carload of range cows along these lines: None of them had been fed grain and several had to be roped before they could be milked. These cows averaged over \$40 per head the first year in cream sold to the creamery, and one cow with these points well developed produced \$60 worth of cream the first year.

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## PREPARATION OF SEED BED.

HINTS FOR THE PLAINS.

BY W. H. OLIN.

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Crop conditions in Eastern Colorado are so different from crop conditions in the humid region that special attention should be called to them for the benefit of the new settler.

The very best system of tillage may fail to produce a crop some years, but proper soil management and use of acclimated seed adapted to prevailing conditions tend to render crop failures less frequent and harvests therefore more remunerative.

In the farming operations of many parts of Eastern Colorado, where irrigation can not be practiced, the amount of water available to plants is the "limiting condition of success," as Prof. Failyer calls it. Here is found abundance of cheap land, quite fertile, and water is the element that must be most carefully conserved to insure a crop. No rain water must be allowed to run to waste if possible to store it in the soil. Rains on the plains are usually quick dashing rains and the seed should be in such tilth that both upper soil and subsoil will readily absorb the water which falls during the crop season.

The preparation of the seed bed calls for careful plowing, harrowing and sub-surface packing.

Experience demonstrates that the preparation of the soil reservoir (seed bed) of good depth several months before seeding, the thorough culture of the ground before and after seeding, are essentials that very largely determine success in Eastern Colorado. Summer tillage conserves moisture while it renders more plant food available, keeps down weeds, and keeps the soil in good tilth.

*Preparing New Ground for Spring Seeding.*—It is always a questionable practice to crop newly broken sod in a dry year. The sod usually contains but little moisture and the process of breaking causes one to lose an appreciable portion of it. Suggestive plan: Plow sod land not less than three nor more than five inches deep, turning sod down as flat as possible, and thus prevent its drying out too soon. Follow as closely with disc harrow as practicable, and this with some form of packer, either single or double roll. This will level the sod land above, and firm the soil in the lower portion of the furrow slice, restoring the capillarity where plowing has arrested it. This firmed under-surface soil is thus enabled to draw moisture from below and give good, normal root development. Follow up the packer with either an acme or a good smoothing harrow to produce a good earth mulch to arrest surface capillarity and check evaporation of soil moisture. Follow with the seeder. All small grain should be drilled in with a press wheel drill, followed up with a good spike-toothed or smoothing harrow. It is almost necessary that all tillage operations on sod be with the furrows rather than across them to avoid tearing up the sod and drying out your seed bed. Do not seed broadcast. Make each tillage operation thorough—plowing, disking, firming, harrowing, and seeding.

When the new crop is up, cross harrow to prevent the formation of a crust and giving the young crop a cultivation. Follow up each rain with a good harrowing as long as character of crop will permit.

Early in June prepare seed bed for the fall and following spring's seeding. Try to hereafter seed only on ground which has been given "summer culture" treatment.

Remember that roots of all cultivated crops make their best growth when you provide:

A firm mellow	} Soil well supplied with plant food.
A warm mellow	
A ventilated	
A moist	

Methods of farming which (a) conserve the moisture, (b) prepare a good seed bed, (c) reduce the evaporation to as near the minimum as possible, (d) use good vital acclimated seed, (e) employ a crop rotation which has stock foods prominent, contain at least one money crop, (f) and practice thorough tillage of the ground, often tide the farmer over bad years and insure his success in good years.

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## SUMMER CULTURE TO CONSERVE MOISTURE.

HINTS FOR PLAINS SETTLERS.

BY W. H. OLIN.

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Many hundred farmers, unfamiliar with the soil and climatic conditions of our eastern plains, are this year coming to make homes

on 160-acre farms in Eastern Colorado in regions where crops have not been generally grown. Many of these settlers have but a limited amount of money and can not afford a crop failure. It is feared that this spring crop will be only partially successful, since many of them are farming as they did "back home," and are not using drouth-resistant crops of demonstrated value in their farming operations. This timely suggestion is sent out to prevent crop failure in fall seeding. Preparation of seed bed is the most important thing in farming the non-irrigated lands, and as soon as spring crops are in, the new settler should plow and cultivate his field he expects to seed to fall crops, or the following spring's grain.

Summer culture is an essential of the Eastern Colorado farmer's success. The French found some centuries ago that "manoeuvring" the land—causing the particles of earth to change place by tillage—made it more productive. Experiments now show that summer tillage in our semi-arid lands has an added value—it conserves the moisture, while it renders more plant food available. Good results have been obtained in Eastern Washington, Eastern Oregon, Utah, and many sections of Colorado from summer culture of the land every other season. It has been found that in this way sufficient moisture can be stored from the year's rainfall to mature a crop in many localities.

After the snows of winter have melted in the spring, plow the ground at least seven or eight inches deep. With disc harrow, corrugated roller, imperial pulverizer, or packer, level and firm this ground as soon after plowing as possible, at least not later than each half day, and follow up with smoothing harrow to establish the earth mulch to check evaporation. This mulch must not be too fine, as the winds of the plains will tend to rift the soil or blow the earth mulch entirely away. If possible, stir the surface soil with a good spike-tooth or acme harrow several times through the summer from two to four inches deep. Follow every summer rain with a good harrowing of this "summer cultured" ground, preventing the formation of a crust at the surface. Keep this ground clean—free from weeds.

Ground that has been well cultivated for several years will produce two crops in succession and can be given summer culture the third year. In this way it is possible to grow two crops in three years on well-tilled soil. If a farmer expects to cultivate 80 acres, he should divide it into two crop divisions—cropping 40 acres the first year and giving summer culture to the other 40 acres. This gives him a crop on one half his land each year while he is storing up moisture in the soil reservoir of the other half to make the next year's crop. A farmer on the non-irrigated lands in Weld County last season, after seeding his spring crop, at once prepared his fall wheat seed bed—150 acres. The writer visited his field early in July and found his seed bed in a fine mellow, moist, condition for seeding. Just a few miles from this careful farmer's ranch was a 500-acre field which had been simply plowed and left in that condition to dry out and become hard. Although an inch of rain had fallen the week previous, the writer found the soil in this field in very poor mechanical condition—dry and hard.

This clearly shows how not to do. Farmer No. 1 now has a most promising field of wheat and will undoubtedly be rewarded with a satisfactory harvest.

One of the writer's correspondents, living ten miles south of Akron, Colo., has practiced summer culture for several years. He reports that in the fall, when he seeds his summer cultured land, he often finds from three to five feet of moisture.

The writer knows that this method of summer culture has been practiced in some parts of California for upwards of forty years with satisfactory results.

Use every practical method you can to conserve the moisture. Summer culture keeps the ground in good tilth, keeps down weeds, renders the plant food easily available for the next year's crop, while it stores up the moisture so necessary to the plant in assimilating its food.

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## ACCLIMATED SEEDS.

### HINTS FOR NEW SETTLERS IN EASTERN COLORADO

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BY W. H. OLIN.

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So many settlers, coming from the humid regions of the central states into Eastern Colorado this spring, are bringing with them the seeds of the crops grown "back home," with which they hope to grow crops in a much drier region, that a word of caution is necessary.

Difference in altitude, amount of rainfall and general climatic conditions urges the writer to warn the new settler that past experience has shown that it will be hazardous to use any but acclimated seeds of such types of grain, forage and root crops as successful farmers of that locality have demonstrated show fairly good drouth resistant power.

Even with the most vital seed of established worth, in some seasons, lack of timely rains jeopardizes a profitable harvest. Last season one Eastern Colorado farmer seeded a drouth resistant strain of wheat, getting twenty-five bushels of good, sound wheat, and in an adjoining field, with the same seed bed preparation and after treatment, he seeded a wheat from another state of unknown drouth resistant power and got seven bushels per acre of inferior quality.

This is further illustrated in every crop grown on the eastern plains of Colorado. Seed, if you will, your choice imported grain in a seed block of an acre or less, but be sure to secure for the general field, grain that is acclimated to semi-arid conditions. The following crops have proven to be reasonably certain in average years for this region:

**GRAIN.**

**Corn.**—(An early maturing corn should always be used)  
White Australian Flint.  
Swadley Dent, and  
"Divide" Dent, or Colorado Yellow Dent.

**Wheat.**—For Spring—  
Kubanka Durum.  
For fall seeding—  
Turkey Red, or  
Kharkov.

**Barley.**—(A bald barley or beardless type, seeded early.)

**Rye.**—One of the surest crops for hay or grain.

**Oats.**—This is not a reliable crop every year, but early types, as the Big Four, Kherson, and Sixty Day, acclimated to that region, have given very good harvest for several seasons.

**Flax.**—This is a new crop to Colorado, and for two years has done well, but its worth has not yet been fully proven. The writer would urge settlers not to seed this crop extensively until it has been more fully tested. If this seed is used, be sure to treat seed with formalin before seeding. The writer will send directions on request. Get Colorado-grown seed, if possible.

**Emmer.**—(Commonly called speltz.)—A drouth-resistant feed grain.

**FORAGE.**

**Kaffir Corn, Dwarf Milo Maize, Early Amber Sorghum, and Proso,** are good forage crops.

**ROOTS.**

**Potatoes,** where non-irrigated, or "Divide" seed is used, have proven the best root crop in recent years for the plains region.

Seek to grow that crop which will furnish feed, and plan to make some form of meat production the main product of the farm. Get the seed of a few well-tried crops and plan to seed them early, so the crop may get what early spring rains may chance to fall.

Rate of seeding is very important, since seeding too heavily takes up the limited amount of moisture in the ground, causing the whole crop to "fire-burn." Do not seed as heavy as you did in the central or eastern states. The following table may be suggestive, but rate of seeding will vary with manner of seeding, size of seed and condition of seed bed, so no definite rule can be laid down. Do not seed broadcast, if you can possibly drill in the grain.

**Rate of Seeding for Eastern Plains.**

Grain Crops.	lbs. per acre.
Wheat .....	30 to 50.
Wheat (Kubanka Durum).....	40 to 50.
Barley .....	35 to 50.
Oats .....	35 to 50.
Rye .....	30 to 40.
Emmer or Speltz.....	35 to 50.
Field Peas .....	25 to 40.
Proso .....	6 to 12.
<b>Forage Crops.</b>	
Sorghum .....	8 to 20.
(Varies with the method of seeding.)	
Alfalfa .....	15 to 25.
Meadow Fescue .....	15 to 25.
Brome Grass .....	15 to 25.
Vetches .....	18 to 30.

## POTATOES ON THE PLAINS.

BY E. R. BENNETT.

Where potatoes can be grown in this State they have proven one of the most valuable of the farm crops. However, little investigation has so far been made of the methods of culture that are best adapted to the conditions under which potatoes must be grown on the unirrigated lands of Eastern Colorado. Some very good crops of potatoes have been grown in this section in the past year or two, and it is thought possible that considerable acreage may be planted this year.

The methods of growing employed and the best varieties to plant are necessarily different from those used in the irrigated districts, so a word of advice to the new comers may be timely.

While it is advisable for every farmer to plant potatoes enough for the use of the family, we would not advise those inexperienced in the business to plant a large acreage at first. An acre or two, if successful, will more than supply the family needs, and, if unsuccessful, comparatively little will be lost.

*Varieties and Seed.*—One of the first requisites for success in growing potatoes on the plains is to get seed that is adapted to the conditions. Probably the best is that which has grown under similar conditions for several generations. If that is not to be had, seed from the Arkansas divide (Elizabeth )country, or even from Dakota, Minnesota, or Wisconsin will do. Seed from the irrigated lands should not be used.

Usually the early part of the season suffers less from drought than the latter; therefore, the early maturing varieties are generally better for the purpose than the larger late potatoes. Early Ohio and Rose Seedling have been grown in this State with considerable success in the past and are probably safer to use than some of the common Eastern varieties.

*Soils.*—Potatoes are grown on nearly all kinds of soils, but the lighter soils that will hold moisture are generally to be preferred. Land that has been cultivated should be selected in preference to raw land.

*Preparation of the Land.*—Plow the land to a good depth when in good condition to work as early in the spring as possible. Harrow the land as fast as plowed to form a soil mulch and prevent loss of moisture by evaporation. From the time plowing is done till planting time, the land should be frequently harrowed. If rains come, the land should be harrowed as soon after the rain as the land can be worked without puddling the soil.

*Planting.*—In most cases the earlier the planting can be done without danger of early frosts hurting the vines, the better. When it is possible to do so, use a machine for planting, for by so doing

the seed is put down into moist soil, while hand work is apt to leave seed covered with loose, dry soil, in which case the seed will be delayed in coming up and a poor stand result. If the seed is planted deep (not less than five or six inches), this trouble will be to a certain extent avoided. If machines for planting are not available, the hand potato planter used in the East will do the work fairly well.

With the limited amount of moisture that is available for the crop, the plants will do better if planted at a greater distance apart than is usually practiced. If the hand planter is to be used, the field can be marked out as for corn and planted in rows both ways. If the machine is used, rows from forty inches to four feet apart with hills twenty inches to two feet apart in the row will probably give the best results.

*Cultivation.*—After the potatoes are planted, the success or failure of the crop will, to a large extent, depend upon the cultivation given.

The first cultivation should be given soon after the potatoes are planted, before the plants are out of the ground. Set the cultivator to run as deeply as possible to loosen and aerate the soil. The cultivator should be immediately followed by the harrow to smooth the surface and re-establish the soil mulch. After the potatoes are up, frequent shallow cultivation should be given till the vines become too large to work.

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## WIND-BREAKS AND SHELTER BELTS FOR THE PLAINS

BY B. O. LONGYEAR.

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Wind breaks, as the term implies, are plantations of trees or similar plants intended to check the force of the wind. They may be used to lessen the drying effects of hot winds in summer to prevent injury or loss to fruit in autumn, and to shut off the cold winds of winter from yards and buildings. Wind-breaks for the last purpose are usually called shelter belts, and are often made several rods in width.

The location of the wind-break will, of course, depend on the direction of the prevailing winds. For general purposes the north and west sides of the area to be protected are the ones along which the trees are planted in most portions of this state. Shelter belts should be planted far enough from buildings so that drifting snows on the inner side will not be an inconvenience.

The simplest kind of wind-break is one formed by planting some one species of tree in a single row. If a tall-growing tree is used alone in this way there is a tendency for the trees to spindle up and in time the trunks lose their lower branches. Such an arrangement may do very well for a time, or where only partial checking of the wind's force is desired. But where more complete shelter

from winds is desired, it is usually necessary to plant several rows of different species, so arranged that the low, dense-growing kinds will fill in the places between the taller ones.

For the taller-growing tree in this region the common cottonwood may be used, setting them about eight feet apart for the outer or north and west rows. A second row of some denser-growing kind should be planted about eight feet from the first and as close as four feet in the row. For this purpose box elder is a suitable tree, except in dry situations, in which case the green ash is recommended. The trees in the third row may be planted the same as in the second row, using a more compact-growing kind. The Russian golden willow is recommended for this purpose as a rapid grower. The Russian wild olive is a more compact tree of lower growth and is particularly desirable. White or American elm is also a suitable tree for the inner rows in many places, especially where a fair amount of moisture can be depended on.

In cases where the wind is exceptionally strong, it may be found necessary to plant a belt four or five rods wide, in order to secure complete protection. The outer two rows may consist of Russian olive, the third and fourth rows of black locust, the fifth and sixth rows of box elder or ash, the seventh and eighth rows of American elm, and the inner two or three rows of cottonwood or Carolina poplar, the rows being about eight feet apart. The golden Russian willow may be used in place of the elm, and honey locust may take the place of the black locust.

The ground should be prepared as carefully as for a crop of grain or sugar beets. Where the rows are to stand, the soil should be furrowed out each way by making a back furrow between each two rows. When harrowed, the land will slope each way toward the trees thus tending to collect drifting snow where it is most needed.

The same care in planting should be taken that would be given in setting an orchard. Seedling trees, two years old, are better in most cases than large ones, as they will bear transplanting more readily, are easily handled, and the cost is much less than with the larger sizes. Trim off all broken and bruised roots with a sharp knife and cut back the top to correspond. Set the trees an inch or two deeper than in the nursery, and firm the soil about the roots.

As soon as planted, irrigate if water is available. If not, give a shallow cultivation to check surface evaporation from the soil.

Cultivation should be continued during the growing season, especially after each rainfall. This is particularly necessary on the plains or where water for irrigation can not be supplied. Such cultivation is calculated to keep a thin layer of fine, dry soil on the surface, which acts as a mulch to conserve moisture. Such care should be continued during the first three to five years, or until the trees shade the ground between the rows. A mulch of old straw at this time may be placed between the rows, and will assist the trees in keeping down the grass and weeds.



Pruning is not desirable, unless it be so done as to cause a thicker growth. Thus in the case of the willow, many smaller stems may be secured by cutting out the main trunk a foot or so above the ground when four or five years old. In this way a single, or, better still, a double row of willows, closely planted, may be used as a hedge, which will also serve as an effective wind-break.

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## GRASSHOPPERS UPON THE PLAINS.

BY C. P. GILLETTE

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The western plains have long been noted for their hordes of grasshoppers. The reputation is chiefly due to the great swarms of the "Destructive" or "Rocky Mountain Locust" that used to fly out from the mountains in numbers sufficient to destroy all crops in a few hours, wherever they stopped. This pest is no longer to be feared in Colorado, but there are several species of locusts (grasshoppers) that are present every year and often in destructive numbers. The habits and remedies for the most of these may be given in a general way as follows:

*Life History.*—During the fall months the female locusts deposit their eggs in little pockets, an inch to an inch and a half deep, in the ground. The eggs are found in largest numbers along road sides, ditch banks and the borders of fields. They hatch about as soon as green vegetation starts enough to give the little hoppers plenty of tender, nutritious food.

If plenty of food is at hand, the little grasshoppers do not wander far from the place of hatching for a few days, and their presence may be noticed by the perforated and ragged leaves of weeds as well as cultivated plants where they are feeding.

By the middle of July, a few of these locusts will have wings, which means they are fully grown, but few, if any, eggs will be deposited before the middle or latter part of August. Very soon after a female has laid her eggs she dies, and there are some of the later individuals that do not finish egg-laying until they are killed by the cold, freezing nights late in November. There is but one generation or round of development of the locust in a year.

*Destruction of Eggs.*—The eggs of locusts are very soon killed by being exposed to the dry air and sunshine of Colorado, so if it is known that there are many of the eggs in meadows, alfalfa fields, along road sides or ditch banks, it is an excellent plan to plow or thoroughly harrow the infested ground during the late fall, winter, or early spring. It will pay well to harrow the alfalfa just because of the increased crop of hay that will result, even if there are no locust eggs.

*Destroying the Locusts.*—The little hoppers, when very abundant about the border of the fields or along ditch banks, can be largely killed by a thorough spraying with arsenate of lead, 3 pounds to 50 gallons of water, or Paris green,  $\frac{1}{2}$  pound to 50 gallons, as for other insects. A narrow strip, not to exceed a rod in width, sprayed early in spring, will not endanger stock eating the hay later on, but care should be used not to put stock upon sprayed areas too soon.

Where straw is available, it may be spread lightly over ditch banks and other places where the hoppers are abundant and be burned. In gardens and among potatoes and other vegetables poisoned bran can often be used with success. Mix 1 pound of Paris green with about 40 pounds of bran, add just water enough to moisten the whole, and then sow it broadcast where the hoppers are most numerous. If this poison is used, care must be taken to keep chickens and other domestic animals from the poison for some time.

One of the simplest and often a very effectual remedy is to grow plenty of chickens and turkeys to range over the infested grounds. Wherever coyotes abound, however, precautions must be taken to protect turkeys and chickens at night. Turkeys are very profitable, if raised with proper care, as they protect crops from destruction, forage nearly their whole living, and sell at a high price in the fall or winter.

Hopper "dozers" or pans are also very successful where they can be used. Anyone wishing directions for making a good hopper pan should write the experiment station for a copy of Bulletin No. 112.

I shall always be glad to receive inquiries concerning insects that are doing damage in any part of the State. Send specimens of the insects when possible, with samples of their injuries.

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## RAISING HOGS ON THE PLAINS.

BY H. M. COTTRELL.

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Farmers living in the Plains regions of Colorado will find it advantageous to give special attention to the raising and fattening of hogs.

The surest grain crops under the dry land farming are barley, wheat, milo maize and Kaffir corn, all four are good feeds for the production of pork.

Barley is the best of all grains for the production of pork of fine quality and flavor. It requires less water to mature a crop than any of our other common grains, and when seeded early is the surest grain crop on the Plains. Many growers on the Plains report an average yield of 2,000 pounds of barley an acre, and this is sufficient to produce over 400 pounds of gain when fed to hogs.

Wheat will produce as much pork as the same weight of corn, and many farmers have found it profitable where rainfall is limited

to raise Durum wheat and fatten hogs with it. Wheat does not produce pork of the first quality and it is best to feed barley the last 30 days of fattening, as it makes the pork finer, the fat whiter, and greatly improves the flavor.

Rye is profitably fed in some sections. It will make good gains, but the hogs should be finished on barley.

Milo maize and Kaffir corn will produce about 90 per cent. of as much gain on hogs as will an equal weight of corn, and are very profitable grains to raise for feeding hogs. Both of these grains are constipating and need some laxative feed to be given with them. Alfalfa hay is one of the best feeds for this purpose, sorghum hay is good, as are also any kind of roots.

Hubbard squash is an excellent feed for fattening hogs and some Colorado farmers use it as an exclusive feed for this purpose, but better gains and finer quality of pork will be secured when some grain is given with it.

A mixture of two grains will give larger gains than the same weight of one grain fed alone.

Dairying is one of the surest and most profitable lines of farming on the Plains, and skim milk fed with grain to pigs and hogs is one of the best of feeds. Hog raising increases the profitableness of dairying.

Grain is high-priced in most sections of Colorado, and while a hog should have some grain every day of his life, at least half the weight of a 200-pound hog should be made from roughage—pasture or fodder. The best pasture is alfalfa, and there are few farms on the Plains but what have some spot where alfalfa will thrive if proper methods are followed, and seed from non-irrigated land is used.

Dwarf Essex rape stands drought fairly well if seeded as soon as the frost is out of the ground. Winter wheat and rye make good early pasture, and sorghum may be seeded in the spring in fields of rye or wheat and will furnish pasture after the grain has dried up.

Good alfalfa hay is the best winter roughage to feed hogs. It can be fed in a rack and will increase the gains and improve the flavor of the pork. In a test made by the writer, hogs fed all the grain they would eat gained 400 pounds, while those fed alfalfa hay and grain gained 600 pounds.

Where alfalfa hay is not available good, juicy, sorghum fodder improves the thriftiness of hogs and increases the gains.

Hogs should have access to salt and charcoal or coal at all times, and wood ashes are beneficial. Good water plentifully supplied is as essential in making gains as is grain.

The Plains section of Colorado has great advantages for raising hogs. The grains most profitable to grow there produce finer flavored pork than corn, and usually the grain can be marketed at a higher price when fed to hogs than when sold on the market. This is especially true where the quality of the grain is inferior.

Denmark sells eighteen million dollars worth of bacon a year to England alone. The Danish bacon sells for a considerably higher

price than the best quality of corn fed bacon. The Danish bacon is made from barley-fed hogs.

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## TYPES OF MILLING WHEAT FOR THE PLAINS.

BY W. H. OLIN.

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*Winter Wheat.*—The Plains farmer has found in the past that wheat is to him a desirable cash crop and when acclimated seed of wheat types having known drouth resistant power, is used, the probabilities for harvest are increased.

The type of winter wheat which for the past five years has been giving best results is Turkey Red. It has a medium straw, a medium to short spike, a small kernel, but is recognized as one of the best of milling wheats. Nearly every mill in the state is ready to pay from 5 cents to 10 cents premium for this wheat, so it has a strong local trade, insuring farmers a good market for the threshed grain. This grain should be seeded on good summer cultured ground at such a time after the middle of September and before the middle of October, as local conditions render advisable. When moisture conditions are such that his wheat gets a good start before it goes into the winter, it has a stem and root growth which enables it to more readily withstand winter conditions and the desirable strength in the spring for sturdy growth. An appreciable amount of winter moisture is very desirable for this crop.

Early fall and late spring rains are essential for a fully developed crop and a satisfactory harvest. Use acclimated seed if possible. Some careful farmers in the vicinity of Holyoke, Vernon, Bennett, Byers and other localities of the Plains, have raised creditable winter wheat this past season, and the writer will be glad to assist, as far as possible, the new settler to get good quality acclimated seed grown under his local conditions.

When the seed bed is well prepared under summer culture conditions, good vital, acclimated seed is properly drilled in the seed bed, (do not broadcast) at least three weeks before the close of the growing season, the farmer has done his part well. This should be followed by cross-harrowing in the spring. This gives cultivation to the growing wheat and thereby invigorates it.

Get and keep pure quality seed.

*Spring Wheat.*—Kubanka Durum for the past four years has shown itself to be our most drouth-resistant spring wheat for the Plains. While Colorado millers have not used it very extensively for milling, several export dealers are lending encouragement to the growing of this grain, and an increasing export trade east and south seems assured. Besides, this grain is being utilized by many farmers, mixing it with other grains for feeding purposes.

It is our very best poultry food, and crushed and soaked with barley or rye, makes a very good hog food.

This wheat, when made into flour, furnishes a rich, nutritious flour, bread made from which has a rich, creamy color, a nutty flavor, holds moisture longer than bread from the common spring wheat flour, and tests made by the writer show that very satisfactory bread, biscuits and pastry can be made from straight Durum flour.

A few Kansas and Colorado millers are successfully milling this wheat, and should Plains settlers call for and use this flour, the growing and milling of Durum wheat on the Plains will be greatly encouraged.

There are fifteen types of Durum wheat grown in this country. Some types have little or no milling value. White Kubanka Durum (the type recommended for the plains) *will make good quality flour*, and also superior macaroni. This wheat should not be grown under irrigation where a hardy winter wheat has proven itself a well-acclimated grain. It is recommended for those regions of the Plains of Colorado where other wheats are not successfully grown. It is one of our most drouth-resistant spring grains, but is heavily bearded. Colorado No. 50 wheat and White Sonora are showing fairly good drouth-resisting power, but not equal to Kubanka Durum. Both of these are beardless types of spring wheat.

Seed your spring wheat on a well prepared seed bed as early as weather conditions will permit. The earlier seeded, usually the better the grain starts, and it is more likely to blossom and fill before the drying winds come to check development.

Plains farmers are urged to grow their own *bread*, as well as *meat*, and thus "Keep the wolf from the door."

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## RAINFALL ON THE PLAINS.

BY L. G. CARPENTER.

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In some current discussion it seems to be forgotten that all moisture must come ultimately from the rainfall, and, therefore, unless increased by drainage or other source, the amount available for crops must be limited to the amount of rainfall or by the amount absorbed which is considerably less. While land favorably situated may have an advantage from its location, and derive water from neighboring land, there is no method of cultivation which will manufacture moisture. The most to be expected is to lessen the losses, by evaporation and otherwise, which normally take place, and possibly to take advantage of favorable location. In depressions or valleys, some water may be received, none the less important because invisible and underground, usually the drainage from higher land. In such locations, the crop may use much more than the local rainfall, hence where crops are

grown below a ditch, they may receive additional waters no less effectively than by surface irrigation. To say they are raised by the natural rainfall is misleading, to say the least.

Many inquiries are asked concerning the amount of rainfall on the plains, and some misunderstandings are prevalent. These may best be answered by giving the records of a number of places where the rainfall has been measured for a series of years. Those which have the longest record are chosen.

To interpret the rainfall records, the distribution and character of the rainfall must be taken into account as well as the amount. It scarcely needs to be said that a moderate rainfall which falls mostly in the growing season, without long intervals between rain, moderate showers, is far more effective than a large rainfall coming principally in the cold season, or which comes in heavy showers at irregular and infrequent intervals. Sudden and heavy downpours are of little agricultural value for the effectiveness of a rain is largely measured by the amount which the soil absorbs and this absorption takes place at a slow rate, varying with the soil, but, say, one-tenth inch per hour. Showers of a few hundredths of an inch are of little value, for they penetrate only the surface of the soil, evaporate almost immediately, and thus are of practically no benefit. Hence moderate rainfalls, well distributed, during the growing months, are of the greatest value. A favorable feature of the distribution of the rainfall in Colorado, is that nearly 50 per cent comes in these growing months. On the divide between the Arkansas and the Platte rivers, more falls in the summer months of July and August. Speaking generally in respect to the plains, the storms of long continuance are mostly in the months of April and May or perhaps the early part of June and October, while the intermediate months of the summer have their precipitation principally in the form of thunder showers.

Even the average rainfall for any given month may in itself be misleading, and especially where the rainfall is moderate or small, and subject to occasional violent storms. The average may be far from indicating the probable quantity to be expected. More than half of the years will be below the average. A better index to the agricultural value of the rainfall is to know the certain surety of a given rainfall which can be depended on. We may take the record of April at Fort Collins to illustrate the difference. While the average for 25 years is 2.31 inches, the record shows that practically three out of four years (18 out of 24) have been below the average. Hence so far as this is a guide for the future, the probability is about three to one that in any given April, the rainfall will be below the average.

If, however, we count the Aprils with reference to the amount, we find that, for a quantity of about 1.44 inches, half of the Aprils have been above and half below. This amount is the safer guide of what to expect. For lack of a better term, I have called this the agricultural mean as distinct from the ordinary average, and it is indicated at the foot of the table. Where there is little difference

between the average and the agricultural mean, it indicates that the rainfall in the month is quite certain.

The records which are given in connection with this bulletin are the records of the stations which have maintained the records for the longest period of time. These include Fort Collins and Denver, on the plains within a few miles of the foothills, and both at an elevation of practically 5,000 feet. Rocky Ford is in the Arkansas Valley about sixty miles east of Pueblo, at an elevation of 4,176 feet. Leroy, (elevation 4,380 feet), Wray, (elevation 3,531 feet) and Yuma, (elevation 4,147 feet), are in Northeastern Colorado; Cheyenne Wells in the Eastern Central (elevation 4,279 feet), and Hamps on the divide between the Arkansas and Platte rivers. The length of record of these stations ranges from 11 to 37 years.

A critical examination indicates that when changes occur at one station they generally indicate a corresponding change at other stations, but that the increase or decrease is not the same. This is due to the fact that while there are many storms which are general in character, there are also local storms which affect a lesser area. Generally speaking, the rainfall decreases for some distance from the mountains on the plains, and then increases toward the eastern border of the state. It increases with elevation, and prominent ridges, like the divide between the Arkansas and Platte rivers, show an increase or change in the character of the distribution, which materially helps the availability of the supply.

While it is not safe to conclude that the rainfall of the whole eastern part of the state has increased because the precipitation at one station has increased, yet generally, there is some parallelism.

An examination of the table indicates a marked increase in all the stations for 1905 and 1906 over the average for a period of years. This is shown by the following summary:

Place.	No. Years on Record.	Average.	1905.	1906.	1907.
Denver .....	37	13.37	17.68	16.84	11.83
Fort Collins .....	27	14.92	19.86	19.88	11.64
Wray .....	11	19.25	22.43	23.09	14.23
Hamps .....	14	14.56	23.60	19.07	10.56
Yuma .....	16	17.77	23.76	20.76	13.53
Leroy .....	17	16.06	22.18	21.80	16.57
Cheyenne Wells ...	16	16.58	18.31	19.46	9.72
Rocky Ford .....	18	13.15	14.39	14.66	13.59
		125.66	162.21	155.56	101.67

The tables give the monthly rainfall. At the bottom is given the average for the whole period of the record. Manifestly in comparing the precipitation in two different stations, it is important that the same years be considered at both places, or the same months. These tables were made up in the summer of 1907 and thus 1907 was omitted. For convenience, it is given in a separate table by months, but not used in determining the averages or agricultural mean.

## PRECIPITATION AT DENVER, COLORADO. U. S. Weather Bureau

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	'Nov.	Dec.	Year.
1870	1.80	1.70	0.70	2.80	0.34	0.52	0.51	0.12	2.85	0.68	0.54	0.73	13.29
1871	0.46	0.23	1.81	1.01	2.56	0.05	0.51	0.27	1.18	0.40	3.10	0.77	12.35
1872	0.55	0.22	1.71	2.09	3.74	2.07	2.69	1.75	1.57	0.68	0.69	0.29	18.05
1873	0.13	0.24	0.22	2.43	0.75	2.24	2.00	1.41	0.89	0.73	0.16	0.61	11.81
1874	0.84	0.53	0.49	1.70	2.43	1.21	3.35	0.68	1.34	0.64	0.08	0.17	13.46
1875	0.38	0.60	0.39	2.24	1.94	0.43	4.32	1.97	2.89	0.22	1.28	0.59	17.25
1876	0.21	0.11	1.80	1.22	8.57	1.10	1.16	2.03	0.60	0.12	1.50	1.70	20.12
1877	1.90	0.40	1.40	2.77	2.30	1.93	0.23	1.30	0.38	2.15	0.73	0.79	16.28
1878	0.10	0.48	1.82	0.05	2.90	2.78	1.38	2.25	1.23	0.80	0.67	1.05	15.51
1879	0.40	0.39	1.00	2.62	3.36	0.32	0.64	1.38	0.02	0.19	0.21	0.33	10.86
1880	0.38	0.32	0.21	0.31	1.11	1.22	1.38	1.46	0.89	1.37	0.83	0.10	9.58
1881	0.49	1.22	0.87	0.50	2.21	0.09	2.50	2.33	0.57	0.32	1.68	0.00	12.78
1882	0.57	0.20	0.20	1.47	2.98	4.96	0.66	1.20	0.06	0.75	0.71	0.73	14.49
1883	2.35	0.45	0.21	3.10	4.30	0.85	2.27	0.75	1.08	1.49	0.32	2.32	19.49
1884	0.22	0.86	0.93	3.33	4.61	1.47	0.65	1.71	0.13	0.21	0.19	0.76	15.07
1885	0.41	0.75	0.97	4.94	2.13	0.66	1.33	1.18	1.22	0.73	0.55	1.08	15.95
1886	0.62	0.72	2.36	2.79	0.09	2.26	0.50	1.62	0.98	0.33	1.93	0.87	15.07
1887	0.67	0.30	0.23	2.16	1.13	0.53	2.49	2.68	0.97	0.97	0.22	0.14	12.49
1888	0.11	0.37	1.15	1.71	2.66	0.29	0.41	1.51	0.11	0.77	0.33	0.09	9.51
1889	0.50	0.70	0.40	1.34	3.44	1.88	2.94	0.33	0.28	2.11	0.53	0.30	14.75
1890	0.18	0.46	0.35	2.50	2.01	T	0.79	1.89	0.17	0.64	0.30	0.04	9.33
1891	1.60	0.27	3.10	2.49	4.15	2.93	0.59	2.84	0.73	0.48	0.69	1.56	21.43
1892	0.40	0.75	1.20	1.75	2.14	1.33	1.19	0.58	T	3.92	0.44	1.32	15.02
1893	0.05	0.83	0.23	0.87	3.09	0.13	1.14	0.35	0.05	0.84	0.55	0.35	8.48
1894	0.18	0.90	0.70	3.30	3.00	0.39	2.11	1.86	1.55	0.19	0.22	0.69	15.09
1895	0.32	0.48	1.19	1.19	2.86	2.65	4.28	0.76	0.98	1.13	0.27	0.01	16.12
1896	0.25	0.24	1.43	0.93	1.27	0.89	2.80	0.97	1.81	0.84	0.10	0.31	11.84
1897	0.58	0.82	0.90	1.31	3.15	2.16	2.06	1.44	0.44	1.64	0.24	0.63	15.37
1898	0.20	0.68	0.28	1.20	4.88	0.94	0.67	0.96	0.28	1.05	0.85	0.99	12.98
1899	0.65	0.58	1.10	0.75	0.15	0.47	1.92	1.78	0.20	1.01	T	0.72	9.33
1900	0.13	0.55	0.63	8.24	0.53	1.87	1.30	0.05	0.87	0.33	0.37	0.42	15.29
1901	0.05	0.06	0.88	1.96	1.18	2.09	0.01	1.30	0.22	0.46	T	0.89	9.10
1902	0.17	0.38	0.63	0.60	1.98	1.89	1.24	0.76	3.70	0.80	0.61	0.59	13.35
1903	0.12	0.42	0.87	0.81	0.75	1.62	1.36	1.35	0.56	1.34	0.07	0.23	9.50
1904	0.04	0.17	0.94	0.74	3.27	3.54	2.13	0.60	1.77	0.40	0.04	0.41	14.05
1905	0.99	0.35	3.07	4.95	2.65	0.61	1.55	0.67	0.49	2.31	0.04	T	17.68
1906	0.17	0.06	1.88	3.67	1.45	1.51	1.21	0.88	2.72	1.98	1.30	0.01	16.84
Average 37 years	0.52	0.51	0.97	2.10	2.49	1.40	1.57	1.27	0.97	0.95	0.60	0.61	13.96
Average 20 years	0.37	0.47	1.06	2.12	2.28	1.38	1.61	1.18	0.89	1.16	0.36	0.49	13.37
Max.	2.35	1.70	3.10	8.24	8.57	4.96	4.28	2.68	3.70	3.92	3.10	2.32	.....
Min.	0.04	0.06	0.21	0.05	0.09	T	0.01	0.05	T	0.19	T	0.00	.....
Agr. Mean	0.38	0.45	0.90	1.75	2.43	1.22	1.33	1.30	0.87	0.75	0.44	0.59	12.41



PRECIPITATION AT AGRICULTURAL COLLEGE, FORT COLLINS, COLORADO

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1872											0.02	0.20	.....
1873	0.25	0.16	0.00	1.20	2.30	1.50	1.30	0.85	0.75	0.42	0.20	0.17	9.10
1874	0.06	0.43	1.29	0.77	2.95	0.65	3.15	0.25	0.00	1.00	0.02	0.00	10.57
1879										1.75	0.15	0.60	.....
1880	0.72	1.09	0.38	0.94	0.60	0.86	1.80	0.37	1.47	2.07	1.10	0.10	11.50
1881	1.10	0.55	1.45										.....
1882			0.17		4.67	3.07	1.76	0.89	2.51	0.82	0.29		.....
1883	1.00	1.50	0.68		2.51	3.18			1.00	1.29	T	1.33	.....
1884	1.10	0.70	1.15	3.94	4.84					0.10	1.80	0.35	.....
1885	1.77												.....
1886										0.69	1.18	0.33	.....
1887	0.86	0.23	0.25	1.10	1.23	1.96	3.05	2.12	0.54	0.43	0.15	0.00	11.92
1888	0.29	0.36	0.73	1.23	3.39	0.47	0.60	1.01	0.29	0.88	0.38	0.16	9.79
1889	0.21	0.34	0.65	2.07	3.39	2.06	0.79	0.95	0.42	3.16	0.43	0.01	14.48
1890	0.13	0.21	0.22	3.92	1.19	0.12	1.27	3.14	0.07	0.70	0.32	0.12	11.41
1891	2.32	0.16	1.20	2.14	4.07	1.30	0.17	2.05	1.02	0.20	0.60	0.46	15.70
1892	0.60	1.29	1.52	1.60	4.83	2.42	1.32	0.22	0.14	0.93	0.23	0.35	15.45
1893	0.02	0.54	0.14	1.66	1.92	0.26	0.64	0.92	0.18	0.16	0.55	0.12	7.11
1894	0.25	0.60	0.67	0.89	3.09	0.42	1.72	1.53	2.29	T	0.14	0.76	12.36
1895	0.24	1.52	0.54	1.36	3.62	3.65	3.75	1.45	0.47	1.06	0.40	0.01	18.07
1896	0.43	0.03	1.73	1.26	1.68	3.05	3.05	2.20	1.55	0.49	0.05	0.24	15.76
1897	0.18	0.54	2.15	1.39	2.06	1.69	2.65	1.74	0.75	0.75	0.67	0.67	15.24
1898	0.14	0.08	0.50	1.08	3.65	1.37	0.50	0.98	0.50	0.82	1.24	0.17	11.03
1899	0.66	1.04	1.50	1.10	1.01	1.03	4.95	0.99	0.21	3.23	T	0.47	16.19
1900	0.25	1.12	1.07	10.56	1.75	0.82	1.14	0.16	1.92	0.24	0.07	0.11	19.21
1901	0.19	0.38	1.88	3.62	7.47	2.35	0.71	0.72	2.10	0.36	0.02	1.37	21.17
1902	0.32	0.15	1.50	0.61	2.13	2.43	1.31	0.67	7.12	1.15	0.27	0.77	18.43
1903	0.16	1.60	1.03	1.50	0.63	2.23	1.06	0.86	0.87	1.70	0.18	0.07	11.89
1904	0.04	0.34	0.51	0.89	5.37	1.68	1.99	0.71	1.09	0.39	0.00	0.12	13.13
1905	0.29	0.35	1.75	6.32	4.13	0.64	2.18	1.25	0.28	2.60	0.07	T	19.86
1906	0.01	0.03	2.44	4.30	2.40	1.80	1.96	0.80	3.08	1.59	1.35	0.12	19.88
Average	0.50	0.59	1.00	2.31	2.96	1.64	1.78	1.14	1.22	1.04	0.41	0.33	14.92
Average 20 Years	0.38	0.55	1.10	2.43	2.95	1.58	1.74	1.22	1.24	1.04	0.36	0.34	14.93
Max.	2.32	1.60	2.44	10.56	7.47	3.65	4.95	3.14	7.12	3.23	1.35	1.37	.....
Min.	0.01	0.03	0.14	0.61	0.63	0.12	0.50	0.16	0.07	T	O	0.00	.....
Agrl. Mean, 20 Years	0.24½	0.34½	1.05	1.44½	2.74½	1.68½	1.31½	0.98½	0.64½	0.78½	0.25	0.14	11.63

Observers—1880, F. J. Annis; 1881, A. E. Blount; 1882-5, C. F. Davis; 1886-7, E. Mead; 1888-1906, L. G. Carpenter, R. E. Trimble, Assistant.

## PRECIPITATION AT WRAY, YUMA COUNTY

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1890 .....			T	T	4.44	1.42	0.62	0.25	1.09	0.45	0.25	T	.....
1891 .....	1.80	0.50	1.90	4.68	2.02	4.55	2.52	0.45	1.24	O	0.20	0.83	20.69
1893 .....				0.03	2.12	1.00							
1895 .....										T	0.12	0.32	.....
1896 .....	0.47	0.02	0.66	4.83	1.64	3.77	1.13	1.47	1.01	1.37	0.06	0.20	16.63
1897 .....	0.28	0.26	1.79	1.64	3.34	4.79	1.79	2.27	0.73	2.92	0.07	0.31	20.19
1898 .....	0.06	0.07	0.83	1.73	5.47	2.98	1.88	2.56	2.33	0.25	0.26	0.29	18.71
1899 .....	0.63	0.07	0.50	0.62	1.96	1.83	2.18	1.38	0.08	T	1.16	0.33	10.74
1900 .....	0.16	0.90	0.33	6.00	0.61	2.35	4.57	2.60	0.15	0.03	0.20	0.34	18.24
1901 .....	T	1.37	2.51	4.02	0.28	3.40	2.05	5.36	2.11	0.43	T	0.91	22.44
1902 .....	0.20	0.74	1.05	0.74	7.00	5.69	3.33	2.71	3.73	1.05	0.16	0.59	26.99
1903 .....	0.25	1.98	0.16	0.54	1.95	1.55	5.16	1.48	0.69	0.34	0.25	T	14.35
1904 .....	T	0.58	0.04	2.46	2.02	6.25	2.00	1.26	1.74	1.19	0.05	0.20	17.79
1905 .....	0.04	0.05	3.10	5.12	2.59	3.19	2.98	0.93	2.19	1.64	0.60	T	22.43
1906 .....	0.55	0.62	1.88	4.82	3.20	2.57	1.62	3.57	1.71	1.43	0.83	0.29	23.09
Means.....	0.24	0.61	1.17	2.96	2.73	3.49	2.61	2.33	1.50	0.97	0.33	0.31	19.25
Agrl. Mean .....	0.20	.58	.83	2.46	2.02	3.19	2.05	2.27	1.71	1.05	0.20	0.26	16.82
Max. for Month .....	0.63	1.98	3.10	6.00	7.00	6.25	5.16	5.36	3.73	2.92	1.16	0.91	.....
Min. for Month .....	T	0.02	0.04	0.54	0.28	1.55	1.13	0.93	0.15	T	T	T	.....

Established by the Colorado State Weather Bureau. Observer—J. C. Tuomey.

PRECIPITATION AT HEMPS, ELBERT COUNTY, COLORADO

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1893	0.02	0.08	0.02	0.24	1.60	0.70	3.07	1.23	0.27	0.16	0.04	0.19	7.62
1894	0.07	0.29	0.54	1.11	4.10	0.51	1.65	1.23	1.19	0.05	0.02	0.17	10.93
1895	0.15	0.42	0.28	0.85	2.05	3.79	4.07	2.08	0.12	0.15	0.10	0.11	14.70
1896	0.52	0.30	1.25	1.22	1.05	0.70	3.42	2.80	0.65	0.57	0.02	0.28	12.78
1897	0.14	.....	.....	0.49	0.70	1.68	1.35	6.21	0.42	0.96	T	0.22	.....
1898	0.04	0.02	0.20	0.96	3.80	1.03	1.84	1.61	1.17	0.90	0.28	0.72	12.57
1899	0.90	0.19	2.26	1.30	0.30	1.13	2.50	2.19	0.19	0.49	0.51	0.71	12.67
1900	0.09	0.60	0.86	11.30	1.25	2.20	1.94	0.91	0.65	0.09	0.25	1.03	21.17
1901	0.34	0.07	1.50	4.24	0.83	0.98	0.38	2.58	0.52	0.81	T	0.69	12.89
1902	0.23	0.13	1.37	1.03	4.97	2.52	0.62	2.68	1.37	0.91	0.22	0.98	17.03
1903	0.20	0.76	0.21	0.53	0.75	3.73	1.99	1.40	0.44	0.53	0.09	0.14	10.77
1904	0.03	0.07	0.06	0.71	3.08	2.70	2.69	3.09	2.37	0.62	T	0.09	15.51
1905	0.08	0.58	3.48	4.86	3.98	2.04	4.72	1.27	2.23	0.23	0.13	T	23.60
1906	0.38	0.90	2.25	4.17	0.98	1.44	3.09	2.56	2.23	0.64	0.38	0.05	19.07
Mean	0.23	0.32	1.10	2.35	2.10	1.79	2.38	2.27	0.98	0.51	0.15	0.38	14.56
Agril. Mean	0.14½	0.29	0.86	1.16½	1.42½	1.56	2.24½	2.13½	0.65	0.55	0.11½	0.20½	11.34
Max. for month	0.90	0.90	3.48	11.30	4.97	3.73	4.72	6.21	2.37	0.96	0.51	1.03	.....
Min. for month	0.02	0.02	0.02	0.24	0.30	0.51	0.38	0.91	0.12	0.05	T	T	.....

Established by U. S. Weather Bureau. Observer—W. Hamp.

## PRECIPITATION AT YUMA, YUMA COUNTY, COLORADO

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1891 .....	2.35	0.50	3.63	2.90	4.21	5.23	2.98	0.75	0.64	0.05	0.13	1.25	24.62
1892 .....	0.80	1.55	0.80	3.20	3.46	1.20	4.44	1.50	0.35	1.00	T	0.62	18.92
1893 .....	T	0.90	0.70	0.38	2.57	1.30	2.10	0.95	T	0.40	0.41	0.55	10.26
1894 .....	0.50	0.90	1.10	0.68	0.04	1.85	0.80	0.70	2.85	O	0.22	0.70	10.34
1895 .....	1.20	1.70	0.50	1.10	2.76	2.73	3.22	1.77	0.55	0.10	0.60	0.10	16.33
1896 .....	0.60	0.20	1.25	1.82	2.06	3.98	2.59	1.04	1.02	0.78	0.30	0.20	15.84
1897 .....	0.37	0.40	2.80	0.80	1.62	4.44	1.78	2.44	T	2.55	0.10	1.00	18.30
1898 .....	0.30	0.20	0.31	1.55	5.80	2.70	1.86	3.62	1.00	1.50	1.45	1.10	20.39
1899 .....	1.38	0.60	1.18	0.97	1.23	3.03	2.63	2.22	0.17	0.03	0.90	0.27	14.61
1900 .....	0.14	1.55	0.61	8.67	1.39	0.72	1.81	2.22	0.16	0.03	0.17	0.51	17.98
1901 .....	T	1.11	2.44	3.90	0.31	3.51	1.61	6.53	0.36	0.39	T	0.57	20.73
1902 .....	0.07	0.56	0.95	0.67	3.76	1.91	2.70	3.33	1.68	0.78	0.20	0.73	17.34
1903 .....	0.14	1.88	0.20	0.40	1.00	2.10	2.65	3.12	0.35	0.10	0.36	0.09	12.39
1904 .....	T	0.70	0.25	3.37	4.26	4.98	1.65	1.28	2.92	1.07	T	0.27	20.75
1905 .....	0.31	0.13	4.47	4.27	3.64	2.16	4.45	0.73	1.91	1.64	0.05	O	23.76
1906 .....	0.38	0.51	2.36	4.45	2.01	1.98	2.44	1.23	1.19	2.92	1.17	0.12	20.76
Means .....	0.53	0.84	1.47	2.45	2.51	2.74	2.48	2.09	0.95	0.83	0.38	0.50	17.77
Agril. Means .....	0.34	0.65	1.02½	1.68½	2.31½	2.43	2.51½	1.63½	0.59½	0.59	0.21	0.53	14.52
Max. for month .....	2.35	1.88	4.47	8.67	5.80	5.23	4.45	6.53	2.92	2.92	1.45	1.25	.....
Min. for month .....	T	0.13	0.20	0.38	0.04	0.72	0.80	0.70	T	O	T	O	.....

Established by the Colorado State Weather Bureau. Observer—Geo. W. Custer.

PRECIPITATION AT LE ROY, LOGAN COUNTY, COLORADO

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1889				4.40	2.09	3.38	0.36	2.56	0.83	0.37	0.60	0.10	.....
1890	0.30	0.48	0.01	2.80	1.03	1.96	0.47	1.41	T	0.98	0.48	0.01	9.93
1891	1.70	1.00	1.99	1.35	5.02	4.84	4.69	2.89	0.67	0.14	0.37	0.94	25.60
1892	0.89	2.24	0.80	4.02	2.53	1.48	3.07	1.83	0.84	1.66	0.10	0.65	20.11
1893	0.05	1.20	0.87	0.46	2.73	1.25	1.75	0.61	0.41	0.41	0.48	0.94	11.16
1894	0.35	0.46	0.95	0.98	0.17	0.75	1.16	0.47	1.06	0.08	0.26	0.65	7.34
1895	0.73	0.88	0.40	2.43	2.05	2.94	2.56	0.79	0.42	0.11	0.47	0.12	13.90
1896	0.53	0.24	1.20	1.91	2.36	3.77	1.33	0.87	0.86	0.90	0.20	0.01	14.18
1897	0.60	0.72	1.66	1.77	3.08	2.24	1.39	2.79	0.41	2.61	0.40	0.81	18.48
1898	0.38	0.26	0.67	1.07	4.60	1.31	2.83	1.13	1.27	0.54	0.65	0.27	14.95
1899	0.50	0.33	1.21	1.57	2.93	0.28	2.17	2.38	0.88	0.30	0.23	0.44	13.22
1900	0.10	0.96	0.12	7.27	2.10	0.78	1.68	0.99	0.35	0.07	0.12	0.20	14.74
1901	0.06	0.49	1.60	2.92	0.72	2.52	0.97	4.03	0.27	0.47	T	0.89	14.94
1902	0.12	0.72	1.23	1.28	3.16	1.82	0.98	3.70	3.46	0.78	0.09	0.99	18.33
1903	0.18	1.50	0.26	1.12	0.80	1.07	1.71	3.44	0.62	0.29	0.06	0.03	11.08
1904	0.10	0.26	0.35	1.99	3.97	4.39	3.46	1.17	2.96	1.55	0.04	0.05	20.29
1905	0.17	0.30	3.28	4.70	3.88	2.48	2.56	1.96	0.78	1.93	0.12	0.02	22.18
1906	0.23	0.43	1.38	4.53	1.96	1.35	1.88	2.83	2.70	2.69	1.29	0.53	21.80
Means	0.41	0.73	1.06	2.59	2.51	2.14	1.95	2.00	1.04	0.88	0.33	0.42	16.06
Agril. Mean	0.23	0.49	0.95	1.95	2.44½	1.89	1.81½	1.89½	.80½	.50½	.24½	.35½	13.58
Max. for month	1.70	2.24	3.28	7.27	5.02	4.84	4.69	4.03	3.46	2.69	1.29	0.99	.....
Min. for month	0.05	0.24	0.01	0.46	0.17	0.28	0.36	0.47	T	0.07	T	0.01	.....

Established by the Agricultural Experiment Station. Observer—Charles Green.

## PRECIPITATION AT ROCKY FORD, COLORADO

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1889	0.36	0.12	0.67	2.12	1.75	0.75	4.50	1.28	0.26	1.68	0.77	0.04	14.30
1890	0.34	0.15	0.15	2.97	0.29	0.77	1.14	0.74	0.08	0.00	0.30	0.00	6.93
1891	1.50	0.00	1.80	0.43	3.52	2.31	0.74	0.73	1.75	0.21	0.20	1.77	14.96
1892	0.59	0.80	1.50	0.73	3.26	3.31	1.99	3.10	0.00	0.95	0.50	0.46	17.10
1893	0.02	0.08	0.80	0.25	0.70	0.40	10.26	3.20	0.30	0.25	T	0.50	16.76
1894	0.10	0.95	0.45	0.60	4.25	0.70	1.40	0.25	0.80	0.00	0.04	0.65	10.19
1895	0.27	0.65	0.07	0.35	1.90	0.52	4.87	1.86	T	0.85	0.20	0.57	12.11
1896	0.32	0.18	0.23	0.55	1.12	0.47	2.09	0.47	1.85	1.96	0.00	0.70	9.94
1897	0.75	0.37	0.20	0.44				0.73	0.79	2.64	0.19	1.06	.....
1898	0.40	0.00	0.16	1.06	2.71	3.16	3.52	0.92	1.55	1.36	0.37	0.96	16.17
1899	0.98	0.55	0.32	0.28	0.99	0.78	7.00	2.22	1.43	0.63	2.40	0.98	18.56
1900	T	0.52	0.37	7.15	2.28	1.47	1.77	1.05	0.08	0.60	0.06	0.24	15.59
1901	0.20	0.10	1.00	2.36	1.34	0.23	1.48	0.74	0.48	0.25	0.00	0.50	8.68
1902	0.18	0.57	1.78	0.18	4.02	0.60	0.72	2.72	0.46	0.80	0.41	0.33	12.77
1903	T	1.05	0.18	0.56	0.28	3.94	0.42	0.87	T	1.62	0.26	0.22	9.40
1904	T	T	0.77	0.81	2.03	2.20	1.75	0.33	2.34	0.50	0.00	0.31	11.04
1905	0.05	0.11	2.11	4.67	2.13	1.56	1.30	0.45	1.48	0.10	0.41	0.02	14.39
1906	0.23	0.10	0.92	5.59	0.59	0.54	2.05	1.21	1.64	1.57	0.22	T	14.66
Normal	0.34	0.35	0.75	1.73	1.95	1.39	2.76	1.27	0.85	0.89	0.35	0.52	13.15
Agril. Mean	0.25	.16	.56	0.66	1.90	0.77	1.77	.90	0.64	0.72	0.21	0.48	9.02
Max.	1.50	1.05	2.11	7.15	4.25	3.94	10.26	3.20	2.34	2.64	2.40	1.77	.....
Min.	T	O	0.07	0.18	0.28	0.23	0.42	0.25	O	O	O	O	.....

Established by Agricultural Experiment Station. Observers—F. L. Watrous, 1889—August, 1892; F. A. Huntley, August, 1892—September, 1895; P. K. Blinn, September, 1895—September, 1897; W. F. Crowley, September, 1897—March, 1898; H. H. Griffin, March, 1898—June, 1903; P. K. Blinn, June, 1903.

PRECIPITATION AT CHEYENNE WELLS, CHEYENNE COUNTY, COLORADO

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1891	.....	.....	1.00	2.00	3.10	2.32	4.97	2.35	1.92	T	T	2.25	.....
1892	0.10	0.60	2.25	0.50	.....	3.63	2.09	4.40	T	0.45	0.20	0.96	.....
1893	0.05	T	T	.....	1.10	1.15	2.50	1.64	0.68	T	0.30	0.03	.....
1894	T	1.30	0.10	0.62	2.36	0.48	1.99	1.03	0.14	0.14	T	0.55	8.41
1895	0.67	0.27	0.16	1.67	1.49	3.00	6.38	1.22	T	0.21	0.30	0.42	15.79
1896	0.45	T	0.71	3.41	2.28	3.03	2.27	3.07	0.84	0.78	T	0.60	17.44
1897	0.26	0.10	1.58	1.20	1.44	2.22	4.19	3.24	0.92	2.73	0.10	0.20	18.18
1898	0.03	0.00	0.61	1.10	5.56	3.95	2.09	1.33	2.00	0.48	0.50	0.48	18.13
1899	0.47	0.36	0.39	0.03	2.88	1.89	3.67	0.55	.78	T	2.49	0.55	14.06
1900	0.03	0.67	0.56	9.95	0.80	2.47	2.02	0.30	1.31	0.22	T	0.18	18.51
1901	0.15	0.38	0.71	4.02	1.18	0.90	2.63	2.59	1.12	0.49	0.02	0.25	14.44
1902	T	0.25	1.92	0.78	3.12	2.53	1.42	6.06	0.20	1.32	O	0.75	18.35
1903	0.34	0.79	0.23	0.94	3.71	2.63	1.87	1.89	T	T	0.75	0.13	13.28
1904	T	T	0.11	1.59	2.51	4.78	3.39	4.89	4.26	0.99	0.00	0.29	22.81
1905	0.14	0.35	2.00	5.16	2.13	2.58	2.02	1.12	2.41	0.40	0.00	T	18.31
1906	0.21	0.24	0.89	3.77	1.24	3.00	4.26	2.39	2.36	0.90	0.20	T	19.46
Means	0.19	0.35	0.83	2.45	2.33	2.54	2.98	2.38	1.18	0.57	0.30	0.48	16.58
Agril. Means	0.14	0.27	0.71	1.59	2.28	2.55½	2.29½	2.12	0.88	0.42½	0.06	0.35½	13.79
Max. for month	0.67	1.30	2.25	9.95	5.56	4.78	6.38	6.06	4.26	2.73	2.49	2.25	.....
Min. for month	T	O	T	0.03	0.80	0.48	1.42	0.30	T	T	O	T	.....

Established by the Agricultural Experiment Station. Observers—J. B. Robertson, 1891—April, 1896; J. E. Payne, April, 1896—October, 1901; L. M. Parker, October, 1901—June, 1902; J. B. Robertson, June, 1902.

## MONTHLY RECORD OF PRECIPITATION, 1907

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Denver .....	0.46	0.33	0.54	2.91	2.93	1.15	1.52	0.23	0.74	0.17	0.40	0.45	11.83
Fort Collins .....	0.23	0.36	0.69	2.80	2.44	0.44	2.28	1.27	0.58	0.08	0.44	0.03	11.64
Wray .....	0.12	0.02	0.24	0.94	2.17	1.53	3.39	3.80	1.27	0.03	0.14	0.58	14.23
Hamps .....	0.15	T	0.27	2.38	1.85	0.65	2.59	1.06	0.74	0.02	0.20	0.65	10.56
Yuma .....	0.28	0.02	0.33	0.94	1.43	2.44	3.44	2.58	1.44	0.04	0.24	0.35	13.53
LeRoy .....	0.12	0.05	0.25	0.97	2.85	2.67	2.24	4.19	1.88	T	0.66	0.69	16.57
Cheyenne Wells .....	T	T	0.13	0.72	1.10	2.86	1.98	0.95	1.28	0.25	0.25	0.20	9.72
Rocky Ford .....	T	T	0.00	1.84	1.85	0.69	4.96	0.78	0.33	0.88	2.00	0.26	13.59