

# 1) COLORADO

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## THE STATE AGRICULTURAL COLLEGE.

2) THE AGRICULTURAL EXPERIMENT STATION

3) BULLETIN No. 26. 4)



### I. FARM NOTES FOR 1893.

HOME STATION, Fort Collins, Colorado.

### II. GARDEN NOTES FOR 1893.

HOME STATION, Fort Collins, Colorado.

### III. SEEDING, TILLAGE, AND IRRIGATION.

ARKANSAS VALLEY STATION, Rocky Ford, Colorado.

*Approved by the Station Council.*

*ALSTON ELLIS, President.*

FORT COLLINS, COLORADO.

FEBRUARY, 1894.

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DIRECTOR OF THE EXPERIMENT STATION,

Fort Collins, Colorado.

COLORADO STATE UNIVERSITY



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# Farm Notes for 1893.

(Home Station, Fort Collins, Colorado.)

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BY W. W. COOKE AND F. L. WATROUS.

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## **SANDWICK---A Promising Fodder Crop.**

For several years this crop has been grown at various experiment stations in the United States under the name of the Hairy Vetch (*Vicia villosus*). Sandwich is its German name. In Germany it has long been grown as an important forage crop. It belongs to the pea family, but the leaves are smaller and narrower and the stem not so long but with many branches. Several stems grow from the same root.

The sandwich was grown at this Station in 1893. It was sown in drills, a double row in each 39 inches. About 30 pounds of seed per acre were used. The seed was sown June 10th. The plants were cultivated three times and received one irrigation in July. The growth was not rapid, but in spite of an exceedingly dry summer and fall the plants kept green and continued their growth. The plant has shown itself, in Nebraska, able to withstand the winter, and it bids fair to do the same here, since it is still green at this writing (the last of December) and sending out new growth, although it has been twice covered with snow. The ground was frozen for two weeks in November.

The amount of the crop is enormous. Its green weight at the present time averages 13,400 pounds per acre, and as it has 43 per cent. of dry matter, this growth is equivalent to  $3\frac{1}{2}$  tons of well-dried hay. This is a much heavier growth than that reported from any of the six States where it has been previously grown and shows that it is particularly adapted to Colorado soil and climate.

It is well relished by cattle and horses. The analysis given below shows that it is rich in the albuminoids or flesh producing elements and, hence, well adapted for the production of milk or for fattening cattle. When sown by itself thinly, it spreads close to the ground,

so low that it cannot be cut with a machine or a scythe. Its special use is as fall, winter, and spring pasture, and as such it bids fair to find a large usefulness in this State.

In Germany it is sown with grain, and after the wheat is harvested it covers the stubble with the finest of feed. In this State, where winter wheat or rye is sown, it should do well, as it does not winter-kill and seems to be able to grow with very little water. It also belongs to the class of plants that can draw from the air part of the nitrogen they need and store some of it up in their roots for the use of a crop of wheat. When sown in the spring with oats, sandwick makes an upright growth and can be cut and cured for hay. The oats and the sandwick together make a well-balanced feed for a milch cow.

Seed of the sandwick will be distributed next spring to many parts of the State for trial.

#### ANALYSIS OF HAY OF SANDWICK.

Water.....	10.00	per cent.
Ash.....	8.31	" "
Crude fibre.....	23.05	" "
Fat (Ether extract).....	3.96	" "
Albuminoids.....	15.25	" "
Starch, sugar, etc.,.....	39.43	" "

This analysis would indicate that sandwick is about a fifth more nutritious than an equal amount of alfalfa hay and also better proportioned, being almost a perfectly-balanced food for a milch cow.

#### CORN VERSUS ALFALFA.

Throughout the northern half of the Mississippi Valley corn is the great crop. It produces more feeding material per acre than anything else that can be grown. In Colorado it meets a worthy rival in alfalfa. Both these crops were grown side by side in acre plots on the Station farm in 1893. The land was in good condition and in addition a very heavy application of stable manure was given to the corn ground, so as to show it at its best. Colorado is not so well adapted to corn culture as are Kansas and Nebraska, owing to the cool nights that result from its high altitude and the near presence of the mountains. But the crop of corn to be described would compare well with crops of the Eastern and Middle States, being equivalent to one of their crops of 14 tons of green fodder per acre. It is also fully up to the average of the great corn States of Kansas, Nebraska, and Iowa.

The variety was the Golden Beauty, planted May 16th in hills three feet apart each way, harrowed two times, cultivated four times, and irrigated once. It was harvested September 21st and the entire

crop, ears and stalks, weighed 15,500 pounds per acre. The analysis showed 35.62 per cent. of dry matter, so that the crop contained 5,539 pounds of dry matter per acre.

The alfalfa growing on a neighboring plot was not fertilized and was three years from seeding. It was irrigated twice and cut three times, yielding at the first cutting 4,600 pounds of hay per acre, at the second 3,350 pounds, and at the third 3,250 pounds, a total of 5.6 tons of hay, containing 10,304 pounds of dry matter per acre.

The alfalfa therefore yielded almost twice as much dry matter per acre as the corn. But this is not quite a fair comparison, for a pound of dry matter from the corn crop is more digestible and has a higher feeding value than an equal amount from the alfalfa. The corn crop contained **3,605** pounds of digestible feeding material, while the crop of alfalfa contained **5,611** pounds, or a little more than half as much again. The corn crop per acre in feeding value was equivalent to three and a half tons of alfalfa hay.

There is no doubt but that it costs much more to grow and harvest the corn than the alfalfa. Moreover, while the corn crop rapidly exhausts the soil, the alfalfa sends its roots deep into the soil, and gathers stores of plant food from the air, so that it seems, for the present at least, to benefit rather than deplete the land.

It is evident that in the irrigated portions of Colorado, alfalfa is a more profitable crop than corn.

YIELD PER ACRE OF CORN AND ALFALFA.

	TOTAL.		DIGESTIBLE.	
	Corn. lbs.	Alfalfa. lbs.	Corn. lbs.	Alfalfa. lbs.
Dry Matter .....	5,539	10,304	3,605	5,611
Albuminoids .....	405	1,602	296	1,198
Starch, sugar, etc .....	3,263	4,782	2,186	3,114
Fibre .....	1,472	2,800	1,060	1,198
Fat .....	84	246	63	101
Ash .....	315	829	.....	.....

## GRAINS.

### WHEAT.

Plot.	VARIETY.	Date of Planting.	Date of Harvest.	Yield per Acre in Bushels.
A 14-21	Polish .....	April 27	August 8	13.5
A 34-41	Improved Pife .....	April 27	August 8	16.4
B 1	Gypsum .....	April 28	August 8	20.0
B 2	Ontario .....	April 28	August 8	20.0
B 3	Egyptian Flint .....	April 28	August 8	2.5
B 4	Mica .....	April 28	August 8	failed
B 5	Dominion .....	April 28	August 8	15.0
B 6	Algerian, No. 2 .....	April 28	August 8	13.3
B 7	China Spring .....	April 28	August 8	17.5
B 8	Feldspar .....	April 28	August 8	13.3
B 9	Canadian Club .....	April 28	August 8	16.7
B 10	Golden Drop .....	April 28	August 8	13.3
B 11	Prussian .....	April 28	August 8	20.0
B 12	Uxbridge .....	April 28	August 8	20.0
B 13	Chili .....	April 28	August 8	25.0
B 14	Nox No. 5 .....	April 28	August 8	20.0
B 15	Eldorado .....	April 28	August 8	13.3
B 16	Defiance .....	April 28	August 8	27.5
B 17	Royal 345 .....	April 28	August 8	13.3
B 18	India No. 1 .....	May 2	August 9	40.0
B 19	India No. 3 .....	May 2	August 9	8.8
B 20	India No. 4 .....	May 2	August 9	13.3
B 21	India No. 6 .....	May 2	August 9	10.0
B 22	India No. 9 .....	May 2	August 9	15.0
B 23	India No. 12 .....	May 2	August 10	5.0
D 2	Australian Club .....	May 2	August 8	24.5
D 3	Clawson .....	Oct. 7, 1892	July 29	33.2

### OATS.

B 24	American Beauty .....	May 2	August 10	13.3
B 25	Chinese Hulleless .....	May 2	August 10	17.5
B 26	Fox Excelsior .....	May 2	August 10	20.0
B 27	Swiss Black .....	May 2	August 10	40.0
B 28	Golden Giant .....	May 2	August 10	22.5
B 31	Colorado Excelsior .....	May 2	August 14	12.5
B 32	New Zealand .....	May 2	August 14	40.0
B 33	Canadian .....	May 2	August 14	30.0
A 22-31	Excelsior .....	April 27	August 8	24.0
G 1	Fox Excelsior .....	May 10	August 8	26.0
G 2	Silesian .....	May 10	August 8	37.0
G 3	Black Tartarian .....	May 10	August 8	20.0
G 4	Colorado Excelsior .....	May 10	August 8	25.0
G 5	Excelsior .....	May 10	August 8	15.0
G 6	Excelsior .....	May 10	August 8	15.5

### BARLEY.

A 1	Guy Malye .....	May 15	August 8	24.0
G 7	Success .....	May 11	August 8	21.0

All grains were irrigated twice, once in June and once in July.

## SUGAR BEETS.

Plot.	VARIETY.	Date of Planting.	Date of Harvest.	Yield per Acre. lbs.	Sugar. Per Cent.	Purity Co-efficient.	Sugar per Acre. lbs.
A 7	Dippe's Klein Wanzelbener	May 16	Sept. 10	12,440	12.70	81.1	1,579
A 8	Original Klein Wanzelbener	May 16	Sept. 10	11,390	9.30	60.8	1,059
A 9	Elvoir .....	May 16	Sept. 10	15,680	9.85	70.6	1,544
A 10	Desprez .....	May 16	Sept. 11	9,725	9.04	72.3	879
A 11	Vilmorin, Improved .....	May 16	Sept. 11	15,280	19.40	64.6	1,589
A 12	Knauer's Imperial .....	May 16	Sept. 11	14,680	10.01	59.4	1,468
A 13	Gov't. Klein Wanzelbener.	May 16	Sept. 11	12,690	13.05	60.0	1,650
G 1	Desprez .....	May 22	Sept. 12	24,186	10.12	63.2	2,443
G 2	Klein Wanzelbener .....	May 22	Sept. 12	27,188	12.97	76.3	3,534
G 3	Original Klein Wanzelbener	May 22	Sept. 13	26,988	13.06	68.7	3,510
G 4	Elvoir .....	May 22	Sept. 13	19,632	9.02	61.3	1,771
G 5	Vilmorin, richest .....	May 22	Sept. 14	18,018	10.90	72.7	1,964
G 6	Klein Wanzelbener .....	May 26	Sept. 14	37,660	9.70	56.6	3,653
G 7	Klein Wanzelbener .....	May 26	Sept. 14	33,390	9.03	56.4	3,015
G 8	Desprez .....	May 26	Sept. 14	38,430	9.25	60.5	3,555
G 9	Elvoir .....	May 26	Sept. 14	33,644	4.88	44.4	1,642

All the sugar beets were cultivated four times, and all but the last four varieties were irrigated twice. These four kinds were put on ground that was moist enough without irrigation, and it will be noted that they made the largest growth of all. But the abundance of water exerted the usual effect of decreasing the per cent. of sugar.

## MISCELLANEOUS FODDER CROPS.

During the season of 1893 quite a large number of crops were tested as to their value for forage under the conditions of Colorado soil and climate.

Both German and Golden millet were raised, but in both cases the amount grown was small. Four varieties of Soy Beans were sown May 23rd. The growth was slow, though they were the hardiest varieties of this plant. None of the seeds ripened and but few pods formed. The crop was far too small to be profitable. The same remarks would apply to the crops of Mexican beans and of lentils.

An extensive trial of sorghums was made, principally of the saccharine varieties, fifty-two kinds being tested. Although the frost held off longer than usual, yet when the first freeze came, September 23rd, only one kind—Haori—had matured seed. The amount of forage from the largest kinds was not equal to an average crop of corn.

Several varieties of non-saccharine sorghums had reached the following stages of growth when they were killed by the frost September 23rd:

Red Millo Maize—Seeds partly mature.

White Millo Maize—Seed heads beginning to show.

Red Kaffir Corn—No seed.

Egyptian Rice Corn—Grain not filled.

White Kaffir Corn—No seed stalk.

African Millo Maize—No seed stalk.

Brown Dhoura—Not quite ripe.

Jerusalem Corn—Fairly well matured.

These crops had all been cultivated and irrigated and had had the advantage of a late fall, and yet the growth was not nearly up to an average corn crop. It was not one-third of what would be considered a fair crop for these fodder plants in Nebraska.

The reason for the failure of all these fodder crops is the same, *i. e.*, the cool nights of summer. They are all hot-weather plants, and there is not much use in Colorado farmers trying to raise them in high altitudes near the mountains.

#### THE LEAVES AND STEMS OF ALFALFA HAY.

The leaves of alfalfa hay fall off very readily from the stems. A little pounding was sufficient to separate a quantity of the hay into two equal parts, one of which was mostly leaves with a few short stems, and the other mostly stems. Samples of each gave analysis as follows for the dry matter :

	<i>Leaves.</i>	<i>Stems.</i>
Ash.....	12.36	7.05
Crude fire.....	25.68	42.47
Fat (Ether extract).....	3.46	2.95
Albuminoids.....	13.12	8.61
Starch, sugar, etc.,.....	45.38	38.92

#### DIGESTIBLE PORTIONS OF DRY MATTER.

	<i>Leaves.</i>	<i>Stems.</i>
Crude fibre.....	11.04	18.36
Fat (Ether extract).....	1.38	1.15
Albuminoids.....	9.84	6.46
Starch, sugar, etc.,.....	29.49	25.30
Total digestible material in 100 lbs of dry matter..	51.75	51.27
Nutritive ratio.....	1 : 4.5	1 : 7.2

It will be seen that the two are about equally digestible. But they are quite different in the proportions of their digestible parts. The stems are properly proportioned for horses at moderate work, while the leaves are well adapted to the needs of growing calves and yearlings.

#### CURING CORN FODDER.

It has been generally assumed that in the dry climate of Colorado all forage crops would cure rapidly, perfectly, and with little or no loss of feeding value. Experiments during several years at the Vermont Station have shown that, in that damp climate, with frequent fall rains, it is possible to cut corn while still green, set it up in large shocks, and have it dry out and cure with a loss of from 18 to 25 per cent. of its entire feeding value.

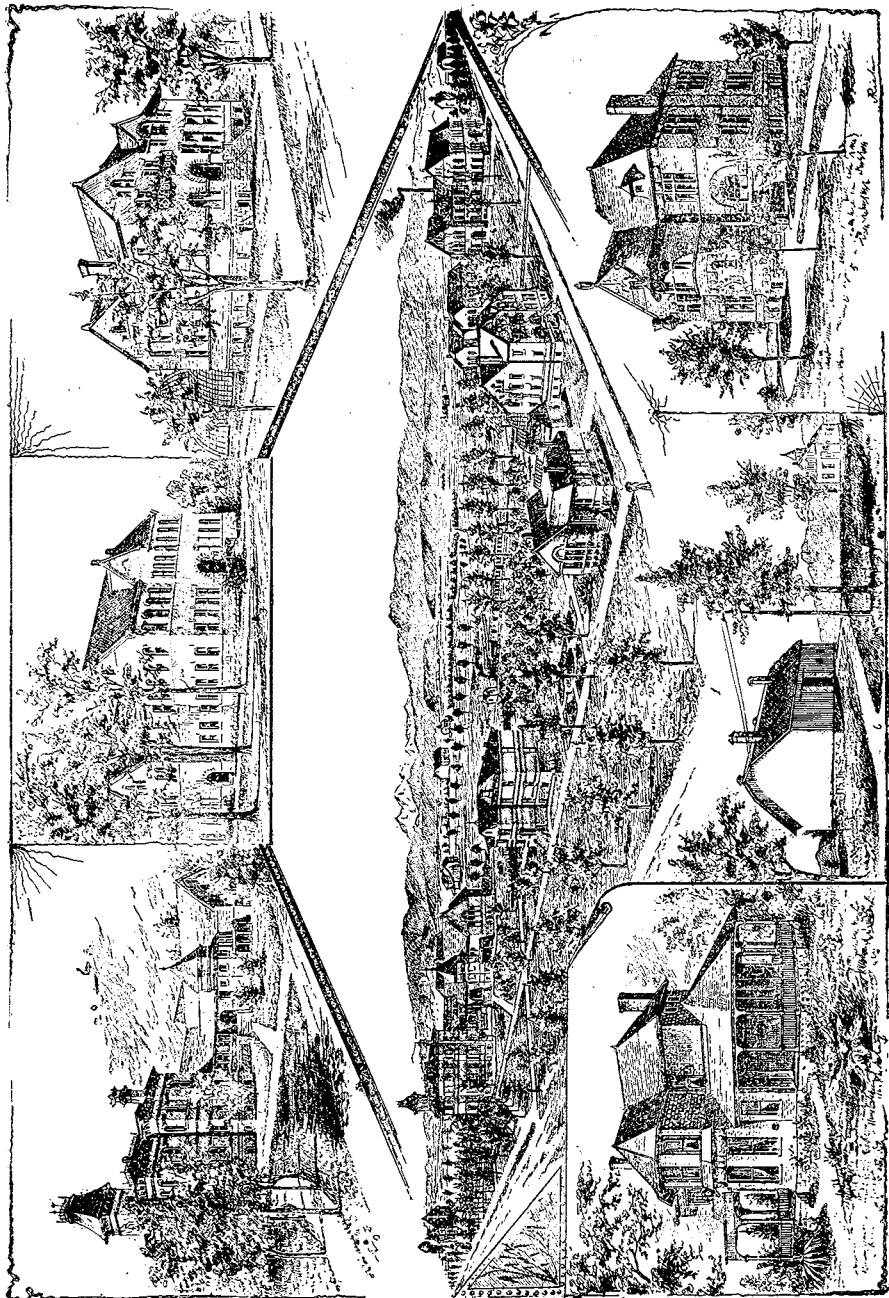


A similar test was made during the fall of 1893 at this Station. A lot of corn was cut up September 23rd, and, without pulling off the ears, was set up in a shock. Samples were taken for analysis at the time of shocking, and three months later the whole shock was cut up into quarter inch pieces and again weighed and samples taken.

The weights and analyses showed that the corn had lost 62.50 per cent. of its weight and, what was most important, had lost **34** per cent. of its dry matter, and therefore of its feeding value. There was no sign of heating or mouldiness; the leaves were still bright green; but there was a decided smell of fermentation that reminded one strongly of ensilage.

This of course is but one trial, and the first that has been made in the State. Further tests will be made to ascertain more fully what the losses are from drying corn fodder in this climate.

Credit should be given to the Chemical Section of the Station for all the analyses mentioned in this bulletin.



THE GROUNDS AND BUILDINGS OF THE STATE AGRICULTURAL COLLEGE, FORT COLLINS, COLORADO.

# Garden Notes for 1893.

(Home Station, Fort Collins, Colorado.)

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BY CHAS. S. CRANDALL AND M. J. HUFFINGTON.

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## TOMATOES.

*Sowing the Seed.*—Seed should be sown in forcing-house or hot-beds by the first of March ; the last week in February would, doubtless, not be any too early. As we generally have a cutting frost in this locality from the 10th to the 15th of September, every effort should be made to force the plants as much as possible, so that the bulk of the crop will be off before that time. For the south where the season is longer, we would still recommend giving the plants an early start. To realize the best results we should have strong, stocky plants, and to accomplish this strict attention should be given to regulating the heating, airing, and watering. All the conditions should be as uniform as possible ; an even temperature should be aimed at and water should be applied at regular intervals, the forenoon being the best time. The water used should not be too cold ; the sudden chill resulting from the application of ice-cold water is very injurious to the plants. On bright, pleasant days the plants should have plenty of air and as the season advances the exposure should be increased, so that when the plants are transferred to the open ground the change will not be felt by them. Care should be taken at all times that the plants do not get chilled from a sudden fall in temperature ; the check in growth resulting from any such sudden change affects the plants for some time and greatly retards their development.

Transplanting once or twice before being taken from the beds to open ground is conducive to a more stocky growth and a better root system. The time for removing plants to open ground must be governed by experience in particular localities. In this latitude plants for extra early fruit may be set between the 15th and 25th of May. Do not plant the entire crop so early that a late frost might kill the plants ; it is a good plan to hold some plants in reserve for replacing those that may receive injury from frost.

*Soil.*—Where earliness is aimed at the best soil for the tomato is a light, sandy loam; the ground should not be too rich, or an over luxuriant growth of plant will be the result to the detriment of earliness. A shovel full of well-rotted barn-yard manure thoroughly incorporated with the soil where the plants are to be set will increase their productiveness and hasten maturity. There seems to be an advantage in not manuring the whole surface when earliness is desired. If only a space of 10 or 12 inches is fertilized around the plant, this will be sufficient to stimulate plant growth until the fruit begins to ripen, after which we do not wish the plant to increase in size but bend all its energies toward ripening its fruit. Should the ground be manured broadcast the growth will continue much longer.

*Varieties Grown in 1893.*—Seed of 15 varieties was sown on March 14th in flats in the forcing-house. The young plants made their appearance in from 9 to 11 days from time of seeding. When three or four inches high they were transplanted to 4-inch pots, in which they were allowed to grow until set in the open ground. On June 6th, 12 plants of each variety, excepting Royal Red, of which there were 24, were set in the garden in rows 4x5 feet. Clean culture was given throughout the season. Water was applied four different times as follows: June 15th, July 3rd and 17th, and August 8th. Cultivation should cease and water should be withheld after fruit begins to ripen, as further stirring of the soil and the application of water would induce plant growth and thus retard the maturity of fruit.

#### VARIETIES.

*Aristocrat.*—A dwarf variety, more erect than the Dwarf Champion, a strong, stocky grower, early—the first fruits being picked August 15th. It possesses the advantage of ripening its fruit rapidly, a desirable feature in a market variety. Fruit medium size, smooth and solid, of a beautiful scarlet color. It greatly exceeds Dwarf Champion in productiveness, but falls considerably below some other varieties, such as Puritan, Ignotum, and Table Queen.

*Buckeye State.*—Plant vigorous in growth, fruit large, fairly smooth, in color resembling the Mikado or Turner Hybrid. The variety, however, can not be recommended because the fruit ripens slowly and is not solid.

*Gold Ball.*—A rank-growing variety, very productive for a tomato of its class; fruit small, oval, smooth, a beautiful golden yellow, firm, and solid; fine for preserving or pickling. Its size, shape, and color are against it as a market variety.

*Ignotum.*—Originated at the Michigan Agricultural College in 1887, introduced in 1889. A strong, healthy grower possessing many points of excellence; fruit ripens medium early, is large, regular in shape, solid and remarkably smooth, of a bright scarlet

color. For slicing and canning it would be difficult to find its superior.

*Large Rose Peach.*—Plant a remarkably strong grower, very productive, fruit early, nearly round, rose-peach color, very soft, containing many seeds. This is one of the novelties, but has no qualities that would recommend it as a variety for general culture.

*Matchless.*—This is a variety of the Ignotum type, possesses vigor of growth, but falls far below Puritan, Potato-leaf, and Ignotum in productiveness. It ripens medium early, is fairly large, very smooth, and has an attractive scarlet color.

*Peach.*—The fruit of this variety possesses the same general characters as that of the New Rose Peach, except that it is much smaller. The habit of growth of the plant is, however, quite different, being much more compact. It deserves no place in a collection of varieties, except as a curiosity.

*Ponderosa.*—A variety introduced in 1892 by Peter Henderson & Co. Plants seem to lack vigor, and the variety appears to be not well fixed; out of 12 plants there were four distinct types. Fruits nearest the introducer's described type were very large, many single specimens weighing over one pound, quite smooth for so large a fruit, a little ridged about the stem, solid, slow in ripening, color as in Mikado. When by further selection the apparent good qualities of this variety become fixed so that their reproduction is assured, it will be valuable.

*Potato-leaf.*—This is a distinct variety originated by Livingston & Sons, and introduced by them in 1887. The foliage resembles that of the potato, as the name implies. Plant a strong grower, ripens its fruit rapidly, and is very productive; the fruits are medium large, very smooth and solid, color the same as in Mikado. This is a fine tomato for canning and also a good market sort.

*Puritan.*—A variety of New England origin, introduced by Rawson of Boston. The plants are strong and stocky. This was the first variety to ripen fruit; fruit large, solid, sometimes slightly furrowed about the stem, ripens very evenly, color a deep scarlet. The Puritan was the most productive desirable variety under test, and is one that will give entire satisfaction.

*Royal Red.*—Seed from Livingston & Sons, originators. Plant a remarkably vigorous grower, not as early as some; fruit large, solid, smooth, occasionally slightly furrowed about the stem; color a beautiful cardinal-red. A desirable variety.

*Table Queen.*—Seed from Peter Henderson & Co., introducers. A good grower, medium early, productive; fruit large, solid, generally smooth, sometimes slightly ridged, color as in Mikado. A variety that will give general satisfaction.

*Trucker's Favorite.*—A vigorous variety, productive, ripening fruits as early as Ignotum and Table Queen, but at succeeding pick-

ings falling below those varieties in quantity of fruit ripened; showing a tardiness in the matter of ripening, which makes the variety undesirable, at least for this locality. The fruit is large, very smooth, dark pinkish-purple in color.

*Shah.*—Seed from Peter Henderson & Co., introducers. The foliage of this variety is of the Potato-leaf type. The plants were vigorous, and the most productive in our test; fruit begins to ripen early, is of large size, golden yellow, firm and solid; as the season advances the fruit becomes more and more irregular in shape, the late pickings yielding only very ill-formed and undesirable fruits. Its color and poor shape would exclude it from the list of market varieties.

*Dwarf Champion.*—Seed from Peter Henderson & Co. This variety did very poorly this season; it was the least productive of those under test. Fruit ripened early, was small, below the usual size, smooth and solid; color as in Mikado. As a dwarf variety Aristocrat is far preferable to Dwarf Champion, producing as much again fruit.

The following table shows the comparative earliness of varieties, number of fruits picked, weight of same, and approximate yield per acre in pounds of ripe fruit, and also the yield of green fruit. The figures in the columns showing yield per acre being derived from so small an area, can be regarded as only approximate.

VARIETIES.	No. of Plants.		No. of Ripe Fruits Picked.	Weight in lbs.	Average Weight per Plant.	Weight of Three Specimens.	Yield per Acre in lbs.	No. of Green Fruits picked Sept. 23rd.	Total Weight of Green Fruits in lbs.	Average Weight of Green Fruits per Plant in lbs.	Yield of Green Fruits per Acre in lbs.
	First Ripe Fruits.	Last Picking.									
Aristocrat .....	12	Aug. 15	216	46.96	3.91	1.1	8,515	262	45.96	3.83	8,341
Buckeye State .....	9	Aug. 22	102	30.91	3.43	1.7	7,470	345	71.73	7.97	17,358
Gold Ball .....	12	Aug. 14	581	50.24	4.18	.4	9,104	846	59.40	4.95	10,781
Ignotum .....	11	Aug. 23	183	52.89	4.80	1.5	10,454	280	74.47	6.77	14,745
Large Rose Peach .....	11	Aug. 17	229	44.81	4.07	1.0	8,864	853	121.20	11.01	23,979
Matchless .....	11	Aug. 22	106	27.54	2.50	1.3	5,445	266	64.13	5.83	12,697
New Dwarf Champion .....	9	Aug. 11	109	18.50	2.05	.6	4,464	126	19.98	2.22	4,835
Peach .....	12	Aug. 17	313	28.12	2.34	.7	5,096	1,277	81.36	6.78	14,766
Ponderosa .....	11	Sept. 2	91	37.54	3.41	5.2	7,426	293	74.58	6.78	14,766
Potato-Leaf .....	11	Aug. 17	320	78.60	7.14	1.4	15,550	375	85.91	7.81	17,010
Puritan .....	12	Aug. 7	257	87.08	7.25	1.7	15,790	406	118.30	9.85	21,453
Royal Red .....	23	Aug. 23	328	112.08	4.87	1.7	10,606	957	118.25	10.28	22,389
Table Queen .....	12	Aug. 23	220	75.46	6.28	2.1	13,677	443	131.10	10.92	23,773
The Shah .....	12	Aug. 16	353	109.76	9.14	2.2	19,906	284	78.90	6.57	14,303
Trucker's Favorite .....	12	Aug. 23	156	41.77	3.48	1.8	7,579	461	117.20	9.76	21,237

## BEANS.

*Bush or Snap Beans.*—As the bean plant is very tender and easily injured by low temperatures, the seed should not be planted until all danger of the young plants being nipped by late spring frosts is over. It is a good rule to make the first planting about the

same time that corn is planted, which for this latitude is about the 15th of May. By making a succession of sowings at intervals of about two weeks, their season may be prolonged until frost. The bean plant succeeds in a great variety of soils, and will produce a fair crop on land that is only moderately enriched; yet it readily responds to good treatment, and as is the case with most crops is more productive and profitable when grown on ground that is in a high state of cultivation.

While only five varieties of beans were tested at this Station the past season, yet the results, so far as these varieties are concerned, were very satisfactory. No damage was done by the bean weevil or any other insect pest. The main points brought out were those of comparative earliness and productiveness. In the matter of earliness there was but little difference in the time of edible maturity, the first picking of each variety being made on the same date, but as will be seen from the following table there is a wide difference in the quantity of marketable beans gathered from the different varieties at the first picking, a fact which it seems should decide the earliest variety, or at least the earliest productive one.

On May 16th, four rows, 93 feet long and 15 inches apart, were planted of Cylinder Black Wax, Golden Wax, Henderson's Earliest Red Valentine, Round Six Weeks, and Yosemite Mammoth Wax. Clean culture was given throughout the growing season with the hand cultivator; water was applied three times on the following dates—June 16th and July 3rd and 19th. The first beans of marketable size were picked on July 18th, nine weeks from time of planting.

*Cylinder Black Wax.*—A wax sort as the name indicates; pod round, somewhat curved, light yellow,  $4\frac{1}{2}$  to  $5\frac{1}{2}$  inches long, seed black; a good variety.

*Golden Wax.*—Pod flat, beautiful golden yellow, 5 to 6 inches long; this variety is more extensively grown for market than any other, being productive, of fine appearance, and a good shipper; the very best of the wax sorts; seeds white, variously marked with purple.

*Henderson's Earliest Red Valentine.*—Pod round, light green,  $4\frac{1}{2}$  to  $5\frac{1}{2}$  inches long; a popular variety of the green-podded sorts, and largely grown for pickling; seeds mottled in various shades of red.

*Round Six Weeks.*—The earliest and most productive variety under test; pods flat, 5 to 6 inches long, of a light green color, an excellent variety; seeds uniformly of a dull yellowish-white color.

*Yosemite Mammoth Wax.*—Pods round, very much curved, 7 to 8 inches long, light yellow; this is a mammoth variety, but it can not be recommended as it is not productive, and ripens very slowly; seed black.

*Bush Lima Beans.*—With the introduction of the Bush Lima a great event is marked in the history of this popular vegetable; now

its cultivation is easy and simple, requiring no hills or stakes as with the pole Limas, and they are from a week to ten days earlier. They require a richer soil and more attention than the snap sorts, but well repay the grower for his trouble; as they are more tender than the bush varieties they should be planted a week later; they do best in a warm loamy soil that is highly manured; the plants being somewhat larger more room should be given them than is required by the snap sorts.

*Burpee's Bush Lima.*—This is indeed a valuable acquisition, possessing, as it does, extreme earliness, productiveness, and large size, and having that bushy habit of growth it requires no poles or stakes whatever for it to run upon; the plant grows from 15 to 24 inches high, branching freely, forming a bush 12 to 18 inches in diameter. The pods are long, producing three or four mammoth beans to each; they are tender and of fine flavor. Seed planted May 16th produced marketable beans (in the green state) August 16th, three months from the time of planting. One hundred pods green beans weighed 2.7 pounds; these shelled gave 1.1 pounds of beans.

*Henderson's Bush Lima.*—This is a vigorous and productive variety, though not so rank a grower as Burpee's Bush Lima; the leaves are of a much darker green. The beans are much smaller, and four days later in maturing. One hundred pods, green, weighed 1.2 pounds; these shelled gave .5 pounds of beans.

*Willow-leaf.*—This novelty was brought before the public in 1891 by W. A. Burpee & Co. It is a distinct variety; the divisions of the leaves are long and narrow, resembling the leaves of the willow, whence the name. It is really worthy of growing as an ornamental climbing vine, the rich dark green leaves making a very pretty effect, with the great profusion of bloom that continues throughout the season; aside from its use as an ornamental vine it is very productive, though not so early by ten days or two weeks as the bush Limas; the pods are larger than those of Henderson's Bush Lima; the beans pure white, tender, and of fine flavor.

VARIETIES.	Date of 1st Pick- ing.	Weight in lbs.	Date of 2nd Pick- ing.	Weight in lbs.	Date of 3rd Pick- ing.	Weight in lbs.	Date of 4th Pick- ing.	Weight in lbs.	Total Weight of Green Beans Picked.	Approximate Yield per Acre in lbs.	Weight of Dry Beans Picked.	Approximate Yield per Acre.
Cylinder Black Wax ..	July 24	4.37	July 28	11.50	Aug. 2	41.60	Aug. 9	59.10	116.57	10,841	16.31	1516
Golden Wax .....	July 24	2.53	July 28	8.30	Aug. 2	37.40	Aug. 9	75.20	123.43	11,478	15.15	1408
Henderson's Earliest Red Valentine.....	July 24	7.48	July 28	11.30	Aug. 2	32.70	Aug. 9	45.30	96.78	9,000	15.61	1451
Round Six Weeks.....	July 24	12.92	July 28	36.02	Aug. 2	55.90	Aug. 9	90.00	194.84	18,120	15.55	1446
Yosemite Mammoth Wax .....	July 24	.79	July 28	1.12	Aug. 2	8.00	Aug. 9	9.00	18.91	1,758	.....	.....



## EGG-PLANT.

This is a vegetable that is not as well known or as highly appreciated as it should be; especially is this true in the West. When properly prepared and cooked, egg-plants make a very appetizing dish, not much inferior to the world-famed fried oyster. Being natives of tropical America they at all times require a high temperature, and for that reason succeed better at the south than at the north.

For this locality seed should be sown from the first to the middle of March. When grown in hot-beds the plants should be separated from the frames containing plants of a hardier nature by a partition running across the bed; in this way more heating material can be used under the egg-plant beds and each lot of plants can be kept at the proper temperature, which would be hard to regulate were they not separated; more attention should be given to covering sash at night with mats or straw, than is required by the tomato or cabbage. Nothing is gained by transplanting too early to open ground, as the plants will not make any growth until the weather becomes warm. For this latitude, June 1st is about the proper time to set in garden. The egg-plant is a heavy feeder and the soil can not be too rich for its best development; a warm, sandy loam is where it gives the best results. Belonging to the same genus as the potato, it often happens that the potato beetle is quite troublesome; a mixture of paris green and flour—one ounce of the former to six pounds of the latter—dusted through a cheese-cloth bag over the plants while the dew is yet on, will kill the pests.

The egg-fruit is fit for use from the time it is the size of a turkey's egg until it is five or six inches in diameter, or until the seeds begin to harden, which indicates that the fruit is maturing.

March 15th, seeds of Early Long Purple, Black Pekin, and New York Improved were sown in the forcing-house; June 6th the plants were set in open ground, the same distance apart as tomatoes; they were given the same culture, and were irrigated on the same dates as the tomatoes.

*Black Pekin.*—One of the newer varieties of superior excellence; fruit of a glossy, almost black color, globular in form and solid; this variety is earlier than the New York Improved, and of finer flavor; average weight of ten specimens, 1½ pounds each.

*Early Long Purple.*—Early and productive; fruit long, nearly the same size at both ends, of a deep purple color; this variety does not attain the size of either of the others tested. Average weight of ten specimens, 6½ ounces each.

*New York Improved.*—This is a leading market variety; the plant is a stronger grower than the early long purple, the leaves and stems are thickly studded with spines, which do not appear to any

great extent on the other varieties. The fruit is pear-shaped, large, purple in color. Average weight of ten specimens,  $1\frac{1}{2}$  pounds each.

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### PEPPERS.

Seeds should be sown in hot-beds or forcing-house from the first to the middle of March. As peppers are among our most tender vegetable plants, more care should be given them than is required in growing tomato plants; at all times they need a high temperature; strict attention should be given to the details of heating, airing, and watering as recommended for the tomato; every effort should be made to keep the plants in a vigorous growing condition; at no time allowing them to receive a check to their growth. Plants may be set in open ground about a week after tomatoes are planted; a warm, mellow soil that is highly improved is the best for their development. Seeds of the varieties herein described were sown in forcing-house March 15th; plants transplanted to open ground on June 6th. They received the same culture as tomatoes, water also being applied on the same days. The varieties designated as sweet, and being used in the green state, are a different type from the Cayenne, and while green are sliced and served like tomatoes with vinegar and salt. The varieties of the Bell and Bull-Nose type are also used for making mangoes; the large green peppers are cut in half, filled with chow-chow pickles, tied up, and placed in jars or cans containing vinegar, where they remain until wanted for use.

*Cardinal*.—A variety of recent introduction; pods from 5 to 6 inches long, tapering to a point, color bright cardinal. Sweet when used in the green state. From one plant, 31 peppers were picked which weighed 1.5 pounds; the three best specimens weighed .4 pound.

*County Fair*.—A variety resembling somewhat the Cardinal; pods larger,  $4\frac{1}{2}$  to  $5\frac{1}{2}$  inches long, regular in shape, obtusely pointed, of a dark red color; a very showy pepper, used in the natural state and for mangoes. From one plant, 27 pods were picked which weighed 2 pounds; the three best specimens weighed .4 pound.

*Black Nubian*.—A distinct variety, foliage of a black green color; pods  $4\frac{1}{2}$  to 5 inches long, obtusely pointed, of a glossy black color, making quite a pretty contrast with the fiery red and golden colored varieties. This pepper is mild and may be used in the natural state. From one plant, 24 pods were picked which weighed .7 pounds; the three best specimens weighed .3 pound.

*Golden Dawn*.—Of the Bell or Bull-Nose type, early, pods  $3\frac{1}{2}$  to 4 inches long, of a beautiful golden yellow color when ripe; mild, used in the green state and for mangoes. From one plant 22 pods were picked which weighed 1.6 pounds; the three best specimens weighed .4 pound.

*Long Red Cayenne.*—From this, a representative of *Capsicum annuum*, and also from the shrubby *Capsicum*, *Capsicum frutescens*, is manufactured the red or cayenne pepper of commerce. Our seed of this variety was not true to name, there being no less than five types varying from the small pyriform shape, not over an inch long, to the long pointed type 5 to 6 inches long, which is the true cayenne; the color is a bright red. From one plant 80 pods were picked which weighed 1.2 pounds; the three best specimens weighed .3 pound.

*Mammoth or Sweet Mountain.*—A large sweet pepper of the Bell or Bull-Nose type used in the natural state, and also grown largely for mangoes; pods  $4\frac{1}{2}$  to  $5\frac{1}{2}$  inches long, of a deep red color when ripe. From one plant 13 pods were picked which weighed 1.6 pounds; the three best specimens weighed .8 pound.

*Red Cluster.*—This is a distinct variety of very showy appearance, producing a profusion of pods which point upward, making a very ornamental plant when the peppers are ripe. Owing to its small size this variety is chiefly grown for pickles. From one plant 460 pods were picked which weighed 1.1 pounds.

*Ruby King.*—The largest variety of the Bell or Bull-Nose type; pods 5 to  $5\frac{1}{2}$  inches long, used in the natural state and also for mangoes. From one plant 22 pods were picked which weighed 2.5 pounds; the three best specimens weighed .9 pound.

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## SWEET CORN.

While our sweet corn the past season did all that we could expect in the way of making a vigorous growth and producing a large number of ears, clearly showing the comparative earliness and productiveness of the varieties under test, yet by far the greater portion of the crop was destroyed by boll or corn worms. These pests are generally supposed to be more destructive at the south than at the north, but it would be hard to imagine their being more numerous, or doing more damage to the corn crop in any other section of the country, than here during the season of 1893. By actual count from  $92\frac{1}{2}$  per cent. to 97 per cent. of the ears had been entered by worms. They have no less than a dozen food plants; attack corn in the growing shoot, the tassel, and the grains in all stages. They seem to prefer sweet corn to the field varieties. There are normally two broods of these worms that feed upon corn, exceptionally three; the eggs are deposited on the leaves of the corn and the newly-hatched larvæ begin feeding at once on the spot of their birth, eating many irregular holes through the leaves. The first brood usually makes its appearance early enough to feed upon the staminate

flowers or tassels, before the ears are formed; this first brood did but very slight damage the past season, but the second brood was very destructive. The eggs of the second brood were laid upon the ends of the husks or on the silk, the worms attacking the ears, often cutting several grooves the whole length of the ear, thus rendering it unfit for use; they by no means confine themselves to a single ear, during their work of destruction, but go from one to another. As yet no very effective means have been discovered by which we can combat the boll worm; having so many food plants it is hard to exterminate them. For some sections of the country, plowing fields deep in December and January is recommended, as by turning up the soil at that season many of the early moths will be killed; hand-picking may be practiced where the area is small, as in family gardens, but it is a slow means of getting rid of them, and would be too expensive in large fields; building fires in the fields in early spring will attract many of the early moths, and thus destroy them.

For this latitude, from the 15th to the 20th of May is early enough to make the first planting. By making a succession of plantings of the early, medium, and late sorts, at intervals of about ten days or two weeks, it may be had in the green state until frost. Corn matures more quickly on a sandy loam, but attains a larger size when grown on clay or bottom land; the soil can not be too rich for it.

On May 15th, four varieties of sweet corn were planted in rows 3x3 feet, there being 150 hills of each kind. The ground was cultivated at frequent intervals until the corn was in bloom, after which the ground was not disturbed; water was applied on June 21st and July 8th and 22nd. The first marketable ears pulled were of the Cory Early variety on August 2nd, 77 days from time of planting.

*Cory Early*.—The earliest variety under test, stalks 4½ to 5 feet high; ears 7 to 8 inches long; mostly eight-rowed, kernels flat, large, creamy white; marketable maturity, August 2nd. This variety ranks second in number of ears produced. Ninety-five per cent. of the ears were injured by worms.

*Early Minnesota*.—The second variety to mature; stalks 5½ to 6 feet high, ears 8 to 9 inches long, 8 to 10-rowed, mostly eight, rows close; kernels large, whiter than those of Cory Early. Marketable size August 11th, ranking first in number of ears produced; 92½ per cent. of the ears injured by worms.

*Crosby's Early*.—Third in time of marketable maturity; stalks 6½ to 7½ feet high, ears 7 to 8 inches long, 12 to 14-rowed, rows close; kernels small to medium, roundish, white; marketable size August 16th, ranking third in number of ears produced; 95½ per cent. of ears injured by worms.

*Country Gentleman*.—A late variety of strong growth, stalks 8 to 10 feet high, ears 8 to 9 inches long, rows irregular, kernels medium size, roundish, white; marketable size, August 22nd. This variety produced the least number of ears; 97 per cent. of the ears injured by worms.

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## CABBAGE.

When grown for early use seed should be sown in forcing-house or hot-beds from the first to the middle of February. As cabbage plants, if well grown, will stand considerable frost without injury, they may be set in open ground from the 10th to the 15th of April; for the late or winter crop seed should be sown in open ground from the 15th to the 20th of May. Plants will then be ready to transplant to the field from the 25th to the last of June. The cabbage is a very heavy feeder and thrives in a deep, rich, loamy soil.

On April 12th, seeds of the ten varieties named in the accompanying table were sown in flats in the forcing-house; plants were set in garden on June 6th, in rows  $2\frac{1}{2}$  feet apart, and 2 feet apart in the rows. Plants were given thorough cultivation with horse cultivator and hand hoes; water was applied on July 5th, 19th, and 31st, and on August 18th. As most of the varieties in our test were of the Flat Dutch type, and there being no very marked difference in habit of growth or form of head of the different kinds, a description of each is not necessary. The two varieties in which there was a readily distinguishable difference from the Flat Dutch type may be mentioned: *Burpee's World Beater* and *Perfection Drumhead Savoy*.

*Burpee's World Beater*.—A late variety, of very large size, producing the largest heads of any under test; spreading in habit of growth; leaves of a dark green color, heads round and solid; this is apparently a good late variety, and will prove a good keeper, as it was the latest to mature, and showed no signs of bursting.

*Perfection Drumhead Savoy*.—This variety is different in type from any others tested; the stems are short, leaves dark green and very much wrinkled; heads small, round, not so solid as those of the other types owing to the peculiar wrinkling of the leaves. The Savoy class deserves more attention than it receives. They are more tender and of finer flavor than the common cabbage.

The following table shows the number of plants set of each variety; the number of heads of marketable size on August 25th, and also September 20th; the number of marketable heads pulled October 18th; average weight of same, and per cent. of plants set producing salable heads:

VARIETIES.	No. of Plants Set.	No. Heads Marketable Size		When Pulled.	No. Marketable Heads.	Average Weight of Heads.	Per Cent. of Plants Set Producing Salable Heads.
		Aug. 25.	Sept. 20.				
Brill's Excelsior Flat Dutch.....	40	4	19	Oct. 18	34	8.2	85
Burpee's All-Head Early.....	60	15	50	Oct. 18	57	7.9	95
Burpee's Safe Crop.....	32	2	18	Oct. 18	28	8.6	57
Burpee's World Beater.....	18	0	+	Oct. 18	16	10.3	86
Early Flat Dutch.....	30	18	18	Oct. 18	26	8.0	86
Fottler's Brunswick.....	34	3	10	Oct. 18	29	8.2	85
Louisville Extra Drumhead.....	50	5	30	Oct. 18	45	8.6	90
None Such.....	30	4	18	Oct. 18	25	7.8	83
Premium Flat Dutch.....	40	4	15	Oct. 18	36	8.5	90
Perfection Drumhead Savoy.....	30	0	0	Oct. 18	22	3.2	73

### CAULIFLOWER.

Sow seed at the time given for sowing cabbage seed. The cauliflower is somewhat more tender than the cabbage, and the plants require more attention in severe weather, in the way of covering sash at night, than do cabbage plants. The kind of soil recommended for the cabbage is equally well suited to the cauliflower. Seed of the five varieties herein described was sown in forcing-house on March 25th, and the plants were transplanted to the garden on June 6th. They were cultivated the same as cabbage and were irrigated on the same dates.

*Early Snowball.*—The first variety to produce marketable heads, and one of the best sorts tested; dwarf in habit of growth, with short outer leaves; heads large, solid and snowy white; weight of an average specimen, 4 lbs., 4 oz.

*Extra Early Dwarf Erfurt.*—This was the second variety to attain marketable size; the stalks are short, plant a close compact grower, heads medium size, close and solid; weight of an average specimen, 3 lbs., 3 oz.

*Long Island Beauty.*—A medium early variety, maturing five or six days later than Early Erfurt; plants are taller than those of the varieties above mentioned; heads large, close, and solid; color not so good as in Early Snowball; weight of an average specimen, 4 lbs.

*World-beater.*—This is a medium late variety; stems and leaves long, heads of large size though not so solid, or of that snowy white color, as Early Snowball; weight of an average specimen, 4 lbs., 6 oz.

*Narrow-leaved Erfurt.*—This is a late variety with long narrow leaves; plant a taller grower than Early Erfurt; heads resemble those of that variety, though not so large; weight of an average specimen, 3 lbs.

## ONIONS.

Seed should be sown as early in spring as the ground can be worked well, which for this latitude is about the 20th of March. When sown early there is a much better chance of getting a good stand, as at that season the ground is generally quite moist.

On March 28th, seeds of 21 varieties were sown in the garden in rows 18 inches apart. Owing to the very dry spring, and the prevailing high winds during the latter part of March and the month of April, which blew out many of the seeds and young plants, a very poor stand was obtained; with many varieties there was not over 20 per cent. to 40 per cent. of an average stand. As the test was not a satisfactory one, a table showing the productiveness of the different varieties is not necessary; but from the experiment the following points were observed:

1st. The varieties producing the greatest weight of marketable onions were: Giant White Garganus, Prize Taker, Large Red Italian Tripoli, Extra Early Flat Red, White Bermuda, and Yellow Globe Danvers in the order named.

2nd. The varieties ripening first were: Extra Early Flat Red, Queen, Neapolitan, White Bermuda, Large White Italian Tripoli, and Pale Red Bermuda.

3rd. More scullions were produced by the late varieties than by the early.

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## SUMMARY.

From the variety tests given in the foregoing we may summarize the following points:

### TOMATOES.

1st. The five varieties producing the greatest weight of ripe fruit were: Shah, Puritan, Potato-leaf, Table Queen, and Royal Red in the order named.

2nd. Those yielding the most pounds of ripe and green fruit together were: Table Queen, Puritan, The Shah, Potato-leaf, and Large Rose Peach.

3rd. The varieties giving the largest yield of fruit at the first two pickings were: The Shah, Potato-leaf, Aristocrat, Table Queen, and Large Rose Peach.

4th. As the most desirable early varieties for either home use or market we would recommend: Puritan, Potato-leaf, Ignatum, Aristocrat, and Table Queen.

5th. The smoothest varieties and those best suited for canning are: Ignatum, Potato-leaf, Table Queen, and Royal Red.

BEANS.

1st. As a bean for market or home use, of the wax sorts, we would recommend Golden Wax ; of the green podded sorts tested, Round Six Weeks proved the earliest and most productive.

2nd. Of the two varieties of bush Limas tested, Burpee's Bush Lima proved to be the more desirable.

EGG-PLANTS.

While New York Improved was the largest variety grown, yet for this locality we believe Black Pekin will give the best results, being earlier, and of finer flavor.

PEPPERS.

Where peppers are grown for market or home use, to be used in the natural state or for mangoes, the Ruby King variety will give the best satisfaction.

SWEET CORN.

Of the early varieties of corn, Cory Early was one week earlier than Early Minnesota, but the latter variety will give more general satisfaction, being more productive, ears larger and of finer appearance.

CABBAGE.

The varieties combining the most desirable features of any in our test were Burpee's All-Head Early, Premium Flat Dutch, and Louisville Extra Drumhead.

CAULIFLOWER.

Of the five varieties of cauliflower grown, Early Snowball gave the best results.



# SEEDING, TILLAGE, AND IRRIGATION.

(Arkansas Valley Station, Rocky Ford, Colorado.)

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BY FRED. A. HUNTLEY.

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The profits in crop growing are, as a rule, determined upon the basis of tillage or cultivation without regard to the application of manures or other fertilizers. This is especially true in comparatively new farming sections where the supply of available fertilizers is usually very limited and skill in the management of a natural soil determines largely the extent of production. That good tillage is everywhere the highest essential in successful farming is not to be denied.

All plants have their own peculiar habits. There are certain conditions of climate, soil, and care best adapted to the production of each. When a plant is introduced into a section differing from that of its nativity, it is but natural to enquire into the conditions of culture under which it has been known to thrive. These conditions are learned and applied to a considerable degree by all, but the highest rewards are attained by the best-adapted energies. As localities differ in characteristics of soil and climate, so must the practices of methods differ to suit the requirements of plant culture.

The climate which is now under consideration is very dry and warm during the summer months and mild at other seasons, with an extreme lack of humidity in the atmosphere generally throughout the year. The average rainfall is very slight, as observations for three consecutive years show but 12.06 inches; and coming, as it does, at irregular intervals can not be depended upon materially to benefit crops. The reliable water supply comes through well-developed systems of irrigating canals. The soil of the Arkansas Valley may be described as a sandy loam, containing a small per cent. of clay. The subsoil has nearly the same characteristics as the surface covering, though it is extremely compact in texture. The natural under-drainage needs no improvement.

It is intended by this bulletin to make known the results observed in the general cultivation of farm crops at this Station and for the locality. What follows is by no means claimed to be exhaustive, since it is offered only in the line of progress towards better methods than are in general practice.

#### CORN CULTURE.

Corn is one of the principal farm crops in the Valley, and in no other section of Colorado are natural conditions found as favorable to its production. Experiments and observations have shown the average yield to be very much below the possibilities, and there is a general demand for better methods and more thorough tillage. The preparation of the soil before planting has, no doubt, more to do with the outcome of the crop than any other operation. It should be borne in mind that our subsoil, though sandy, has a most compact structure. Corn roots have the habit of growing downward as well as branching. They are deep and broad feeders, in consequence of which the soil must be made loose and mellow to a considerable depth to secure full development. Land for corn should be plowed to an average depth of ten inches or more for this and another very important reason. Those familiar with the conditions of irrigation know with what rapidity a compact soil loses moisture. A well-tilled, porous soil collects and retains moisture by a natural law known as capillary attraction. Compact soils have that power to only a very limited extent. A comparative test of deep and shallow plowing was illustrated here in the case of a field of Colorado White field corn. One portion of the field was plowed to an average depth of four and five inches, while an adjacent portion received double the depth of cultivation. The whole planting received uniformly the same culture, including irrigation. A comparison of the yields in measurement upon deep and shallow plowing showed a little over thirty per cent. gain on the greater depth of plowing with grain of superior quality.

Land should always be well irrigated before plowing if not sufficiently moist to leave the work in the best possible condition for after cultivation. Fall plowing, as compared with that done in the spring, has the advantage of exposing the greatest possible amount of surface to the action of prolonged weather changes, which greatly facilitate the breaking up and putting in available form the fertilizing properties of the soil for the food of plants. If done thoroughly it also aids in retaining moisture which comes from natural causes. As irrigation restores the soil to its former compactness, it should never be done upon soils freshly plowed and prepared for planting, unless required to germinate the seed. There are advantages claimed for spring plowing. It enables the farmer to control moisture in making the operations of irrigating, plowing, and planting continuous. Irrigating to germinate seed

after planting should never be practiced, since much of the seed becomes ruined, and feeble growth takes place, which can seldom if ever be overcome by cultivation.

It is my opinion that an improvement in planters is desirable to meet our conditions of soil. The ordinary style of two-horse planter with wide wheels, such as is used in the soft soils of other states, does not seem to be just what is wanted here. Wheels for our use should be made with narrower tires, similar to those of press seed-drills, for making the seed-bed more firm. Since we plant corn to a greater depth than is done in moister climates, wide tires do not accomplish the desired purpose of making the soil compact over the seed.

Usually two waterings are sufficient during the growth of a crop, and often one irrigation is preferable. If soil contains sufficient moisture in the spring to start the crop to a thrifty growing condition, and growth seems not to be retarded for the want of moisture, watering can be delayed until the tassels begin to appear, at which time drouth would cause great injury to the crop. The harrow is the best cultivator for corn until it has attained an average height of at least six inches. Continuous surface cultivation saves moisture, and cross-plowing with a two-horse cultivator, work in both directions, is the least that should be done.

The mistake is often made in the use of a large head of water while irrigating, and in attempting to get it properly distributed over large areas and through long rows. Much of the land thus watered becomes too wet, while other portions receive an insufficient supply. In either case the best results can not be expected. Another very serious objection to irrigating with a very large head of water is, that the water contains much insoluble earthy matter which is ever being deposited as sediment. Water-ways become coated and moisture fails to penetrate to the roots of plants along their course. To irrigate properly, furrows must be well made and as nearly free of obstructions as careful methods will permit. The slope of the land will determine the distance it is practicable to run water for uniform results. No greater quantity should be turned into each furrow than will flow with uniform rate. Seepage is slow at best, and it usually takes many hours to secure the proper amount of moisture to the soil to prove of lasting benefit. Some may disagree with the statement that seepage is more effectual and rapid from a small head of water than from a heavy flow. The reason is that water from the Arkansas river is nearly always thick with earthy matter, and the amount of deposit decreases with the volume. We have tested this thoroughly in the garden as well as in the field. It has been found advisable, while irrigating, to expose the smallest amount of surface possible to the flow of water, and thus protect the porous condition of the soil. Another expen-

sive practice is that of allowing a great amount of overflow or waste water to leave the fields and return to the river or lower ditches. Much fertility necessarily goes with it and is forever lost.

Every farmer should practice economy in saving and applying to his land all matter that will eventually decay. The soil, though rich in mineral fertility, is poor in vegetable matter, due to the barrenness of the country before the advent of agriculture. The litter of the farm is slow to decay in a dry climate like ours unless the process is assisted by artificial methods. In view of this fact, a pit was recently dug on the farm of this Station, into which all that will make manure is systematically hauled. Here the process of decay is hastened. The pit is conveniently located where water can be turned into it at any time from a ditch near by.

It may be well to describe here the construction of this excavation for saving fertility. One man and team finished the work in a little more than a day by means of plow and scraper. The pit is 30x70 feet, and four feet deep at the center. The sides and ends were left sloping toward the center to allow easy access with team and wagon for hauling in and out. The usefulness of this arrangement has been so well proven that a companion pit will be dug in the same manner near by, thus rendering more convenient the process of handling the varying stages of decay.

#### WHEAT CULTURE.

A greater acreage is devoted to wheat culture in this section of country than to any other grain. Both winter and spring varieties are produced with equal success when seasons are equally favorable, but as a rule winter grains have superior advantages in respect to climatic conditions. The year 1892 proved an exceptionally good one for spring grains, by reason of an abundance of early moisture. During the spring months of 1893 but very little precipitation occurred and the irrigating waters were unusually late; all of which resulted more favorably to fall-sown seed. Within these two years, yields per acre at this Station have been as follows: Winter varieties—Clawson, 29 bushels; Turkish, 28½ bushels; Red Russian, 28 bushels. Spring varieties—Sonora, 29 bushels; Amethyst, 29 bushels; Defiance, 24 bushels; Australian Club, 17½ bushels; and Improved Fife, 13½ bushels.

There is usually some speculation going on relative to the cost of producing wheat, but the most convincing arguments that can be advanced are downright facts. Through the last season we kept a careful expense account on raising a field of four and one-half acres of Clawson winter wheat, as given in the following summary:

Labor in irrigating land,.....	\$ 35
Plowing, 3½ days,.....	7 85
Harrowing, ¼ day,.....	55
Seed, 22 pecks,.....	2 75
Vitriolating seed,.....	20
Drilling seed, 6 hours,.....	75
Winter irrigating,.....	35
Spring harrowing,.....	55
Irrigating,.....	50
Harvesting,.....	4 00
Twine,.....	1 12
Shocking, 5 hours,.....	80
Stacking, ½ day, two men and team,.....	1 95
Threshing, 7 cents per bushel,.....	8 05
<hr/>	
Total,.....	\$29 77
Yield, 115 bushels, at 50 cents per bushel,.....	\$57 50
Expenses,.....	29 77
<hr/>	
Net profit,.....	\$27 73
Net profit per acre,.....	6 16

No estimate is given on cost of keeping water-right in force, or cost of hauling grain to market; but as the straw has both a feeding and manurial value it should be worth at least enough to cover these two items.

It may be well to add that we do not, as a rule, recommend using five pecks of seed to the acre, as was done in the above experiment, but rather a less quantity. Our reason for using that amount of seed in the test was to determine the value of shriveled seed; and since much of the grain seemed to lack germinating power, it appeared advisable to use a larger quantity to offset the possibility of a per cent. of loss. From this shrunken, inferior-looking seed came a product of good quality. It may be argued that the area being small the example is not suited to a large field; yet other fields of wheat grew adjacent, which gave results equally as good. There is no doubt that, as a rule, profits are greater on medium-sized areas than on large ones, but it is also true that small areas well tilled at a profit are preferable to large ones handled at a loss. Better and more thorough methods are needed in the production of all grain crops.

Among the various operations necessary to the production of a wheat crop, deep plowing has here been shown the most essential. In the early stages of the crop there should be a never failing resource of moisture. Such cannot be maintained within compact soils. A porous condition of soil saves moisture, while evaporation soon exhausts the limited supply which compact soils have the power to acquire. Manuring land with any kind of decayed vegetable material increases capillarity or looseness of soil. But since improvement of this character can be furnished only by degrees, deep tillage should supply the requirements for a time at least by making available all the natural resources.

Wheat sown in dry soils can never be made to germinate uniformly even if thoroughly irrigated afterwards. The most perfect requirements of a seed-bed, mellowness and moisture, must be complete before planting to secure uniform advantages for the crop.

Many demonstrations have been made in proof that, as a rule, farmers use too much seed. The best results at this Station have come from the use of about four pecks per acre. The press drill is recommended for advantages over other methods of seeding. By its use the soil is made firm over the seed and rapid and uniform germination insured; while the surrounding soil is left mellow and porous, allowing the young and tender roots to reach in every direction for the available fertility and moisture. The advantages of deep rooting are secured by drilling seed to a depth of at least four inches.

Winter wheat usually requires three irrigations, and spring wheat two after growth has been established. We irrigate winter wheat once during the winter, in January, harrow in February, and irrigate in March or April, as the conditions of the season seem to require. After that, and as soon as the surface becomes sufficiently dry to pulverize without becoming cloddy, it is again harrowed for the second and last time. Wheat is benefitted by harrowing the same as other crops are benefitted by cultivation; and no harm has been found to result from the use of the harrow upon fields after a growth of five and six inches has been established. The final irrigation is required during the stage of forming heads, or not later than the bloom appears. Later watering than this may produce shriveling. While irrigating small grains, water is unavoidably allowed to flow in contact with the stems, by reason of which the application should be made within as short a period of time as possible consistent with thoroughness. Numerous laterals over difficult places facilitate the work.

#### OAT CULTURE.

The requirements of oat culture do not differ essentially from those of wheat, yet the former grain is found not as well adapted to the various conditions of climate as the latter. Oats attain the highest development in cool climates. They are produced with reasonable success in this valley when the soil is given deep and thorough cultivation. It is important to get the crop started as early in the spring as it is possible to work the soil, after the danger of severe freezing is over. Ripening before the hot weather invariably secures plump grain. The best results at this Station have been an average of  $30\frac{1}{2}$  bushels per acre of Excelsior, a white variety. The grain could hardly be surpassed in quality anywhere. The land had been in corn the previous season, which had received good culture, after which thorough and early preparation followed for oats.

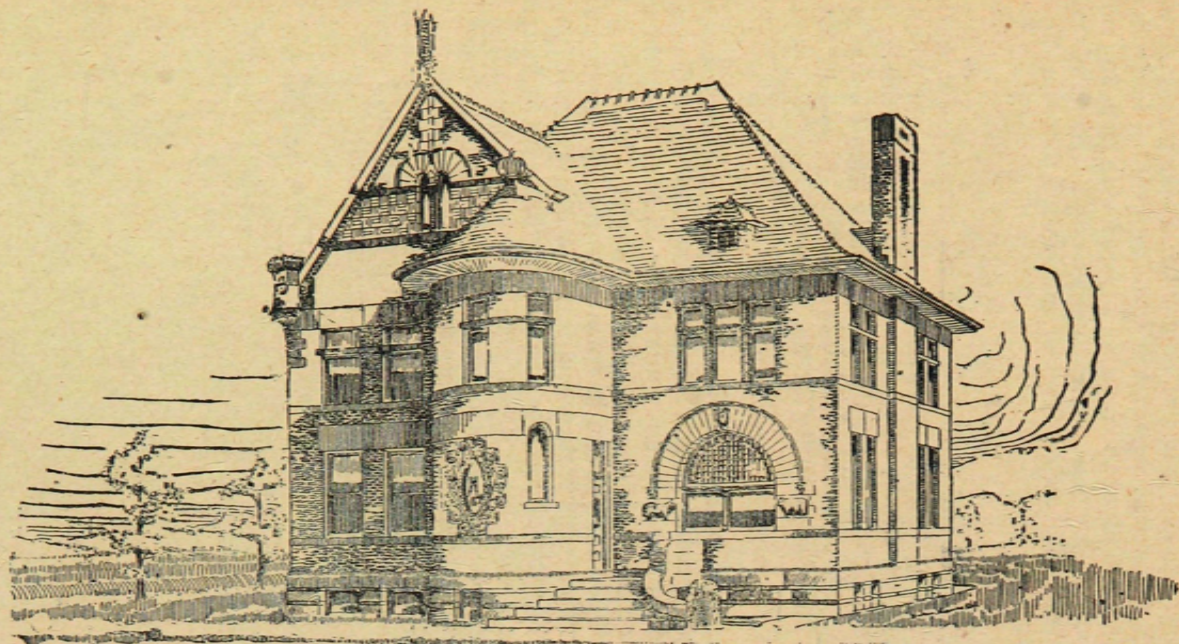
Owing to advantages being claimed for late sowing, to bring the harvest as late as the last of September, I was prompted to visit a number of fields this season, but was disappointed in finding the straw of late grain almost invariably covered with rust, and no indications of improved yields over early sown crops. Some advantages may be developed later in favor of late sowing, but thus far early sowing is advised.

#### BARLEY CULTURE.

Barley is but little grown as a farm crop in this section of Colorado. Six varieties in test plats at this Station, including both hull and hull-less kinds, have done well in every particular. The culture requirements do not differ essentially from those of wheat, except in the rate of seeding, which is about eight pecks for the hull sorts and a little less quantity for the hull-less.

#### RYE CULTURE.

The value of winter rye as a quick land renovator seems to be but little understood. When a heavy growth of vegetation can be made, to plow under between regular crops without losing the use of the land for a season, it ought to be encouraged. We have it from experience here that rye can be sown on early fall plowing, which will make two months' pasture and furnish a heavy growth to plow under in the spring. Besides the benefits from green manuring, whatever they may be, a fresh crop of weeds is prevented from going to seed by early plowing, and the necessary spring tillage places moisture beneath the surface for later use. The best yield of rye on these grounds the past season gave 19 bushels per acre. If seed raising is to be the object, about 80 pounds should be sown on an acre, and at least 100 pounds for a matted growth.



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