TEXAS AGRICULTURAL EXPERIMENT STATION.

BULLETIN NO. 15,

MAY 1891.

INFLUENCE OF CLIMATE ON COMPOSITION OF CORN.

Digestibility of Southern Food Stuffs:

COTTON SEED HULLS;

CORN FODDER.

ASH ANALYSES.

ROASTED COTTON SEED.

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS.

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TEXAS AGRICULTURAL EXPERIMENT STATION.

INFLUENCE OF CLIMATE ON COMPOSITION OF PLANTS.

(H. H. HARRINGTON, M. SC.)

With a view of finding if the composition of the same plant would vary according to the locality of its growth, a co-operative experiment was begun in 1890 with stations at Mississippi, Maryland, Georgia, Connecticut, New York, Wisconsin and Kansas.

Previous work and observation had lead to the belief that such a variation would be found to exist at least between the plants of the more southerly states and those grown far removed on the north. To decide this question, if possible, and to determine also the variation from east to west, was the object of the experiment.

THE GENERAL PLAN

was to send out samples of maize grown in different parts of the country to the stations in each of the above states. The seed corn to be analyzed, and the crop in each state including both forage corn and the mature grain to be weighed and analyzed.

The analytical work to be conducted at two stations. Here, and through the kindness of Dr. Jenkins, at New Haven, Conn. station. The plan of having the green forage corn analyzed at each station as at first contemplated, had to be abandoned because it entailed too much work upon the chemists at the several stations. Owing to drouth, and other unavoidable causes, reports have been received from but three stations. That of Connecticut, Georgia and New York. Of the corn grown in Connecticut 1890 but two samples, that of Wisconsin Pride of the North, and the New York C. U. Improved, were analyzed in duplicate (see page 81.) In Connecticut two of the southern corns failed to mature, Georgia and Texas. It is thought best to embody the reports from Connecticut and Georgia just as received with a few minor changes of arrangement. Names of varieties of seed corn will be found in Connecticut report(page 80).

THE EXPERIMENT AT THE CONNECTICUT STATION.

History of the land.

For five years previous to 1888 the field had been a meadow in fair condition as regards fertility. In 1888 it was ploughed and received a dressing of one ton of fertilizer to the acre. The fertilizer was mixed according to the following formula:

287	pounds	sulphate of ammonia.
217	"	dried blood.
287	"	muriate of potash.
1209	"	dissolved bone black.
2000		

The piece after harrowing was planted to White Edge Dent maize as described in our report for 1889, page 11, plots M to R, where yields, etc., are given. In 1889 this field was ploughed, a ton to the acre of fertilizer was applied at last year, made according to the following formula:

119	pounds	nitrate of soda.
169	"	sulphate of ammonia.
598	"	tankage.
309	"	dissolved bone black.
805	"	double sulphate of potash.
2000		

The field was then planted to potatoes. They were badly blighted and the yield was only about 200 bushels to the acre.

Preparation of Land and Planting.

In 1890 the field was plowed 7 inches deep the third week in April and Sanderson's Formula was broadcasted at the rate of 1000 pounds to the acre and harrowed in. On the 21st. of May the field was harrowed a second time. The soil was very mellow and moist, in excellent condition for planting but perhaps rather colder than is usual at this season.

The separate plots each contained exactly two square rods and were separated by a strip eight feet wide in which was grown one row of maize of a variety distinct from the others.

The prescribed distances of planting were exactly followed, the seed being all dropped by hand and by a measuring line. Extra seed was used to make allowance for the failure of some to germinate and the seed was covered about an inch and a half deep.

The maize came up evenly and at the same time on all the plots. On June 17th. the surface was stirred with a "hoop" cultivator which stirs the soil to the depth of an inch or an inch and a half and cuts off weeds.

June 17th. and 20th. the rows were thinned leaving the stand almost perfect. At this date the Maryland corn is 7 inches high, the others about 6 inches high with the exception of the New York corn which is ten inches high and thicker at the butt than any of the others.

Notes During Growth.

To get a comparason of the rate of growth the distance from the ground to the tip of the longest leaf was measured at different dates on stalks in the middle row of each plot, the same stalks being measured on each date. The average of the ten measurements was taken as the average height, or more properly, length of the corn in each plot. The results of these observations:

Height of Maize in Inches.

		July 8	July 22	Aug. 1	Aug. 14
Wisconsin..	plot planted for ears.....	46	71	88	91
	plot planted for forage.....	43	69	89	87
New York..	plot planted for ears	44	67	86	86
	plot planted for forage	51	86	90	88
Maryland ..	plot planted for ears.....	41	68	91	123
	plot planted for forage.....	39	64	96	122
Kansas	plot planted for ears.....	31	55	77	108
	plot planted for forage.....	33	52	87	116
Kentucky...	plot planted for ears.....	34	59	92	122
	plot planted for forage.....	34	58	89	114
Texas.....	plot planted for ears.....	31	51	74	99
	plot planted for forage.....	34	51	77	101
Georgia.....	plot planted for ears.....	34	54	81	106
	plot planted for forage.....	34	62	88	104

July. 8., The New York thickly planted plot has a good many tassels visible in the folds of the leaves. The corresponding thin planted plot has very few. The Wisconsin thick planted plot has only a few tassels showing.

July 10., The plots were hooped a second time.

July 21., The plots were hoed.

July 22., The New York maize plots are well tasselled and the anthers are showing quite generally. The silk does not show yet. The Wisconsin maize plots are a little less advanced in development. No tassels showing on any other plots.

August 1., The New York and Wisconsin maize is in full bloom. The pollen is falling and the silk is beginning to dry. The New York maize suckers badly where thin planted. The Georgia and Texas maize show no sign of tassel. All the others are beginning to show tassels.

August 14., The Wisconsin and New York maize is past bloom, silk dry. The kernels on the thin planted stalks are in milk; on the thick planted stalks in the last stages of milk. The Georgia and Texas maize plots are just showing their tassels above the leaves. No silk appears. The other plots are pretty even in development and are in full bloom.

HARVEST.

September 19., Clear weather after two weeks of continuous wet weather. The Wisconsin maize, thin planted, is ripe; leaves no longer green, kernels dry and hard and tips of ears opening. Cut and stacked.

The New York maize is in exactly the same state as that from Wisconsin and is also cut and stacked to day.

The Maryland maize foliage is entirely green, kernels glazed.

The Kentucky maize foliage is also green, kernels in late milk, where thick planted a little past the milk.

The Kansas maize foliage is still green and kernels in full milk.

The Georgia maize is green. The kernels in early milk,

The Texas maize is in full milk. In every case the thick planted plots are a little further developed than the corresponding thin planted plots.

September 22., Cut exactly one square rod of the forage plot of Maryland maize, the kernels being just past the dough state, weighed and analyzed. The average height of stalk was 118 inches. Also cut one rod of Kentucky maize, weighed and analyzed. Average height 132 inches.

September 30., The kernels are just past the dough state on the forage plots of the Kansas, Georgia and Texas maize and one square rod of each was cut, weighed and analyzed. The average height of the Kansas stalks was 116 inches, of the Georgia stalks 122 inches and of the Texas stalks 132 inches.

The following night a severe frost ruined the maize that was still standing and cut off that part of the experiment. It was apparent earlier in the season that the Southern varieties could not ripen in our latitude.

On Oct. 3rd. the stacked maize on the thin planted Wisconsin and New York plots was husked and weighed, and on the 16th. the maize on the corresponding thick planted or forage plots.

Results of the Experiment.

We confine ourselves to a report of the analytical work and weights

of crops. No discussion of them is possible till the results of all the experiments have been compared. The methods of the Association of Official Agricultural Chemists were followed in the analytical work. Starch was determined by Sachsse's method, the dextrose found being multiplied by the factor 0.9. The following table shows the composition of the seed maize when received at the Station in the spring of 1889:

Composition of the Seed Maize used in the Experiment—Connecticut Station.

	Pride of the North Wisconsin.	C. U Improved New York.	Silver's Yellow Mammoth Maryland.	St. Charles. Kansas.	White Det. Kentucky.	Red Dent Texas.	Red Cob. Georgia
Fresh.							
Water	13.75	14.00	13.52	12.98	14.56	12.45	13.20
Ash	1.16	1.46	1.40	1.26	1.30	1.20	1.16
Albuminoids	9.44	12.00	10.25	9.75	9.56	9 75	8.63
Fiber	1.48	1.30	1.53	1.77	1.49	1.84	1.82
Nitrogen-free Ex	69.79	66.31	68.09	69.89	68.71	70.19	70.30
Fat	4.38	4.93	5.21	4.35	4.38	4.57	4.89
	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Starch	68.76	65.76	67.19	69.02	67.35	68.73	69.08
Reckoned water-Free.							
Ash	1.34	1.69	1.62	1.44	1.52	1.37	1.32
Albuminoids	10.94	13.96	11.85	11.20	11.13	11.15	9.94
Fiber	1.72	1.51	1.77	2.02	1.76	2.10	2.09
Nitrogen-free Ex	80.92	77.12	78.74	80.35	80.44	80.17	80.99
Fat	5.08	5 72	6.02	4.99	5.15	5.21	5.66
	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Starch	79.76	76.46	77.68	79.33	78.86	78.54	79.58

These analyses show the composition of selected corn of the varieties named. The one flint variety, C. U. Improved, from New York differs from the dents by its higher per-centage of albuminoids and lower per-cent of starch.

The following table gives the composition of the thick-planted fodder maize of the several varieties, both in the fresh state and calculated water-free. It also gives the total weights of the crops reckoned to pounds per acre. By dividing these results by ten the yield in ounces per square rod can be ascertained. In each case the fodder was cut when the kernels were just past the dough state.

Exactly one square rod was measured off in the middle of the two rod plot in order to avoid the unequal growth which sometimes appears on the edges of such plots, and from this central plot the harvest was taken.

Composition of the Crops of Fodder Maize and yield of each Ingredient per Acre.

	Silver's Yellow Mammoth. Maryland.	St. Charles. Kansas.	White Dent. Kentucky.	Red Dent Texas.	Red Cob. Georgia.
Fresh.					
Water	76.33	73.52	74.83	77.62	76.80
Ash	1.10	.98	1.13	.93	.99
Albuminoids	1.33	1.26	1.30	1.43	1.22
Fiber	5.48	6.58	5.98	5.05	6.13
Nitrogen-free Extract	15.19	17.15	16.24	14.54	14.42
Fat	.57	.51	.52	.43	.44
	100.00	100.00	100.00	100.00	100.00

Water-Free.

	Silver's Yellow Mammoth. Maryland.	St. Charles. Kansas.	White Dent. Kentucky.	Red Dent. Texas.	Red Cob. Georgia.
Ash	4.64	3.68	4.49	4.14	4.29
Albuminoids	5.62	4.91	5.14	6.38	5.25
Fiber	23.13	24.81	23.78	22.54	26.43
Nitrogen-free Extract	64.19	64.66	64.50	65.11	62.14
Fat	2.42	1.94	2.09	1.93	1.89
	100.00	100.00	100.00	100.00	100.00

Yield of each Ingredient in Pounds per Acre.

Water	25013	21056	36735	26577	20029
Ash	316	281	313	318	258
Albuminoids	436	361	360	490	318
Fiber	1796	1885	1657	1729	1599
Nitrogen-free Extract	4978	4912	4500	4979	3761
Fat	187	146	144	147	115
	32770	28640	33709	34240	26080
Water Free Substance	7713	7585	6974	7663	6051

Owing to the continuous wet weather and pressure of other work the thick planted plots of Wisconsin and New York maise were not cut when just past the dough stage but ripened along with the thin planted plots of the same varieties. Their results are given in the following table.

Composition and Yield of the Field Cured Crops of Wisconsin and New York Maize.

Fresh.

	PRIDE OF THE NORTH. Wisconsin.		C. U. IMPROVED. New York.	
	Thin Planted.	Thick Planted.	Thin Planted.	Thick Planted.
Water	46.51	39.92	52.07	37.35
Ash	1.93	2.31	2.02	1.99
Albuminoids	4.24	4.32	4.02	4.67
Fiber	8.57	10.35	7.55	10.49
Nitrogen-free Ex	37.31	41.20	32.64	43.26
Fat	1.80	1.90	1.70	2.24
	100.00	100.00	100.00	100.00

Water-Free.

Ash	3.58	3.86	4.22	3.18
Albuminoids	7.87	7.17	8.38	7.46
Fiber	15.92	17.23	15.75	16.75
Nitrogen-free Ex	69.29	68.59	68.11	69.03
Fat	3.34	3.15	3.54	3.58
	100.00	100.00	100.00	100.00

Yield of each Ingredient in Pounds per Acre.

Water	4897	4375	6319	3884
Ash	205	253	245	207
Albuminoids	450	474	487	486
Fiber	909	1134	915	1091
Nitrogen-free Ex	3959	4516	3956	4449
Fat	191	208	206	233
	10610	10960	12120	10400

The kernels from the 1890 crop of the Wisconsin and New York maize had the following composition:

	PRIDE OF THE NORTH. Wisconsin.		C. U. IMPROVED. New York.	
	As analyzed.	Water Free.	As Analyzed.	Water Free.
Water	6.04	.....	10.08	.....
Ash	1.37	1.46	1.39	1.55
Albuminoids	9.87	10.51	10.37	11.53
Fiber	1.55	1.65	1.48	1.64
Nitrogen-free Extract	76.23	81.12	71.67	79.72
Fat	4.94	5.26	5.01	5.56
	100.00	100.00	100.00	100.00

REPORT FROM GEORGIA—BY DR. R. J. REDDING.

History of the Land.

Clay loam—clay subsoil—planted in cotton the previous year—fertilized with 200 pounds of ammonium superphosphate; producing 350 pounds lint cotton.

Preparation of Land and Planting.

Plowed with a one-horse turning plow, one-horse sub-soil plow, depth ten inches–harrowed until the soil was thoroughly pulverized. Fertilized at the rate per acre, 180 pounds cotton seed meal, 160 pounds acid phosphate and 80 pounds muriate of potash applied in the furrow and well mixed with the soil with cultivator.

Planted April 12th, three inches deep and prescribed distance exactly followed, dropped by hand and covered with cultivator.

Came up evenly, and near the same time.

April 20th. harrowed with a smoothing harrow.

May 3rd. plowed with a scooter plow.

May 10th. plowed with a cultivator.

May 20th. reduced to a stand, nearly perfect.

Rows were 1-2 acre long and three in each plot.

May 20th., hoed, and plowed with cultivator.

June 10th. plowed with cultivator.

June 20th. hoed, and plowed with cultivator.

June 30th. plowed with cultivator.

July 18th.—Plowed with Cultivator.

Notes During Growth.

HEIGHT OF MAIZE IN INCHES.

		May 10	May 20	May 30	June 10	June 20	June 30
Wisconsin	plot planted for ears	11	22	43	60	80	84
	plot planted for forage	11	22	40	60	80	84
New York	plot planted for ears	15	27	42	58	80	80
	plot planted for forage	15	27	42	58	80	80
Maryland	plot planted for ears	12	25	46	68	90	102
	plot planted for forage	12	25	44	68	90	102
Kansas	plot planted for ears	12	20	40	62	84	102
	plot planted for forage	12	20	38	62	81	96
Kentucky	plot planted for ears	13	25	50	69	96	114
	plot planted for forage	13	25	49	69	96	108
Texas	plot planted for ears	11	21	36	62	78	96
	plot planted for forage	11	21	36	60	78	96
Georgia	plot planted for ears	11	24	42	62	84	108
	plot planted for forage	11	24	42	62	84	108

May 30th, the New York samples showed their first tassels; June 10th, the Wisconsin plots showed tassels; June 20th, plants of Kentucky, Maryland and Kansas, showed first tassels; June 30th, Texas and Georgia had begun to tassel; June 10th, New York plot was in full tassel and silk; June 20th, the Wisconsin plots in full tassel and silk; and on June 30th, those of Kentucky, Maryland and Kansas; July 10th, Texas and Georgia in full tassel and silk.

Dough state—New York, on June 20th; Wisconsin, June 30th; Kentucky, Maryland and Kansas, August 1st; Texas and Georgia August 5th.

Harvest—Yield Per Acre.

FORAGE CORN IN DOUGH STATE—GREEN—IN LBS.

Wisconsin.	New York.	Maryland.	Kansas.	Kentucky.	Texas.	Georgia.
11252	8120	16864	14364	13716	17892	16224

CURED—FODDER MAIZE.

		9828	8100	7776	9984	8840

FORAGE CORN—GRAIN HARD—YIELD PER ACRE.

5184	3564	9720	1614	6588	12852	11880

Wisconsin and New York were cut June 20th and July 20th; Kentucky, Maryland and Kansas were cut Aug. 1st and Sept. 1st; Texas and Georgia were cut Aug. 5th and Sept. 15th.

FIELD CORN—HARD IN EAR—LBS. PER ACRE.

2088	928	2268	2106	2160	2704	2496

STALKS AND LEAVES PER ACRE—LBS. PER ACRE.

2668	1740	4806	4104	2754	6240	7124

Calculated at same time as last dates above.

We can not reach any conclusions from the work on forage corn, because only that of Connecticut was analyzed. A comparison might be made of the yield, with that of Georgia, (See Reports of the Stations) but this could not be of any value. It is published to give a better understanding of the nature of the work, and because such compilations may be of use at some future time. In the following table will be found the results, reproduced, on analysis of seed corn as conducted at Connecticut Station, compared to that done here by Mr. Duncan Adriance. The large discrepancy in water content is due in part to the fact that in Connecticut the analyses were made some months before being made here—our samples having dried out very materially, and analyzed from different bottles at the two stations, so that the comparison will properly come between the water-free substances.

Composition of the Seed Maize Used in the Experiment, Connecticut Report.

Fresh.

	Pride of the North Wisconsin.	C. U. Improved New York.	Silver's Yellow mammoth Maryland.	St. Charles Kansas.	White Dent Kentucky.	Red Dent Texas.	Red Cob Georgia.
Water	13.75	14.00	13.52	12.98	14.56	12.45	13.20
Ash	1.16	1.46	1.40	1.36	1.30	1.20	1.16
Albuminoids	9.44	12.00	10.25	9.75	9.56	9.75	8.63
Fiber	1.48	1.30	1.53	1.77	1.49	1.84	1.82
Nitrogen-free Ex	69.79	66.31	68.09	69.89	68.71	70.19	70.30
Fat	4.38	4.93	5.21	4.35	4.38	4.57	4.89
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Reckoned Water-Free.

Ash	1.34	1.69	1.62	1.44	1.52	1.37	1.32
Albuminoids	10.94	13.96	11.85	11.20	11.13	11.15	9.94
Fiber	1.72	1.51	1.77	2.02	1.76	2.10	2.09
Nitrogen-free Ex	80.92	77.12	78.74	80.35	80.44	80.17	80.99
Fat	5.08	5.72	6.02	4.99	5.15	5.21	5.66
	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Composition of the Seed Maize used in the Experiment—Texas Station.

	Wisconsin	New York.	Maryland.	Kansas.	Kentucky	Texas.	Georgia.
Nos	1	2	3	4	5	6	7
Water	12.32	12.20	12.51	12.26	12.77	11.32	10.72
Ash	1.22	1.49	1.34	1.38	1.30	1.45	1.54
Albuminoids	9.90	11.34	9.77	9.37	9.68	9.53	8.65
Flber	2.11	1.51	2.15	2.39	1.92	2.42	2.42
Nitrogen-free Ex	70.26	68.34	68.94	69.97	69.59	70.58	71.08
Fats	4.18	9.12	5.29	4.63	4.70	4.74	5.59
Rekconed Water-Free.							
Ash	1.39	1.70	1.53	1.57	1.48	1.62	1.75
Albuminoids	11.29	12.91	11.18	10.68	11.08	10.74	9-79
Fiber	2.41	1.71	2.46	2.74	2.20	2.73	2.71
Nitrogen-free Ex	80.15	77.85	78.78	79.74	79.81	79.61	79.53
Fats	4.76	5.83	6.05	5.27	5.30	5.43	6.22

Water-Free Analysis.

Comparing the above it will be noticed that the New York sample is richest in Albuminoids, and lowest in tender Fiber, while the fat is highest except in Georgia and Maryland. The Nitrogen-free Extract is lowest in New York sample.

Composition of Georgia Grown Corn 1890, Nos. 1 to 7 inclusive. Seed obtained from the severally named States.

CONNECTICUT ANALYSES.

	Wisconsin	New York.	Maryland.	Kansas.	Kentucky	Texas.	Georgia.
Nos	1	2	3	4	5	6	7
Water	12.89	13.52	12.84	12.91	13.65	13.38	13.52
Ash	1.18	1.32	1.26	1.24	1.26	1.36	1.38
Albuminoids	10.50	11.06	10.00	8.19	9.31	8.62	10.43
Fiber	1.45	1.07	1.65	1.50	1.39	1.52	1.38
Nitrogen-free Ex	69.40	69.19	69.19	72.79	69.83	70.39	68.45
Fats	4.58	3.84	5.06	4.37	4.56	4.86	4.84
New York Grown Corn—seed same as above.							
Nos	8	9	10	11	12	13	14
Water	14.83	14.37	15.49	15.84	16.72	15.23	19.80
Ash	1.41	1.33	1.24	1.35	1.16	1.25	1.24
Albuminoids	10.44	10.81	8.50	9.31	8.31	9.44	8.50
Fiber	1.25	1.06	1.39	1.61	1.25	1.39	1.63
Nitrogen-free Ex	67.97	68.41	69.29	68.24	68.83	69.85	66.77
Fats	4.10	4.02	4.09	3.65	3.73	3.67	2.06
Reckoned Water-free, Georgia Grown, 1890.							
Nos	1	2	3	4	5	6	7
Ash	1.35	1.52	1.44	1.42	1.45	1.52	1.59
Albuminoids	12.05	12.78	11.49	9.40	10.76	9.95	12.06
Eiber	1.66	1.23	1.89	1.72	1.60	1.75	1.59
Nitrogen-free Ex	79.66	80.00	79.38	83.50	80.86	81.26	79.15
Fats	5.25	4.44	5.80	5.01	5.28	5.61	5.59
New York Grown, 1890.							
Nos	8	9	10	11	12	13	14
Ash	1.65	1.55	1.46	1.60	1.39	1.47	1.54
Albuminoids	12.25	12.62	10.05	11.06	9.97	11.13	10.59
Fiber	1.42	1.23	1.64	1.91	1.50	1.64	2.03
Nitrogen-free Ex	79.80	79.76	81.99	81.08	82.64	82.39	83.25
Fats	4.81	4.69	5.43	4.33	4.47	4.32	2.56

SAME AS ABOVE, BUT TEXAS ANALYSIS.

As Analyzed—grown in Georgia, 1890.

	Wisconsin.	New York.	Maryland.	Kansas.	Kentucky	Texas.	Georgia.
Nos.	1	2	3	4	5	6	7
Water	11.91	11.97	10.22	10.32	11.75	12.02	12.32
Ash	1.90	1.33	1.57	1.54	1.60	1.38	1.49
Albuminoids	10.22	10.88	10.25	8.75	9.29	10.18	10.18
Fiber	1.62	1,35	1.92	1.67	1.85	1.82	1.80
Nitrogen-free Ex	70.59	70.47	70.95	73.38	71.01	69.40	69.14
Fats	4.76	4.00	5.09	4.31	4.52	5.20	5.05

Grown in New York, 1890.

Nos.	8	9	10	11	12	13	14
Water	13.48	13.15	13.96	14.33	15.48	13.45	17.90
Ash	1.48	1.49	1.44	1.65	1.28	1.28	1.41
Albuminoids	10.48	10.97	8.75	9.87	8.31	8.53	8.30
Fiber	2.29	2.06	2.16	2.35	2.03	2.09	1.97
Nitrogen-free Ex	68.31	69.97	69.51	67.98	68.88	70.38	67.20
Fats	3.96	4.36	4.18	3.82	4.02	4.27	3.22

Texas Analyses Reckoned water-free, Nos. 1 to 7 inclusive, grown in Georgia, 1890.

Nos.	1	2	3	4	5	6	7
Ash	1.02	1.51	1.74	1.71	1.81	1.56	1.65
Albuminoids	11.60	12.35	11.41	9.75	10.52	9.73	11.62
Fiber	1.83	1.53	2.13	1.86	2.09	2.06	2.07
Nitrogen-free Ex	80.12	80.07	79.06	81.84	80.46	81.74	78.87
Fats	5.43	4.54	5.66	4.84	5.12	5.91	5.76

Water-free—grown in New York, 1890.

Nos.	8	9	10	11	12	13	14
Ash	1.71	1.71	1.67	1.92	1.51	1.47	1.72
Albuminoids	12.24	12.48	10.16	11.52	9.83	9.85	10.10
Fiber	2.67	2.34	2.57	2.51	2.40	2.42	2.39
Nitrogen-free Ex	78.76	78.51	80.80	79.60	81.51	81.31	81.87
Fats	4.62	4.96	4.86	4.45	4.75	4.93	3.92

WISCONSIN AND NEW YORK CORN GROWN IN CONNECTICUT, 1890.

Nos. 1 and 2, Connecticut Analyses; Nos. 3 and 4, Texas—Duncan Adriance.

	As Analyzed. (1) Wiscon'n.	Water-free.	As Analyzed. (2) New York	Water-free.	As Analyzed. (3) Wiscon'n.	Water-free.	As Analyzed. (4) New York	Water-free.
Water	6.04	.....	10.08	.....	10.69	.....	12.96	.....
Ash	1.37	1.46	1.39	1.55	1.36	1.53	1.56	1.79
Albuminoids	9.87	10.51	10.37	11.53	8.10	9.07	9.69	10.99
Fiber	1.55	1.65	1.48	1.64	2.05	2.29	1.90	2.17
Nitrogen-free Ex	76.23	81.12	71.67	79.72	72.80	81.52	69.39	79.56
Fats	4.94	5.26	5.01	5.56	5.00	5.59	4.80	5.49

CONCLUSIONS.

One years work is not sufficient to decide the object of the experiment; but as several of the stations could not spare the time, or did not deem the matter of sufficient importance, to continue the work for another season, it is thought best to report progress for this year. At the same time, some facts are indicated which may prove of interest and value. If we examine the analytical results on the Georgia and Maryland corn as grown in that state, and as grown

in New York the same season, we find the albuminoids and the fat decreased in the New York grown sample. Texas and Kentucky also diminished in fat content; the albuminoids remaining about the same. Kansas and Wisconsin corn grown in New York increased their albuminoids over that of same corn grown in Georgia. The fat of Kansas remaining about the same, but an increase for Wisconsin in Georgia.

If we compare southern corns Georgia, Texas, Kentucky, and Maryland grown in New York 1890 with analyses of seed corn from same states, we find they all lost in albuminoids and fat; except Georgia albuminoids, which remains about the same, while there is some discrepancy between the same seed corns, and that grown in Georgia 1890, there is no uniform or regular difference.

The experiment simply indicates, without proving, the southern grown corns to be richer in albuminoids and fats with a corresponding diminishing in the less important ingredients.

DIGESTIBILITY OF FOOD STUFFS.

COTTON SEED HULLS.

Within the last few years large quantities of cattle have been fattened for market in the South on a ration of cotton seed meal and hulls mixed. It has proven itself a great economical feed and at the same time, a most desirable one for fattening purposes. Farmers in the South have long been accustomed to "winter" their range cattle upon the husks or shucks from corn, with cotton seed, or substituting straw for the corn shucks. Fed in this way regularly to cattle, there is no trouble from scours, and it is a cheap valuable food. Mixed with a little corn meal, slops and scraps from the kitchen, or particularly with sweet potatoes or pumpkins, it makes an excellent feed for milk cows. But while this gives good results when fed to cattle, it is a waste, because of the large quantity of oil in the seed, that cattle are unable to appropriate. It was, and is, an empirical way of feeding. Not much more so, however, than the common method at present of feeding meal and hulls, which has in so many instances proved satisfactory. It has been commonly supposed that the hulls were digested in great part; and that they added materially to the nutritive value of the meal. With a view of better observing the appearance of the hulls as they came from the animal, the dung both from sheep and steers was well washed, and the hulls "somewhat the worse for wear" broken into pieces of all sizes, were recovered. The tables of hull digestion show that scarcely any of the albuminoids or nitrogenous matter is digested; while about one-half of fiber and three-fourths of fat appear to undergo digestion. This makes a poor showing for the digestibility of cotton seed hulls, exept for the fat, and shows that their effect must be largely mechanical, whatever that may be. With the meal, they certainly give most satisfactory results in a practical way. In a carefully conducted experiment at this station (see Bulletin No. 10.) by Profs. Gulley and Carson J. W. where the weight of steers, cost of feed, and gain of flesh on a variety of steers were accurately kept, cotton seed meal and hulls, with or without silage, was the most desirable of the several rations.

COMPOSITION.

The analysis of the hulls is likely to vary considerably, because the quantity of broken seed and parts of kernel remaining attached, will differ widely in different samples. Even in analyzing from the same sample, great care must be taken that these parts are properly mixed with the lint and shell of the hull. The following is the average analysis as fed in the experiments. No. 1 in the first test, No. 2 in the second.

HULLS, WATER FREE

	No. 1.		No. 2.	
Fats	2.23	Per-cent.	1.60	Per-cent.
Fiber	58.26	"	53.74	"
Protein	5.24	"	3.85	"
Carbhydrates	30.83	"	37.37	"
Ash	3.41	"	3.46	"

DIGESTIVE EXPERIMENT.

STEERS FED ON COTTON SEED HULLS.

Analysts: HARRINGTON. WIPPRECHT. ADRIANCE.	Fresh Weight.	water.	Dry Matter.	Fat.	Fiber.	Carb-hydrates.	Protein.	Ash.
Steer No. 1	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Hulls eaten in pounds	53.0	5.29	47.71	1.07	27.80	14.71	2.504	1.63
Dung excreted "	89.9	61.4	28.5	.447	12.78	11.26	2.422	1.60
Hulls digested "	.....	.....	19.21	.623	15.02	3.45	.082	.03
Coefficient of digest', pr. ct.	.....	.....	40.2	58.2	.54	23.4	3.28	1.84
Steer No. 2	.....	.....	.....	.....	.....	.....	.....	.....
Hulls eaten in pounds	50.5	5.04	45.46	1.02	26.48	14.02	2.386	1.554
Dung excreted "	108.8	79.29	29.51	.244	13.57	12.20	2.324	1.174
Hulls digested "	.....	.....	15.95	.876	12.91	1.82	.062	.380
Coefficient of digest', pr. ct.	.....	.....	35.0	85.8	48.7	12.9	2.59	24.4
Steer No. 3	.....	.....	.....	.....	.....	.....	.....	.....
Hulls eaten in pounds	56.5	5.7	50.8	1.14	29.6	15.67	2.66	1.73
Dung excreted "	98.2	71.51	26.69	.224	12.54	9.75	2.35	1.63
Hulls digested "	.....	.....	23.11	.916	17.06	5.92	.31	.10
Coefficient of digest', pr. ct.	.....	.....	45,4	80.3	57.6	37.7	11.6	5.77
Mean coefficient of the three	.....	.....	45.4	74.7	53.4	24.6	4.78	10.6

At another time, two steers were again fed on hulls, and degestibility determined. The feeding in all these tests was conducted by J. W. Carson, Assistant to Director.

TABLE OF DIGESTIBILITY.

ANALYST—DUNCAN ADRIANCE.

	Total dry matter. Lbs.	Fats. Lbs.	Fiber. Lbs.	Carb-hydrates Lbs.	Protein. Lbs.	Ash. Lbs.
Steer No. 1						
Hulls eaten in pounds	40.16	0.638	21.605	15.046	1.547	1.377
Dung excreted in pounds	23.57	0.103	11.601	9.406	1.490	0.928
Hulls digested	16.59	0.535	10.004	5.640	.057	0.449
Coefficient digestibility, per-centage	41.4	83.8	46.3	37.4	3.6	32.6
Steer No. 2						
Hulls eaten in pounds	39.29	0.624	21.135	14.677	1.512	1.348
Dung excreted in pounds	20.63	0.110	9.484	8.670	1.401	0.830
Hulls digested	18.66	0.514	11.651	6.007	.111	0.518
Coefficient of digestibility, per-centage	47.5	82.3	54.1	40.8	7.3	38.4
Mean Coefficient of the two steers	44.4	83.	50.2	39.	5.4	35.5
Mean Coefficient of the two tables	42.4	73.8	51.8	31.8	5.0	23.

Of course in a digestive experiment the hulls were fed alone. In an actual feeding test with cotton seed meal, their digestibility would appear still less than the above figures show. Particular attention is called to the fact that the fat of the hulls is largely digestible; and that the Protein, which has been supposed to have a digestive coefficient (see Bulletin No. 3. Tenn. Ex. Sta.) of 26, really has one of about 5. That is to say, in every one-hundred pounds of hulls there would be only about 5 per cent of the total protein available to the animal. If we feed 20 pounds of hulls a day containing .9 pounds of protein, we could expect that the animal would assimilate about 1-2 of 1-10 of a pound of protein, practically none.

Corn fodder analysis, water free, as fed to steers in digestive experiment below; This is the fodder such as frequently gathered in the South, consisting of the blades and tops of the stalks.

ANALYST—ADRIANCE.

Ash	9.65	per cent
Fats	3.11	"
Fibre	30.70	"
Protein	7.72	"
Carbhydrates	48.82	"

DIGESTIBILITY OF CORN FODDER.

HARRINGTON AND ADRIANCE.

	Fresh Water. Lbs.	Water. Lbs.	Dry Matter. Lbs.	Fats. Lbs.	Fiber. Lbs.	Carb-hydrates. Lbs.	Proteins. Lbs.	Ash. Lbs.
Steer No. 1								
Fodder eaten	54.19	6.38	47.81	1.4860	14.6770	22.340	3.6909	4.61
Dung excreted	106.8	87.22	19.58	.4175	4.2292	8.873	1.6877	4.35
Fodder digested			28.23	1.0685	10.4478	14.467	2.0032	0.26
Digestive coefficient pr.-ct.			59.0	71.9	71.1	61.9	54.2	.056
Steer No. 2								
Fodder eaten	46.53	5.48	41.05	1.276	12.602	20.03	3.169	3.9613
Dung excreted	81.67	65.42	16.18	3.75	3.566	7.476	1.375	3.4042
Fodder Digested			24.87	0.901	9.036	12.554	1.794	.5571
Digestive coefficient			60.5	70.6	71.7	62.6	56.6	0.140
Av'ge coefficient of the two			59.7	71.2	71.4	62.2	55.4	.098

This makes a good showing for the fodder. The well known fondness that stock have for it, with its digestibility, makes it very desirable for feeding.

PTOMAINES.

An exhaustive attempt has been made again to separate these by the *Stas-otto* method, and modifications with different solvents. Of some hogs being fed by the Station on cotton seed meal with other feed, several died. The blood and contents of the stomach from 2 or 3 of these was extracted with acidified alcohol, ether and chloroform, and tests carefully made for alklaoids, but with negative results only.

COMPARATIVE ASH DETERMINATIONS.

With the view of finding the effect of sulphuric acid on the ash of different food stuffs, and comparing the official method with that of the muffle method, the following work was done by assistant Duncan Adriance. The substances were moistened with sulphuric acid, and then burned off over the direct flame. The muffle furnace used was such as shown in catalogue of Eimer & Amend p 146 No. 6440; a low red heat was used, in most cases securing complete whiteness.

TABLE OF ASH DETERMINATIONS.

GRAIN.	No. 1.			No. 2.		
	Muffle Method.	Acid Method.	Official Method.	Muffle Method.	Acid Method.	Official Method.
Missouri Maize—per-cent	1.68	1.80	1.71	1.32	1.44	1.02
Maryland " "	1.38	1.40	1.67	1.37	1.44	1.74
Kentucky " "	1.37	1.38	1.51	1.51	1.52	1.81
Kansas " "	1.55	1.53	1.92	1.40	1.52	1.71
Texas " "	1.47	1.46	1.47	1.43	1.53	1.56
Georgia " "	1.57	1.77	1.72	1.59	1.57	1.69
New York " "	1.86	1.75	1.71	1.46	1.64	1.51
Wheat Bran	3.00	3.11	3.59			
Corn Fodder	11.12	12.54	9.67			
Cotton Seed Meal	6.22	6.34	6.58			
Linseed Meal	6.76	6.68	6.64			
Bermuda Grass—Green	5.19	5.74	4.75			
Bermuda Hay	16.04	17.03	12.70			
Paspalum Dilitatum Grass	8.95	10.75	9.27			
Pea Vine Hay	10.51	15.09	10.29			
Cotton Seed Hulls	3.10	3.24	2.30			

A noticeable thing with the grains is, that the official method almost uniformly gives higher results than that obtained by burning off with sulphuric acid. The same is true of wheat bran, but with the grasses and hays, the official method is very much lower. With cotton seed meal and linseed meal there is little difference among any of the methods. The work clearly shows that the methods are not comparable; only in exceptional cases.

ANALYSIS OF WATER.

Hempstead, Texas., Analyst, P. S. Tilson. Examined to see if it could be used for boilers.

	Grains per gallon:
Total mineral matter as sulphates,	115.00
" Suspended matter	6.90
" Suspended mineral matter	1.59
" Insoluble mineral matter	33.00
Carbonate of Lime	9.40
Sulphate of Lime	12.30
Oxide of Lime, held as Bicarbonate	13.76
Soda and Potash, as chlorides	43.59
Magnesium chloride	26.70

The water contains a very large amount of mineral matter, while the quantity of soluble mineral matter is also comparatively large. It would be condemned for the purposes intended. But the large quantity of alkalies present would tend to counteract the effect of the scale forming substances, and because of this the water might be used.

FERTILIZERS.

Nos. 1, 2, 3, 4, and 5 were done for the Horticultural Dept. by Mr. Adriance. No. 6. for a manufactory, just started in the state. The name of the firm is with held because of a promise to improve the fertilizer, rather to *make* a commercial fertilizer. As yet, the state has no fertilizer control. It should have, because of the growing use of fertilizers by the farmers of the state. Especially by the hor-

ticulturists and market gardeners. Without an analysis, the farmer is likely to be imposed upon by the manufacturer; at the same time, it would be a protection to the honest manufacturer, against spurious and worthless goods in the market. It would be a saving to the farmers simply upon the analysis. That is, when a fertilizer was analyzed for the manufacturer, the goods showing the analysis offered for sale in different parts of the state, no second analysis would be necessary, as is now so frequently the case. Each farmer that may happen to buy a fertilizer paying for his individual analysis:

Nos.	1	2	3	4	5	6
Total phosporic acid	15.06	6.56	0.61	21.59	0.93	0.448
Water soluble Phosphoric acid	12.22	.....	.....	.....	.....	0.041
Insolv. phosphoric acid	1.71	0.63	.....	4.00	.....	0.384
Reverted phophoric acid	1.13	5.93	.....	17.57	.....	0.024
Total potash	.....	13.58	1.52	.....	0.50	0.12 1-2
Total nitrogen	.....	.....	7.07	3.64	0.99	0.40
Moisture	.....	.....	.....	.....	21.1	8.10

No. 1 is an acid phosphate; No. 2 cotton seed hull ashes; No. 3 cotton seed meal; No. 4 ground bone; No. 5 barnyard manure.

ROASTED COTTON SEED.

Within the last year considerable attention has been attracted to these as a feed stuff. It has been claimed that a part of the oil has been expelled by the roasting, and that the remaining oil has otherwise been changed; so that no ill effects result from feeding alone, or with a small amount of "roughness," as is so frequently the case when the raw seed are fed.

ANALYSIS OF ROASTED SEED.

Fats	32.70 per-cent.
Fiber	16.81 per-cent.
Albuminoids—Nitrogenous Matter	17.75 per-cent.
Ash	8.72 per-cent.
Carbhydrates	21.10 per-cent.
Hygroscopic Moisture	2.92 per-cent.

This analysis does not indicate that any of the oil has been volatilized during the process of roasting; the fats may have undergone some chemical change that would make them less laxative to the animal than fats in raw seed. But it is probable that any heat that was sufficient to drive off the fats, or change their chemical character, would also drive off some nitrogenous matter. However, a little of this could be sacrificed, if the seed could be gotten in a condition to feed without being mixed with other less concentrated feed. It certainly is the case, that in the process of roasting, the seed are much improved in appearance, and apparently in flavor. The separated kernels have very much the odor and taste of roasted maize. One difficulty attending the practical use of roasted seed, would be some device to roast them cheaply and conveniently. They must not be heated too high, yet evenly. Until some means is provided by which this can be done economically on the average farm, they are not likely to displace the raw seed for general feeding purposes. And in fattening cattle, hulls and meal make an excellent combination, that will not be easily supplanted by any other feed.