BULLETIN NO. 3. NEW SERIES.

REPORT

OF

Agricultural Experiment Station,

Agricultural and Mechanical College,

AUBURN, ALA.

JANUARY, 1889.

SUBJECTS.

REPORT OF EXPERIMENTS WITH CORN, SWEET POTATOES, GROUND PEAS, TURNIPS AND GRAPES.

ANALYSES OF FERTILIZERS, SOILS, ETC.

WOODS OF ALABAMA—CONTINUED.

METEOROLOGY.

THE BAPTIST PRINTING CO., MONTGOMERY, ALA.

REPORT

—OF—

Agricultural Experiment Station,

Agricultural and Mechanical College,

AUBURN, ALA., JANUARY, 1889.

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EXPERIMENT WITH CORN.

The object of this experiment was to inquire if corn could be grown profitably upon land which chemical analysis classes as practically sterile. The soil in question is a sandy drift with no clay within three feet of the surface. When the station took charge of it, it had been "worn out" and had grown up in stunted pines and broom sedge. Chemical analysis showed the following percentage composition:

	Soil, Per Cent.	Sub-soil, Per Cent.
Sand and insoluble matter	96.00	95.95
Soluble silica	0.02	0.04
Sulphuric oxide	0.01	—
Phosphoric oxide	0.017	0.011
Ferric oxide / Aluminic oxide	0.55	1.36
Lime	0.051	0.14
Magnesia	0.01	—
Potash	0.15	0.11
Clorine	0.01	0.01
Moisture / Organic matter	2.49	2.10

By order of the Board of Trustees, ten acres of this land were carefully prepared and fertilized, an account of all expenses kept and products carefully weighed.

The land was thoroughly broken with turn plows on the 6th, 7th and 8th of March, and the corn planted on the 15th and 16th —rows five feet, stalks three feet in the row. Compost of cotton seed, stable manure and English super phosphate was applied between the hills of corn in the drill at the rate of 1,000 pounds per acre. After the corn was planted heavy rains, followed by drying winds, baked the soil to such an extent as to render it necessary to re-break the land after the corn came up. This seriously checked its growth by breaking its feeding roots.

A drouth and heated term, which occurred while the plants were in flower, caused an estimated injury of twenty per cent. Corn planted upon land adjoining, which was broken and planted after that on the ten acres was up, produced, with half the manure, twenty per cent more per acre. Ordinarily, early planted corn gives best results, but the last season proved an exception in this locality.

One acre adjoining the ten, and of same quality of soil, was planted without manure and cultivated in the manner usually practiced in this section of the State:

TEN ACRES CORN FERTILIZED—RESULTS.

Fodder per acre	387.3 lbs.	
Shucks per acre	169.06 "	
Corn per acre	13.68 b'shl's.	
Total value of crop per acre	$15 01	—$15 01
Cost seed corn per acre	0 20	
Cost of fertilizer per acre	5 00	
Cost of labor per acre	4 25	—$ 9 45
Profit		$ 5 56

ONE ACRE CORN—WITHOUT MANURE.

Fodder per acre	202.1 lbs.	
Shucks per acre	74.9 "	
Corn per acre	6.5 b'shl's.	
Total value of crop per acre	$ 7 26	—$ 7 26
Cost of seed corn per acre	0 20	
Cost of labor per acre	4 57	
Total cost per acre	$ 4 77	—$ 4 77
Profit		$ 2 49

GROUND PEAS.

The accompanying experiment with fertilizers applied to ground peas was undertaken with the hope of discovering a remedy for the tendency of this crop to produce faulty pods (pops) upon sandy soils.

The yield was so far beyond our expectation that extra pains were taken to secure accurate and absolute results. A given number of hills were selected from each plat of apparently average vigor, the vines carefully lifted and all peas collected and counted with the results shown in the first column of the table. In order to ascertain as nearly as possible the whole product, after the vines were lifted the ground was carefully raked to collect the peas which remained.

To ascertain the effect of the different manures in reducing the percentage of "pops," a measured peck of peas was taken from the produce of each plot and the sound peas and "pops" in each accurately counted. It will be observed that an application of air-slaked lime gave the largest per cent of good peas, while the complete manure gave the smallest. A combination of the so-called complete manure with the lime might possibly combine the large yield with good quality.

EXPERIMENTS WITH GROUND PEAS.

Planted March 6th and gathered November 1st, 2d and 3d, 1888. Object: To compare effects of different fertilizers.

Plat No.	FERTILIZERS PER ACRE.	Average No. of Peas Per Hill.	Yield Per Acre in Bushels of Sound Peas and Pops.	Percent of Sound Peas.	Yield of Sound Peas Per Acre in Bushels.
1	400 pounds lime (air-slaked)	205	134.67	95.6	128.74
2	200 pounds English super phosphate	246	154.58	91.6	141.59
3	200 pounds cotton seed meal	294	136.81	90.9	124.36
4	200 pounds English super phosphate and 100 pounds kainit	252	220.59	84.2	185.73
5	200 pounds English super phosphate and 200 pounds cotton seed meal	357	202.91	90.4	183.43
6	600 pounds of compost	306	240.85	84.2	202.79
7	No manure	291	196.65	84.2	175.58
8	200 pounds cotton seed meal and 100 pounds kainit	428	343.00	66.6	228.43
9	200 lbs. C. S. meal, 100 lbs. kainit, 200 lbs. E. S. phosphate	342	323.07	61.5	198.68

EXPERIMENT WITH SWEET POTATOES.

Planted May 7th, and gathered November 21st, 1888.
Object: To compare effects of different fertilizers.

Plat No.		Yield Per Acre in Bushels.	Yield Merchantable Per Acre in Bushels.	Per Cent. Merchantable.
1	200 lbs. C. S. Meal	*69.20	57.71	83.4
2	100 " Kainit	130.45	115.70	88.7
3	50 " C. S. Hull Ashes	132.22	118.33	89.5
4	200 " English Acid Phos	145.72	132.45	90.9
5	50 " Sulphate of Ammonia	168.15	153.85	91.5
6	200 " Gossypium	180.56	165.21	91.5
7	No manure	128.18	109.59	85.5
8	400 lbs. Compost	156.06	142.48	91.3
9	70 " Nitrate of Soda	154.00	143.52	93.2
10	200 " C. S. Meal & 50 lbs. C. S. H Ashes	156.54	142.76	91.2
11	200 " E. S. Phosphate & 50 lbs. C. S. H. Ashes	150.65	140.55	93.3
12	200 " E. S. " " 200 " C. S. Meal	*86.22	75.87	88.0
13	200 " E. S. " " 200 " " " " & 50 lbs. C. S. H. Ashes	137.29	120.95	88.1
14	No Manure	91.15	78.57	86.2

*Plats 1 and 12 were injured by shade and roots of wild vegetation, along a fence row.

FERTILIZERS FOR TURNIPS.

The following questions were propounded to the turnip plant. Beds one acre in length and ten feet wide, were prepared and planted August 22nd in plats as shown in the tabulated statement. The questions asked, are:

(a) What element or elements of plant food does the turnip plant need to be supplied on the soil in question?

(b) From what source does it prefer to derive its nitrogen?

(c) From what source its potash?

(d) What are the comparative effects of acidulated phosphate and the raw phosphate?

(e) How do cow-lot and horse-lot manures compare in producing capacity with commercial compounds?

(f) What is the best distance at which to leave the plants in the drill?

The Norfolk variety of turnips was planted on all of the plats August 22nd. In order to detect the effect of the different manures in securing and maintaining a stand, all were planted exactly alike in the same seed and missing places filled by transplanting once, and finally, the number of turnips on each plat carefully counted. To compare the effects of the different manures in producing tops and roots, the whole plants were weighed when gathered, December 18th, then the roots weighed after removing the tops. In answer to the first question, kainit gave a larger yield than any other single substance. See plat 5. It will be observed also, that the application of the same number of pounds of kainit and cotton seed hull ashes resulted in favor of the former, though the cotton seed hull ash contains an average of about twice the per centage of potash.

While cotton seed meal compared with sulphate of ammonia with reference to the percentage of ammonia in each gives better

result than the latter when each is used alone, the sulphate of ammonia gives better results where it was used either in combination with potash only, or with potash and phosphoric acid.

The former result in favor of the cotton seed meal may have been due to the fact that the latter contains both potash and phosphoric acid, while the sulphate ammonia contains neither of these. See plats 2 and 3, and 8 to 13 inclusive, and 19 to 22 for comparison of sources of nitrogen.

High grade English super phosphate was compared with raw phosphate presented to the Station by the Meridian Phosphate Company, Meridian, Miss. In the former nearly all of the phosphoric acid was soluble; in the latter it was all insoluble, but the quantity greater than in the former. It will be observed that the raw phospate was applied in twice the quantity per acre, but it will be remembered that its cost per ton is but little more than half that of the super-phosphate. Considering the results on all of the plats to which the two forms of phosphoric acid were applied alone, and in various combinations, the plant seems to have been indifferent as to the source from which it derived this important mineral element and seemed to have the means of procuring it from the raw as well as from the acidulated.

The effects of 2½ tons of cow and horse-lot manure do not compare favorably with one twentieth that weight of commercial goods. See plats 27 and 28 and compare with 2 and 4. Finally, the turnip finds itself somewhat crowded at six inches in the drill, but lonesome at two feet. The best results both as to the aggregate weight and average size were obtained from those left to grow one foot apart in the drill.

The season during the last fall was exceptionally favorable for growing turnips. The accompanying tabulated statement gives the results in compact form.

EXPERIMENTS WITH FERTILIZERS WITH TURNIPS.

NORFOLK VARIETY. PLANTED AUGUST 22D.

Plat No.	NAME.	Yield per Acre with Tops, in lbs.	Yield per Acre without Tops, in lbs.	No. of Turnips per Acre.	No. of Bushels per Acre.	Average Weight of Turnips in lbs.	Increase from use of Fertilizers in bus.	Per Cent Increase.
1	440 lbs. English Super-phosphate	22330	13200	16500	220	.80	66	43
2	220 " Sulphate Ammonia	30360	17380	18480	289⅓	.93	135⅓	88
3	440 " Cotton Seed Meal	32670	20790	30800	346½	.64	192½	125
4	220 " Cotton Seed Hull Ash	25960	16720	21120	278½	.79	125⅔	82
5	440 " Kainit	39600	25080	31020	418	.80	264	106
6	880 " Raw Phosphate	23320	15180	19360	253	.77	99	64
7	No Manure	29261	14960	20240	249	.73	.....	.....
8	220 lbs. C. S. H. Ash, 220 lbs. Sulph. Am.	39380	30360	33000	506	.92	352	129
9	220 " C. S. H. Ash, 220 " Sulph. Am., 440 English Super-phosphate	50600	31900	29480	541⅔	1.04	387⅔	251
10	220 lbs. C. S. H. Ash, 220 lbs. Sulphate Ammonia, 880 lbs. Raw Phosphate	22400	17600	20900	273⅔	.84	139⅔	90
11	220 lbs C. S. H. Ash, 440 lbs. C. S. M.	34320	21340	25740	355⅔	.82	201⅔	130
12	220 " C. S. H., Ash, 440 " C. S. M., 440 lbs. English Super-phosphate	36910	20350	29260	339⅙	.69	185⅙	120
13	220 lbs. C. S. H. Ash, 440 lbs. C. S. M., 440 lbs. Raw Phosphate	37400	19800	20680	330	.95	176	114
14	No Manure	13640	6600	13200	110	.50	.....	.....
15	220 lbs. C. S. H. Ash, 440 lbs. English Super-phosphate	20460	11880	16720	194⅓	.71	40⅓	26
16	220 lbs. C. S. H. Ash, 880 lbs Raw Phos.	23320	12540	18260	209	.68	55	36
17	220 " Kainit, 440 lbs. Eng. Sup-phos.	37400	19800	23100	330	.85	176	114
18	220 " Kainit, 880 " Raw Phosphate	43780	18480	20020	308	.90	154	100
19	220 " Sulphate Ammonia, 440 lbs. Eng Super-Phosphate	28820	14960	23100	249⅔	.64	140⅔	91
20	220 lbs. Sul. Am., 880 lbs Raw Phos.	30140	16940	23100	282⅓	.73	128⅓	83
21	440 lbs. C. S. M., 440 lbs. Eng. Sup-phos.	25080	12100	17160	201⅔	.70	47⅔	30
22	440 lbs. C. S. M., 880 lbs. Raw Phosphate	33220	15400	20900	256⅔	.73	102⅔	66
23	No Manure	11880	6160	10160	102⅔	.60	.....	.....
24	440 lbs. C. S. H. Ash, 440 lbs. Sulp. Am., 440 lbs. Eng. Super-phosphate, Turnips 6 inches in drill	36300	19140	18040	319	1.06	165	107
25	440 lbs. C. S. H. Ash, 440 lbs. Sulph. Am., 440 lbs. Eng. Super-phos, Turnips 1 foot in drill	42460	22880	18700	381⅓	1.21	227	147
26	440 lbs. C. S. H. Ash, 440 lbs. Sulph. Am., 440 lbs. Eng. Super-phos., Turnips 2 feet in drill	23760	12760	11440	212⅔	1.10	58⅔	38
27	4400 lbs Rotted Cow Lot Manure	19140	10120	16500	168⅔	.61	14⅔	08
28	4400 " " Horse Lot Manure	23540	12540	19140	209	.65	55	35

COMPARISON OF VARIETIES OF TURNIPS.

Twenty-five varieties of turnips were planted August 23d upon thin, sandy land, well manured broadcast with compost, cotton seed meal and cotton seed hull ash. The difference in the stands on the plats, due to the difference in vigor of the varieties in their early growth, was quite marked, though in nearly every case a good stand and in many a perfect stand was secured. Some of the seed of the varieties were purchased from D. Landreth & Sons, Philadelphia, and some presented to the station by the United States Department of Agriculture. Earliest Bloomsdale Red Top is the earliest of the twenty-five varieties; Milan Strap-leaf, second; Early Flat Dutch Strap-leaf, third; Purple Top Strap-leaf, fourth; and Large Early Red Top Globe, fifth. White Globe and White Globe Strap-leaf seem to be identical.

Each of these varieties has been put in hills in the open ground, as sweet potatoes are hilled, to test their keeping qualities. The tabulated statement presents results of observations in compact form.

EXPERIMENTS WITH VARIETIES OF TURNIPS.

No. Acre.	NAME.	Seedsman.	Number of Turnips Per Acre.	Yield Per Acre with Tops, in Pounds.	Yield Per Acre Without Tops, in Pounds.	Number of Bushels Per Acre.	Average Weight of Turnips in Pounds.	Diamet'r of Variet's on Nov. 1 in Inches.	Color Above Ground	Color Below Ground.	Form.
1	Amber Globe Strap Leaf	Landreth.	25 856	39 396½	24 932	415½	.97	3⅞	Greenish Yellow	Golden Yellow.	Globe.
2	Aberdeen, or Scotch Yellow	"	15 428	25 346	14 737	245½	.96	3¼	"	"	"
3	Bloomsdale Swede Improved Purple	"	39 121	44 080	30 105	501⅔	.76	2¾	Purple.	Yellow.	"
4	Champion Swede	"	33 611	44 080	23 698	394 5-6	70	2¼	Light Purple.	White.	"
5	Cow Horn	"	37 468	56 890¾	36 917	615⅓	.98	3⅝	White.	"	Long, Round, Point'd
6	Early White Egg	"	42 978	51 293	35 815	596 5-6	.83	3⅞	"	"	Pointed Globe.
7	Early Snow Ball	"	24 795	38 156¼	24 795	463⅓	1.00	5	Greenish Yellow.	"	Globe.
8	Early Flat Dutch Strap Leaf	"	31 607	43 391¼	26 274½	437 5-6	.83	5½	White.	"	Flat.
9	Earliest Bloomsdale Red Top	"	43 529	37 908¼	32 233½	437⅙	.73	5¼	Bright Purple.	"	"
10	Golden Rose	U. S. Dept. Agri.	22 591	19 973¾	8 540½	142½	.37	3¼	Greenish Yellow.	Golden Yellow.	Globe.
11	Impr ved Yellow Purple Top Ruta Baga	Landreth.	33 060	51 794	29 203	486⅔	.88	2½	Purple.	Yellow.	"
12	Long French	"	26 448	46 284	30 105	501⅔	1.13	1¾	Greenish Purple.	White.	Roots Sprangled.
13	Landreth's Snow White Globe	"	19 285	26 370¼	13 324	222	.69	3½	White.	"	Globe.
14	Large Early Red Top Globe	"	17 081	28 101	20 214	336 5-6	1.18	4⅞	Bright Purple.	"	"
15	Milan Strap Leaf	U. S. Dept. Agri.	29 754	39 396½	25 791	129⅔	.86	4	Purple.	"	Roundish Flat.
16	Norfolk	Landreth.	14 326	26 605¾	11 295½	188⅙	.78	2⅝	White.	"	Pointed Globe.
17	Purple Top Strap Leaf	U. S. Dept. Agri.	33 611	34 299¾	23 968½	394⅔	.71	4⅜	Purple.	"	Flat.
18	Purple Top Munich	"	21 489	21 626¾	9 678	161⅙	.45	3¼	Dingy Purple.	Golden Yellow.	Globe.
19	Prussian	Landreth.	22 591	47 386	28 652	477½	1.22	2	.....	.....	Roots Sprangled.
20	Pomeranian White Globe Strap Leaf	"	21 489	29 478	15 288	254⅔	.71	3½	White.	White.	Flattened Globe.
21	Sweet German	"	30 105	46 835	27 825½	463⅓	.92	2½	.....	.....	Roots Sprangled.
22	White Globe Strap Leaf	U. S. Dept. Agri.	31 407	40 350¾	18 734	312⅙	.59	4¼	Tinged with Purple.	White.	Globe.
23	White Fleshed Purple Top White Swede Ruta Baga	Landreth.	33 611	39 121	22 040	367⅓	.69	2½	Purple.	"	.....
24	White Stone	"	24 244	43 529	19 836	330	.81	3½	White.	"	Pointed Globe.
25	White Globe	"	29 203	43 529	21 349	372⅓	.73	34-7	"	"	Globe.

VARIETIES OF GRAPES.

In order to convey reliable information with regard to the general adaptation of varieties to this soil and climate, a large number of the varieties of grapes generally grown by nurserymen are being tested on the grounds of this station. Thirty-nine of these fruited last season, on vines just three years old. The accompanying tabulated statement of results of observations made upon the vines and fruit may serve as a partial guide to those desiring to purchase. To render these observations very valuable and reliable, they must be continued through a series of years under the effects of different seasons. In order to test the practicability of protecting the berries from the attack of "black rot," insects and birds by means of paper bags pinned over the bunches, in early spring, about 7,000 bags were used on varieties under test and in the commercial vineyard. The common two-pound bags used by retail merchants were employed on the varieties to test the effects of bagging upon the berries—on the standard commercial sort, to determine the question of profit from their use. The effects upon the varieties is given in the tabulated statement as far as practicable in so compact form. The effects of confinement in the bags are not alike in all the varieties. The Delaware takes a soft rot in the bags or dries like raisins. The Perkins is preserved perfectly in bags, but is not good when thoroughly ripe, and hence it is not profitable to bag them.

The Hartford was planted on the lower edge of the vineyard with a N. Western exposure—that most favorable to the development of black rot. All of these not protected by the bags rotted before they ripened, while the berries upon the protected bunches were perfectly preserved and good August 18th, or 33 days after ripening. The Concord and Ives are well preserved in bags, the Ives *perfectly*. The skin of the Concord is so thin that the berries burst in the bags when very ripe and thus cause fermentation, which attracts insects.

The Ives improves in flavor for a month after it turns black and shipped well as late as August 19th, forty days after the crop is usually marketed.

These standard varieties sold at five cents net when first ripe without the bags early in July. Those protected and preserved in the bags brought ten cents per pound net a month later when the local crop not so protected had been consumed or destroyed. It costs one dollar to protect 500 pounds or 1,000 bunches of grapes. The bags should be put on as soon as the berries set. The bag is simply slipped over the bunch, folded around the stem and pinned. Before taking the bags out of the bundles in which they are packed, a small opening should be made in the bottom of each by means of a sharp knife or chisel in order that any moisture which may accumulate in the bags in wet seasons may escape. It is believed that it will not only prove desirable for the amateur grower to use the bags to prolong the season and insure exemption from attacks of rot, birds and insects, but those growing grapes on a commercial scale may find it to their interest to thus protect a portion of the crop.

EXPERIMENTS WITH GRAPES. OBJECT: TO TEST VARIETIES.

	Name.	Color.	Time of Ripening.	Effect of Bagging.	Condition Out of Bags.	Size and Shape of Bunch.	Quality.	Growth of Vine.
1	Agawam	Red	July 16th	Good	Rotted badly	Medium, compact	Good	Vigorous
2	Beauty	Red	July 21st	Excellent	Good	Medium, compact	Best	Very vigorous
3	Berckmans	Red	July 23rd	Excellent	Good	Small, compact	Best	Vigorous
4	Brighton		Did not ripen	Mildewed				Not vigorous
5	Catawba	Red	July 25th	Very good	Good	Medium, compact	Best	Vigorous
6	Champion	Black	August 4th	Excellent	Good	Large, compact	Good	Vigorous
7	Concord	Black	July 25th	Excellent	Good	Very large, compact, shouldered	Very good	Very vigorous
8	Delaware	Red	July 18th	Rot'd slightly	Good	Small, compact	Best	Small but vigorous
9	†Diana							
10	*Duchess							Not vigorous
11	Elk Eagle	Black	July 17th	Very good	Rotted	Very large and shouldered, open	Very good	Very vigorous
12	Elvira							Not vigorous
13	Goethe	Light Red	July 28th	Rotted	Rotted	Medium	Best	Vigorous
14	Greins' Golden	Golden yellow	August 8th	Good	Rotted	Small, compact	Very good	Vigorous
15	Hartford	Black	July 6th	Excellent	Rotted badly	Medium, compact	Good	Vigorous
16	Iona							Not vigorous
17	Ives	Black	July 10th	Excellent	Very good	Large, very compact, shouldered	Good	Very vigorous
18	Irving	White	July 28th	Very good	Rotted	Large, compact, shouldered	Very good	Vigorous
19	Jefferson	Red	August 5th	Very good	Good	Large, open	Best	Very vigorous
20	Lady Washington	White	August 6th	Very good	Rotted slightly	Large, compact	Good	Not vigorous
21	Lindley	Red	July 18th	Rotted	Rotted	Small, open	Best	Not vigorous
22	Martha	White	August 5th	Good	Good	Large, compact	Good	Vigorous
23	Mason's Renting	White	July 25th	Very good	Good	Medium, compact	Good	Vigorous
24	Maxatawney	Pale yellow	July 20th	Good	Rotted	Small, open	Good	Moderate
25	Meno	Pale yellow	July 25th	Good	Rotted	Small, open	Good	Moderate
26	Merrimac	Black	July 25th	Good	Rotted	Small, compact	Very good	Quite vigorous
27	Moore's Early	Black	July 12th	Very good	Good	Small	Good	Moderately vigorous
28	Norton's Virginia	Black	July 28th	Very good	Good	Large, compact	Very good	Very vigorous
29	Pearl	Pale yellow	July 18th	None bagged	Rotted	Medium	Very good	Vigorous
30	Perkins	Pale Red	July 8th	Not good	Excellent	Medium, very compact	Good	Very vigorous
31	Pocklington	Golden		Very good	Good	Medium, compact		Not very vigorous
32	Peter Wylie	White	July 15th	Very good	Rotted	Small, compact	Best	Not vigorous
33	Rogers No. 11		July 21st	None bagged	Rotted			Quite vigorous
34	Telegraph	Black	July 15th	Rotted	Rotted badly	Large, compact	Good	Vigorous
35	Triumph	White	July 20th	Good	Good	Medium	Good	Not very vigorous
36	Vergennes	Red	July 20th	Very good	A few rotted	Medium, compact	Best	Very vigorous
37	Wilder	Black	July 25th	Very good	Some rotted	Medium, compact	Good	Vigorous
38	Worden	Black	August 2nd	Good	Good	Large, compact	Good	Vigorous
39	Wyoming Red	Red	July 12th	Very good	Good	Small, compact	Very good	Vigorous

†Vines died. *Vines mildewed and berries rotted.

NOTE.—The bulletins of this station will be sent free to any farmer who desires them. Address all requests to Experiment Station, Auburn, Ala.

Report of N. T. Lupton, Chemist.

During the quarter ending December 31, 1888, the work in the Chemical Laboratory has been chiefly the analysis of commercial fertilizers received from the State Commissioner of Agriculture. This includes thirty-seven samples of fertilizers containing phosphoric acid, nitrogen and potash, twenty-one acid phosphates, and twelve miscellaneous samples, consisting of muriate of potash, cotton seed meal, tankage, Swan Island, Mona Island, and Carib natural guanos, also several phosphatic marls. In addition to these, six soils and sub-soils, and two specimens of coal have been analyzed, and a variety of minerals examined and their character determined.

The details of these analyses are as follows:

PHOSPHATES WITH NITROGEN AND POTASH.

Stat'n No.	Name of Fertilizer.	By Whom Sent.	Nitr.	Phosphoric Acid.			Potash.	Commercial Value.
				Water Soluble.	Citrate Soluble.	Acid Soluble.		
1062	Furman's Am. Soluble Bone	Adair Bros. & Co., Atlanta, Ga.	1.47	8.23	2.06	1.69	1.96	$23 08
1063	Buffalo Bone Guano	Adair Bros. & Co., Atlanta, Ga.	2.17	7.75	2.32	1.62	2.56	26 12
1065	Furman High Grade Guano	Adair Bros. & Co., Atlanta, Ga.	2.17	8.14	2.85	1.18	2.70	27 64
1066	Farish-Furman Formula	Adair Bros. & Co., Atlanta, Ga.	...	9.75	3.23	2.10	4.13	23 60
1067	Bone Compound	Baldwin Fertilizer Co., Savannah, Ga.	1.64	9.02	2.06	0.44	1.20	24 21
1068	Georgia State Grange Fertilizer	Baldwin Fertilizer Co., Savannah, Ga.	1.92	8.64	1.28	3.13	2.45	24 81
1070	Bone and Potash	Baldwin Fertilizer Co., Savannah, Ga.	....	10.36	2.77	2.94	3.86	23 55
1071	Am. Dissolved Bone	Baldwin Fertilizer Co., Savannah, Ga.	1.92	9.02	1.55	2.19	2.00	25 33
1078	Fertilizer	J. S. Phillips, Somerville, Ala.	2.38	8.71	4.33	1.36	1.12	29 96
1079	Acid Phosphate with Potash	Georgia Chemical Works, Augusta, Ga.	...	12.26	2.32	1.24	1.61	23 48
1080	Mastodon	Georgia Chemical Works, Augusta, Ga.	2.24	8.33	2.71	2.86	1.85	27 13
1083	Fertilizer	W. J. Hudson, Mobile, Ala.	2.24	5.95	5.79	3.71	1.18	27 32
1084	Soluble Pacific Guano	Frank S. Roberts, Mobile, Ala.	2.24	5.35	7.19	2.09	1.43	28 97
1086	Fertilizer	R. A. Mitchell, Opelika, Ala.	....	....	1.47	0.23	0.27	.....
1089	Eutaw Fertilizer	Ashepoo Phos. Co., Charleston, S. C.	2.34	7.08	2.65	3.59	2.04	25 56
1090	Ashepoo Fertilizer	Ashepoo Phos. Co., Charleston, S. C.	2.17	7.56	1.60	3.78	1.20	23 40
1092	B. D. Sea Fowl Guano	Bradly Fertilizer Co., Boston, Mass.	2.03	9.92	1.73	1.54	1.13	26 51
1093	Bradly's Pat. Super-phos. of Lime	Bradly Fertilizer Co., Boston, Mass.	2.66	10.52	0.93	0.81	1.95	29 52
1097	Georgia State Grange Fertilizer	Baldwin Fertilizer Co., Savannah, Ga.	1.67	10.07	1.84	0.94	1.98	26 26
1098	Bone and Potash	Baldwin Fertilizer Co., Savannah, Ga.	....	11.06	2.71	1.32	3.11	23 70
1099	Baltimore Am. Dissolved Bone	Mrs. Geo. Welp, Hanceville, Ala.	1.33	9.46	3.47	1.52	0.25	24 82
1100	Home Mixture	Columbus Fertilizer Co., Columbus, Ga.	2.45	10.37	0.73	1.20	2.52	28 72
1106	Crown Guano	Jno. D. Weld, Savannah, Ga.	1.89	7.68	1.95	2.46	1.51	21 95
1107	Bowker's Cotton Fertilizer	Jno. D. Weld, Savannah, Ga.	2.13	8.34	1.48	2.66	1.45	24 48

PHOSPHATES WITH NITROGEN AND POTASH.

Station No.	Name of Fertilizer.	By Whom Sent.	Nitrogen.	Phosp'ric Acid. Water Soluble.	Phosp'ric Acid. Citrate Soluble.	Phosp'ric Acid. Acid Soluble.	Potash.	Commercial Value.
1108	Nassau Guano	John D. Weld, Savannah, Ga	1.82	7.37	2.98	2.31	1.64	24.25
1109	Carib Am. Guano.... ...	W. J. Hudson, Mobile, Ala.	1.26	0.65	9.58	7.89	3.19	23.44
1111	Fertilizer	East Alabama Fertilizing Co., Clayton, Ala.....	1.96	9.00	1.11	1.98	2.50	25.30
1112	Complete Cotton Fertilizer	Commercial Guano Co., Savannah, Ga.....	1.75	8.77	1.51	2.73	2.47	24.71
1113	Chatham Guano..... ..	Commercial Guano Co., Savannah, Ga.....	1.61	8.41	1.71	2.76	2.20	23.65
1114	Pomona Guano....	Commercial Guano Co., Savannah, Ga..... .	1.64	8.31	2.34	2.77	2.48	24.84
1119	Rasin Fertilizer.....	Rasin Fertilizing Co., Baltimore, Md.	2.06	7.39	2.57	2.52	2.12	25.05
1123	Holmes' Formula.....	N. H. Holmes, Montgomery, Ala.....	2.20	8.04	1.82	1.74	0.59	24.96
1124	Ivey's Formula.....	N. H. Holmes, Montgomery, Ala	3.04	6.50	0.46	1.85	0.92	23 21
1125	Soluble Pacific Guano....	Prof. W. L. Hutchinson, A. & M. College, Miss.....	2.24	4.22	3.97	5.99	1.28	22.29
1115	Farmers' Alliance.....	Troy Fert. Co., Troy, Ala...	2.02	7.94	2.18	1.53	1.11	24.16
1116	Troy Perfect Guano... ..	" " " " "	2.45	7.56	1.19	1.60	1.73	24.40
1117	Pike County Fertilizer...	" " " " "	1.75	7.48	1.46	1.08	2.56	23.79

ACID PHOSPHATES.

Station No.	Name of Fertilizer.	By Whom Sent.	Phosp'ric Acid. Water Soluble.	Phosp'ric Acid. Citrate Soluble.	Phosp'ric Acid. Acid Soluble.	Commercial Value.
1052	Diamond Soluble Bone, No. 1.	W F Vandiver & Co., Mont'gy, Ala	10.36	4.42	3.18	$22.17
1053	Diamond Soluble Bone, No. 2.	" " " " "	10.08	4.23	3.16	21.46
1054	XX Acid Phosphate, No. 1...	" " " " "	10.36	3.77	2.99	21.19
1055	" " " " 2...	" " " " "	10.36	4.08	2.60	21.66
1056	Cotton Boll Eng. Acid Phosphate, No. 1.....	" " " " "	10.84	3.16	3.08	21.00
1057	Cotton Boll Eng. Acid Phosphate, No. 2.....	" " " " "	10.08	4.39	3.19	21.70
1064	Furman Acid Phosphate..	Adair, Bros. & Co., Atlanta, Ga.	11.11	2.77	2.38	20.82
1069	Georgia State Grange Acid Phosphate.....	Baldwin Fert. Co., Savannah, Ga	10.36	2.77	0.69	19.69
1075	XX Acid Phosphate.....	W F Vandiver & Co., Mont'gy, Ala	10.54	4 09	2.65	21.94
1076	High Grade Eng. Acid Phos.	" " " " "	10.84	4.50	2.41	23.01
1081	Acid Phosphate.....	Ga. Chem. Works, Augusta, Ga.	12.36	4.58	1.35	25.41
1082	Troy Acid Phosphate..	Troy Fert. Co., Troy, Ala.....	12.17	2.97	2.31	22.71
1087	Eutaw Acid Phosphate.....	Ashepoo Phos. Co. Chls'ton, S. C.	10.25	2.39	2.50	18.96
1088	Ashepoo Acid Phosphate.. .	" " " " "	10.92	2.54	2.36	20.19
1091	Brady's Patent Acid Phosphate	Brady Fert. Co., Boston, Mass..	13.61	1.42	0.50	22.54
1096	Georgia State Grange Acid Phosphate.....	Baldwin Fert. Co., Savannah, Ga.	12.46	2.42	1.49	22.32
1101	Soluble Bone.....	Columbus Fert. Co., Columbus, Ga	11.28	2.75	1.84	21.04
1104	Nassau Dissolved Bone.....	John D. Weld, Savannah, Ga...	12.19	1.28	2.65	20.20
1105	Bowker's Dissolved Bone....	" " " " "	7.39	3.77	3.52	16.74
1121	Magnet Acid Phosphate... ...	Davis, Marshall & Co. Mobile, Ala	11.98	1.57	2.17	20.32
1122	Dissolved Bone.....	N. H. Holmes, Montgomery, Ala	12.48	1.03	2.79	20.26

MISCELLANEOUS FERTILIZERS.

Station No.	Name of Fertilizer.	By Whom Sent.	Nitrogen.	Phosp'ric Acid. Water Soluble	Phosp'ric Acid. Citrate Soluble	Phosp'ric Acid. Acid Soluble	Potash.
1073	Muriate of Potash	East Ala. Fert. Co., Clayton, Ala.	....	....	.....	.....	46.25
1074	" " "	" " " " " "	...	....	.....	.....	47.48
1077	Cotton Seed Meal	" " " " " "	7.00	....	.....	3.52	1.99
1085	Tankage	Troy " " Troy, "	7.14	....	.....	9.52	0 10
1094	Swan Island Guano	Frank S. Roberts, Mobile, Ala.	...	0.69	9.62	11.73	.....
1095	Mona Island Guano	Campbell & Co., 59 Wall St., N. Y.	....	0.23	12.51	11.41	.....
1103	Swan Island Guano	Frank S. Roberts, Mobile, Ala.	....	0.79	16.57	7.48	.....
1110	Carib Natural Guano	W. J. Hudson, Moblle, Ala.	....	0.84	15.76	6.68	.....
1118	Swan Island Guano	Frank S. Roberts, Mobile, Ala.	....	0.62	13.59	6.66	.....
1120	"Phosphate Rock"	Troy Fertilizer Co., Troy, Ala.	....	....	.....	0.38	... ..

MISCELLANEOUS SUBSTANCES.

STATION NO. 1061—COAL FROM H, G. MCCALL, CALERA, ALA.

Moisture	0.40
Volatile Matter	32.40
Fixed Carbon	51.90
Ash	15.30
Total	100.00
Sulphur	6.64

STATION NO. 1102—COAL FROM PROF. O. F. CASEY, AUBURN, ALA.

Moisture	3.60
Volatile Matter	33 00
Fixed Carbon	54.61
Ash	8.79
Total	100.00
Sulphur	1.21

STATION NOS. 1126, 27 AND 28—"MARLS" FROM R. M. PARKER, COATOPA, ALA.

	No. 1.	No. 2.	No. 3.
Phosphoric Acid	0.77	0.51	4.13
Carbonate of Lime	75.90	0.37	81.80

AIR-DRIED SOILS AND SUB-SOILS.

Locality	Butler Coun y.		Talladega Co.		Pike County.	
Soil Marked	8 (a) Soil.	8 (b) Sub-soil	9(a) Soil.	9(b) Sub-soil	10 (a) Soil	10 (b) Sub-soil
Station No.	1129	1130	1131	1132	1133	1134
Moisture	2.559	2.469	3.676	3.670	0.817	1.267
Insoluble Silica	78.379	68.586	66.126	68.159	92.931	85.507
Soluble Silica	0.105	0.198	0.153	0.175	0.067	0.102
Hydrated Silica	4.759	11.084	8.627	7.280	2.118	5.417
Sesquoxide of Iron	1.864	3.584	3.942	4.128	0.812	1.601
Alumina	4.562	9.684	8.007	8.020	1.609	4.472
Phosphoric Acid	0.029	0.020	0.150	0.174	0.032	0.035
Lime	0.275	0.176	0.289	0.255	0.039	0.050
Magnesia	0.293	0.409	0.633	0.654	0.062	0.081
Potash	0.182	0.194	0 903	0.992	0.149	0.174
Soda	0.550	0.410	0.391	0.287	0.350	0.293
Sulphuric Acid	0 103	0.068	0.233	0.177	0.127	0.153
Chlorine	0.006	0.008	0.056	0.039	0.009	0.008
Carbonic Acid	0.133	0.046	0.114	0.154	0.066	0.088
Volatile and Organic Matter	5.462	3.219	5.969	6.089	1.553	1.603
Total	99.361	100.155	99.369	100.253	100.741	100.851
Nitrogen	0.260	0.239	0.260	0.280	0.109	0.087
Air-Dried { Coarse Gravel	8.50	6.91	9.81	12.49	1.50	1.92
Contains { Fine Material	91.50	93.09	90.19	87.51	98.50	98 08

Department of Botany.

WOODS OF ALABAMA—(*Continued.*)

P. H. MELL.

Fraxinus (Ash.)—The trees of this genus grow rapidly and attain a height of forty feet or more. The quality of the wood is very much the same in all species—the white ash, however, is considered to be the best. The wood possesses great toughness and durability. Experience has shown that in the case of white ash the second growth is superior in toughness to the first growth of timber. The wood is well adapted for all purposes requiring light colored, tough and hard material as in the manufacture of carriages, oars, cabinet work and blocks for pulleys. The roots are finely veined and sometimes have knotty convolutions, which resemble certain compound figures and are susceptible of high polish. In the trunk there is little difference between the sap and heart woods and therefore a large proportion of the stem is suitable for cabinet work and most farm utensils. It has been estimated that the cohesive power of the wood is about 160 pounds to the square inch when the load is applied transversely. The tensile strain per square inch is 5,495 pounds. The crushing strain per square inch is 2.4 tons. In selecting the timber care should be taken to obtain the wood that is gray white, because when the color changes to a dark shade, it is an indication that the wood is decaying. The best season for felling the tree is in winter, and it should be cut into boards soon after felling, because if left in the log state, cracks will open on the surface and severe loss be sustained. If the trees are cut in any other season than winter the timber will perish quite rapidly. The flexibility of the wood renders it unfit for the framing timbers in buildings.

The leaves of the white ash fall so early it should not be placed by itself on the lawn if transplanted, but should be clustered with other trees, so that its ragged condition, when denuded of its leaves, will not be perceptible. It requires a moist, cool, deep soil, and stands transplanting well on account of numerous small fibrous roots. The green ash is a very handsome tree and will be quite showy on lawns; it is, however, smaller than the others. This tree is found on river banks in moist soils. The red ash resembles the white, but differs from it in the down over the young branches and lower surfaces of leaves. It has a broad spreading head and is quite graceful in a landscape. The bark of the ash is used for tanning calf skins and for dyeing black, green, and blue.

For medicinal purposes the ash is highly prized. The white ash furnishes an excellent tonic and astringent. The extract of the bark is valuable for salt-rheum and other cutaneous diseases. When used as an infusion, it is good in some cases of constipation and dropsical affections. When the leaves are rubbed on the sting made by mosquitoes, the inflammation is reduced at once. "A decoction of the leaves is said to be an antidote to the poison of lamb-

kill, or sheep laurel (*Kalinia Augustifolia*) when taken by lambs." (*Trees of Mass.*)

Aesculus pavia, L. (Buckeye.) The tree is ornamental, but the wood is of poor quality. The bruised branches and bark are used to stupefy fish so that they may be easily caught.

Cephalanthus occidentalis, L. (Button Bush.) A handsome shrub growing to a height of six to twelve feet. It is generally found in damp places. The bark is used as a remedy for intermittent and remittent fever, and the inner bark of the root forms a bitters that is thought to be good for coughs.

Bumelia lanuginosa, Pers. (Buckthorn.) Grows from fifteen to thirty feet in height. The wood has been used but little, if any, in the arts, although it is very hard. The berries make a good vegetable paint and a first-rate dye. They are also strongly purgative or cathartic, but the action is so strong and severe the remedy is but little used now. The tree has been tried with some success as a hedge and for this purpose may be propagated by means of seed, cuttings or layers. It requires a rich, moist soil and will stand transplanting and training very well. The juice of the berries, evaporated to dryness with alum or lime and gum arabic, make the color sap green.

Juglans nigra, L. (Black Walnut.) A graceful tree with a straight trunk and broad branching head. It grows quite rapidly, and is a valuable tree to transplant and cultivate for lawn, or for the fruit or timber. The wood is dark purple, becoming almost black with age. The fineness of the grain, toughness and durability make it valuable for many purposes. Even the roots of the trees are now cut up for veneering, and beautiful variegated slabs are thus obtained. The nuts furnish an oil that is used in mixing paints and is not congealed by cold, and the sap is said to yield sugar that will crystalize on evaporation. The bark when properly treated gives strength to the stomach and is recommended in fevers. The hull of the nut is used to make an excellent dye. The walnut and butternut furnish in the young stage of the fruit an excellent material for pickles.

Walnut trees are rapidly disappearing from the State because of the great numbers cut annually for lumber; and unless some steps are taken to protect them they will soon be unknown in the forests of Alabama. It would be a wise plan if the people of the State would plant even a small number of the trees each year, to take the place in some degree of those now being cut. The cultivation of walnuts will well repay the outlay.

Fagus ferruginea, Ait. (Beech.) This is a large and graceful tree and the wood is very hard, fine grained and will take a very fine polish. The color of the wood is red, with a delicate silky gloss, and it cleaves very easily. It makes an excellent tree for the lawn, but for one drawback: the leaves remainuntil nipped by the frost and fall very slowly, producing constant litter on the grass throughout the winter.

Betula nigra and *Cuta*, L. (Black and cherry birch.) The cherry birch grows 70 feet high, with a diameter of two to three feet. This is a beautiful tree and flourishes best in mountain

districts. The wood is a delicate rose color, takes a good polish, and deepens with age, but never becomes dark. It is even grained and works with ease. The variegated cast given to the wood by the annual rings adapts it for panels in cabinet work. The bark as a dye gives a beautiful drab color to wool.

Catalpa bignonioides. (Catalpa.) This is a handsome tree that grows to a height of 60 feet or more and two to four feet in diameter. The growth is rapid, but the grain of the wood is close and will take a fine polish. The color of the wood is grey white, and it is quite durable. It is commonly believed that the seeds are poisonous, but the United States Dispensary states that they have been used with good results in cases of asthma. It is best, however, to begin with small doses of the decoction made from the seeds.

Castanea vesca, L. (Chestnut.) The wood of this tree is coarse grained, but retains considerable elasticity and is very durable. There is but little sap wood. It is used for fences, and wherever wood of durability is required. The grain, however, is so coarse and so porous it is not well suited for cabinet work where high polish is desired. The color of the wood is light yellow or brown. When the bark is treated with iron, an exceedingly black ink is obtained from the tannin, which abounds in the bark. The tree thrives best in granite or sandy soils and submits readily to transplanting. The nuts may be improved in size and flavor by cultivation, but there are certain varieties to be found in the wild state that produce unusually large nuts, and it is best to select these for transplanting, if the yield of nuts is the chief object. The trees of this State seem to be subject to a blight or some destructive disease that is rapidly destroying them. This is particularly true when other trees are cut from around them. This subject is worthy of careful investigation, and it will be a problem for the experiment station to solve in the future. There is a very good market for the nuts and many of them are sent each year to Europe. One great drawback, however, in keeping the nuts consists in the fact that they wither and become mouldy. They may be kept successfully by placing them in boxes of clean, moderately dry sand and the boxes buried in the ground, where they will be neither too wet nor too dry, and of sufficient depth to be out of the range of sudden atmospheric changes. Before burying, all wormy and imperfect nuts must be carefully picked out. In using the wood for fence posts, it is best to select old trees, because experience has shown that young wood will soon decay—within six or eight years unless coated with tar or other preservatives. The wood makes an inferior fuel. The bark of the chinquapin, a species of the same genus, is used in medicine as an astringent and tonic in intermittent fevers.

The following woods are added to the list given in the last bulletin:

	COMMON NAMES.	SCIENTIFIC NAMES.
108.	Ash, blue.	Fraxinus quadrangulata, Michx.
109.	Alder, black.	Ilex verticillata, Gray.
110.	Alder, white.	Clethra alnifolia, L.
111.	Arrow wood.	Vibernum acerifolium, L.
112.	Arrow wood.	Vibernum dentatum, L.
113.	Blueberry, swamp.	Vaccinium corymbosum, L.
114.	Blueberry, Farkleberry.	Vaccinium arboreum, Mar.
115.	Buckeye, yellow.	Aesculus flava, Ait.
116.	Chokeberry.	Pyrus arbutifolia, L.
117.	Haw.	Cratægus arborescens, Ell.
118.	Hawthorn.	Cratægus spathulata, Mx.
119.	Huckleberry, dwarf.	Graylussacia dumosa, T. and Gray.
120.	Hazlenut.	Corylus Americana, Walt.
121.	Mock Orange.	Prunus Caroliniana, Ait.
122.	Mulberry, French.	Callicarpa Americana, L.
123.	Oak, overcup.	Quercus lyrata, Walt.
124.	Oak, white.	Quercus alba, L.
	Oak, post. (Typographical error in last bulletin.)	Quercus obtusiloba, Mx.
125.	Prickly Ash, Southern.	XanthoxylumCarolinianum, Lam.
126.	Strawberry Bush.	Euonynius Americanus, L.
127.	Titi.	Cliftonia ligustrina, Banks.

(*Continued in next Bulletin.*)

Meteorological Report.

P. H. MELL.

T. D. SAMFORD, Assistant.

Climatic influences upon vegetation are of the greatest importance. The success or failure of crops is due largely to the state of the weather. It is a well known fact that, not only the warmth of the atmosphere, but also the heat in the soil is necessary to germination of seeds as well as for the development of the plant.

Recognizing the importance of these principles, meteorological observations have been made at this station for the purpose of more accurately determining the effects of the weather upon crops and to ascertain the exact temperature of the soil at different depths, as well as the conditions affecting climatic changes.

To accomplish this work the station is furnished with a complete set of atmospheric meteorological instruments, and also with thirty soil thermometers, divided into three sets, ranging in depth from one to ninety-six inches.

Two of these sets of soil thermometers are placed on the top of a hill which is exposed to the constant sweep of the winds and the full strength of the sun's rays. The third set is situated in bottom land on the banks of a running stream. This set is more or less shaded by a rank growth of vegetation. Over each instrument is placed a box perforated with holes to allow a free circulation of air and at the same time to exclude the heat rays of the sun. The character of the soil is sandy and is well drained.

In studying the data of these instruments the following conclusions may be drawn: During the summer months the upper layers of the soil are ten to fifteen degrees warmer than the atmosphere, but become cooler with depth, and in July a depth of five feet below the surface shows a temperature ten degrees cooler than the upper layer. In the fall and winter the reverse of this is true, that while the upper layers of the soil are still somewhat warmer than the atmosphere, yet the lower layers increase in warmth, proportionally so with depth. For instance, the month of July shows a temperature, at the depth of ninety-six inches below the surface, eleven degrees cooler than the air; while December shows a temperature at the same depth nearly fifteen degrees warmer than that of the air.

It is also observed that while the range of temperature of the atmosphere fluctuates considerably, that of the soil is more constant; and further, that the daily range steadily decreases for twenty-four inches, below which depth it is practically nothing—seldom being higher than a half of a degree, and from the figures in the table below it will be seen that the daily range of temperature is several degrees less in the bottom than it is on the hill; showing the effects of location of land, moisture in soil, and the

effects of evaporation caused by the sweep of the winds—the bottom being greatly protected from this agent.

Again, it will be seen that there is but little difference in the temperature of the bottom land and upland, during the fall months. During the hot summer the bottom is a little cooler, during winter it is a little warmer than the upland, and whenever the temperature is about forty degrees and below, then the bottom land is several degrees warmer than the upland.

DATA FROM SOIL THERMOMETERS

AT DIFFERENT DEPTHS COMPARED WITH TEMPERATURE OF ATMOSPHERE.

Atmosphere.	October.			November.			December.		
Monthly mean	62.5			54.7			46.1		
Monthly maximum	81.			78.			66.		
Date	6			6			25		
Monthly minimum	43.			29.			20.		
Date	21			28			20		
Range for month	38.			49.			46.		
Greatest daily range	19.			22.			25.		
Date	30			24			21		
Least daily range	3.			1.			3.		
Date	10			8			26,31		
Mean daily range	17.4			10.1			16.1		
Surface.									
Monthly mean	50.			43.2			38.4		
Monthly maximum	62.			66.			52.		
Date	23			8			10		
Monthly minimum	41.			30.			19.		
Date	2			26			20		
Range for month	21.			36.			33.		
One Inch.	Set I	Set II.	Set III.	Set I.	Set II.	Set III.	Set I.	Set II.	Set III.
Monthly mean	65.5	65.5	65.	57.5	56.5	57.	48.2	48.3	47.5
Monthly maximum	78.5	81.	76.	77.5	76.	73.	60.	60.	55.5
Date	6	5	5,6	3,6,7	1	3	16	25	25
Monthly minimum	49.	47.	52.	34.5	34.	38.	30.5	31.	32.5
Date	29	29	14	28	28	28,29	21	20	21
Range for month	29.5	34.	24.	43.	42.	35.	29.5	29.	23.5
Greatest daily range	21.	22.	16.5	19.	19.	12.5	21.5	22.	14.
Date	1,4,21	4,21	1	1	12	1	3	3	3
Least daily range	1.5	1.	1.	1.	2.	.5	2.	2.	2.
Date	25	25	11,25	8	9,14,21	21	26	10	10,26
Mean Daily range	13.37	12.85	9.8	11.21	11.5	7.55	11.43	11 53	8.5
Three Inch.									
Monthly mean	66.5	65.5	65.	57.5	57.	56.5	48.1	48.3	48.
Monthly maximum	80.	80.5	75.	75.5	76.	71.5	59.	58.5	55.5
Date	5,6	5	6	3,7	7	3	16	25	25
Monthly minimum	51.	49.	53.5	37.5	35	40.5	33.	33.	35.
Date	13,14,29	14,29	14	28,29	28,29	28,29	21	21	21,22
Range for month	29.	31.5	21.5	38.	40.5	31.	26.	25.5	20.5
Greatest daily range	19.	22.5	13.5	15.5	17.	10.	15.5	19.5	11.
Date	1	4	5	1	1	7	2	7	2,3
Least daily range	.5	1.5	1.5	0.	.5	.5	2.	2.	2.
Date	25	25	25	.....	8	13,20	10,16	10	10
Mean daily range	11.53	12.33	7.84	7.8	10.11	6.03	8.62	10.56	6.80
Six Inch.									
Monthly mean	66.	66.	65.	57.5	57.	58.	47.9	48.1	48.5
Monthly maximum	77.	78.5	73.	72.5	73.5	70.	57.5	56.	55.
Date	6	5,6	6	3,6,7	7	3	6	9	10
Monthly minimum	53.5	51.	57.	40.5	38.5	44.5	35.5	35.	38.5
Date	13,14	14	14	28	28,29	29	20,21	21	21,22
Range for month	23.5	27.5	16.	32.	35.	25.5	22.0	21.	16.5
Greatest daily range	12.5	17.5	8.	10.5	13.	5.	11.5	14.	6.5
Date	1,5	1,4,5	5	1,12	12	6,7	6	3	30
Least daily range	1.5	2.	1.	0.	1.	.5	.1	1.5	1.
Date	25	25	10,11	8	8,17,21	14,19,21	27	10	10
Mean daily range	7.61	10.46	4.03	6.	7.58	3.33	6.16	7.90	3.47
Nine Inch.									
Monthly mean	65.5	65.	65.	57.	55.5	56.5	47.4	47.4	48.4
Monthly maximum	74.5	76.	71.5	70.5	71.5	68.5	54.5	55.	54.
Date	6	6	6	3	7	3	10	10	10
Monthly minimum	56.	53.	59.	43	40.	46.	38.	38.5	40.
Date	13,14	14	14	29	29	29,30	20	22	22
Range for month	18.5	23.	12.5	27.5	31.5	22.5	16.5	18.5	14.
Greatest daily range	8.5	12.5	5.5	6.5	9.5	3.5	6.5	9.5	4.5
Date	5	4	5	1	7	1,7	25	3	9
Least daily range	.5	1.	1.	0.	0	0	0.5	1.	.5
Date	10	10	8	8	21	9,19	27	27	10
Mean daily range	4.77	7.43	2.95	3.4	5.36	2.06	3.12	5.17	2.06
Twelve Inch.									
Monthly mean	65.	64.5	65.	57.	57.	58.	47.7	47.3	48.5
Monthly maximum	73.5	73.5	70.	69.	68.5	67.5	54.	54.	54.
Date	6	6	6	3	3	9	10	10	9,10
Monthly minimum	58.	55.5	61.	45.	43.5	48.	39.	39.5	41.5
Date	13,14	14	14,15	29	29	29,30	21,22	21,22	22,23

DATA FROM SOIL THERMOMETERS.

(CONTINUED.)

ATMOSPHERE.	OCTOBER.			NOVEMBER.			DECEMBER.		
TWELVE INCH.	SET I.	SET II.	SET III.	SET I.	SET II.	SET III.	SET I.	SET II.	SET III.
Range for month	15.5	18.	9.	24.	25.	19.5	15.	14.5	12.5
Greatest daily range	6.5	13.5	3.5	4.5	4.5	2.5	4.	3.	4.
Date	19	14	3	1	1,24	14	25	3,4,9	9
Least daily range	0	.5	0	0	0	0	0.5	0.	0
Date	10	20,24	21,22	19	19	8	10,27	27	15,21
Mean daily range	2.95	3.51	1.46	2.2	2.28	.81	1.90	1.63	.97
TWENTY-FOUR INCH.									
Monthly mean	67.5	66.5	65.5	60.5	59.	61.5	51.1	50.4	52.6
Monthly maximum	71.5	70.5	70.5	68.	67.5	67.	55.	54.	55.
Date	6,7	7	3	8,9	8,9	9	10,11	10,11	10
Monthly minimum	64.5	63.5	64.5	52.	51.	54.	45.	45.	49.
Date	8	8	17	29,30	29,30	30	25	2.5	22
Range for month	7.	7.	6.	16.	16.5	13.	10.	9.	6.
Greatest daily range	3.5	2.	4.	2.	1.5	1.	1.5	2.5	1.
Date	11	11	10	10	10	14,24	31	25	9
Least daily range	0	0	0	0	0	0	0	0	0.
Date	8	8	8	8	8	8	8	8	8
Mean daily range	.5	.56	.72	.4	.4	.28	.51	.5	.18
THIRTY-SIX INCH.									
Monthly mean	69.5	68.	68.5	62.5	62.	63.	53.1	53.	54.6
Monthly maximum	71.5	71.	71.5	67.	67.	67.	55.5	55.5	57.5
Date	1	1	1	5,7,8,9	8,9	10	12	10,11	2
Monthly minimum	65.5	65.5	66.	55.	55.	57.	49.5	49.5	51.5
Date	31	31	31	30	30	30	25	25	25
Range for month	6	5.5	5.5	12.	12.	10.	6.	6.	6.
Greatest daily range	.5	2.5	1.	5.	1.	1.	.5	.5	.5
Date	8		11	8	14	14,16	8	8	8
Least daily range	0	0	0	0	0	0	0	0	0
Date	8	8	8	8	8	8	8	8	8
Mean daily range	.32	.29	.16	.11	.18	.18	.13	.08	.18
FORTY-EIGHT INCH.									
Monthly mean	69.5	69.5	69.5	64.	64.	64.5	54 3	55.2	56.5
Monthly maximum	72.5	72.5	72.5	67.5	67.5	67.5	58.	58.	59.5
Date	12	1	1	7,8,9	2,9	8	1,2	1	1
Monthly minimum	67.	67.	67.5	58.5	58.5	60.	52.5	52.5	53.5
Date	31	31	29 31	30	30	30	25,26	25	29
Range for month	5.5	5.5	5.	9.	9.	7.5	5.5	5.5	6.
Greatest daily range	1.	1.	.5	.5	1.	.5	.5	.5	.5
Date	11	11		8	2	8	8	8	8
Least daily range	0	0	0	0	0	0	0	0	0
Date	8	8	8	8	8	8	8	8	8
Mean daily range	14.	.25	.05	.11	.16	.10	.06	.08	.08
SIXTY INCH.									
Monthly mean	70.	70.	70.	66.	65.	65.5	56.8	57.5	58.4
Monthly maximum	73.	73.	72.5	67.5	68.	68.	60.	60.5	61.5
Date	1	1	1	8	1,2	1	1.2	1,2	1,2
Monthly minimum	67.5	68.	68.	60.	61.	62.	54.	55.	56.
Date	29,30,31	27,31	29,31	30	30	30	8	8	31
Range for month	5.5	5.	4.5	7.5	7.	6.	6.	5.5	5.5
Greatest daily range	.5	.5	5	.5	1.	.5	.5	.5	.5
Date	8	8	8,16,21	8	14	8	8	8	10
Least daily range	0	0	0	0	0	0	0	0	0
Date	8	8	8	8	8	8	8	8	8
Mean daily range	.06	.19	.05	.1	.13	.06	.04	.06	.016
SEVENTY-TWO INCH.									
Monthly mean		70.5			66.			58.7	
Monthly maximum		73.			68.5			62.	
Date		1,2			1,2			1,2	
Monthly minimum		68.5			62.			56.	
Date		26,31			30			31	
Range for month		4.5			6.5			6.	
Greatest daily range		.5			.5			.5	
Date								3,28	
Least daily range		0			0			0	
Date		8			8			8	
Mean daily range		.06			.07			.03	
EIGHTY-FOUR INCH.									
Monthly mean		71.			66.			60.1	
Monthly maximum		73.			68.5			63.5	
Date		1			1,2,3			1	
Monthly minimum		69.			63.5			57.5	
Date		28,31			30			31	
Range for month		4.			5.			6.	
Greatest daily range		.5			.5			.5	
Date					10,18			8	
Least daily range		0			0			0	
Date		8			8			8	
Mean daily range		.07			.03			.06	

DATA FROM SOIL THERMOMETERS.

(CONTINUED.)

ATMOSPHERE.	OCTOBER.			NOVEMBER.			DECEMBER.		
NINETY-SIX INCH.	SET. I.	SET II.	SET III.	SET I.	SET II.	SET III.	SET I.	SET II.	SET III.
Monthly mean		71.			67.5			62.	
Monthly maximum		73.			69.			65.	
Date		1			1-5			1	
Monthly minimum		69.5			65.			59.5	
Date		28,31			30			31	
Range for month		3.5			4.			5.5	
Greatest daily range		.5			.5			.5	
Date					10			2	
Least daily range		0			0			0.	
Date		8			8			8	
Mean daily range		.06			.017			.017	

DATA FROM OTHER INSTRUMENTS.

ATMOSPHERIC PRESSURE (In Inches.)	Oct.	Nov.	Dec.
Monthly mean	30.060	30.060	30.133
Maximum	30.340	30.360	30.150
Date	18	12	23
Minimum	29.740	29.770	29.710
Date	11	9	10
Monthly range	.600	.590	.440
PRECIPITATION.			
Total in inches	4.39	4.96	2.94
Greatest daily	1.08	2.15	
Date	25	8	
Number of rainy days	9	6	6.
Number of cloudy days	11	11	9.
Number of fair days	15	12	13
Number of clear days	5	7	9
WIND.			
Prevailing direction from	N.W	E.	S.E.
Total monthly movement (in miles)	3.632	4.361	
Average daily movement	118.1	150.4	
Greatest daily movement	210.	271.	
Date	29	14	

APPENDIX.

In response to a number of inquiries for the act establishing the experiment stations in connection with the Agricultural and Mechanical colleges of the different States and Territories, we give below:

THE HATCH ACT.

An Act to establish agricultural experiment stations in connection with the colleges established in the several States under the provisions of an act approved July second, eighteen hundred and sixty-two, and of the acts supplementary thereto.

Be it enacted in the Senate and House of Representatives of the United States of America in Congress assembled, That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established, under direction of the college or colleges or agricultural department of colleges in each State or Territory established, or which may hereafter be established, in accordance with the provisions of an act approved July second, eighteen hundred and sixty-two, entitled "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts," or any of the supplements to said act, a department to be known and designated as an "agricultural experiment station:" *Provided*, that in any State or Territory in which two such colleges have been or may be so established the appropriation hereinafter made to such State or Territory shall be equally divided between such colleges, unless the Legislature of such State or Territory shall otherwise direct.

SEC. 2. That it shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories.

SEC. 3. That in order to secure, as far as practicable, uniformity of methods and results in the work of said stations, it shall be the duty of the United States Commissioner of agriculture to furnish forms, as far as practicable, for the tabulation of results of investigation or experiments; to indicate from time to time, such lines of inquiry as to him shall seem most important; and, in general, to furnish such advice and assistance as will best promote the purposes of this act. It shall be the duty of each of said stations, annually, on or before the first day of February, to make to the governor of the State or Territory in which it is located a full and detailed report of its operations, including a statement of receipts and expenditures, a copy of which report shall be sent to each of said stations, to the said Commissioner of Agriculture, and to the Secretary of the Treasury of the United States.

SEC. 4. That bulletins or reports of progress shall be published at said stations at least once in three months, one copy of which shall be sent to each newspaper in the States and Territories in which they are respectively located, and to such individuals actually engaged in farm-

ing as may request the same, and as far as the means of the station will permit. Such bulletins or reports and the annual reports of said stations shall be transmitted in the mails of the United States free of charge for postage, under such regulations as the Postmaster General may from time to time prescribe.

SEC. 5. That for the purpose of paying the necessary expenses of conducting investigations and experiments and printing and distributing the results as hereinbefore prescribed, the sum of fifteen thousand dollars per annum is hereby appropriated to each State, to be specially provided for by Congress in the appropriations from year to year, and to each Territory entitled under the provisions of section eight of this act, out of any money in the Treasury proceeding from the sales of public lands, to be paid in equal quarterly payments, on the first day of January, April, July and October in each year, to the treasurer or other officer duly appointed by the governing boards of said colleges to receive the same, the first payment to be made on the first day of October, eighteen hundred and eighty-seven: *Provided, however*, That out of the first annual appropriation so received by any station an amount not exceeding one-fifth may be expended in the erection, enlargement, or repair of a building or buildings necessary for carrying on the work of such station; and thereafter an amount not exceeding five per centum of such annual appropriation may be so expended.

SEC. 6. That whenever it shall appear to the Secretary of the Treasury from the annual statement of receipts and expenditures of any of said stations that a portion of the preceding annual appropriation remains unexpended, such amount shall be deducted from the next succeeding annual appropriation to such station, in order that the amount of money appropriated to any station shall not exceed the amount actually and necessarily required for its maintenance and support.

SEC. 7. That nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States or Territories in which they are respectively located.

SEC. 8. That in States having colleges entitled under this section to the benefits of this act and having also agricultural experiment stations established by law separate from said colleges, such States shall be authorized to apply such benefits to experiments at stations so established by such States; and in case any State shall have established, under the provisions of said act of July second aforesaid, an agricultural department or experimental station, in connection with any university, college or institution not distinctly an agricultural college or school, and such State shall have established or shall hereafter establish a separate agricultural college or school, which shall have connected therewith an experimental farm or station, the Legislature of such State may apply in whole or in part the appropriation by this act made, to such separate agricultural college or school, and no Legislature shall by contract express or implied disable itself from so doing.

SEC. 9. That the grants of money authorized by this act are made subject to the legislative assent of the several States and Territories to the purposes of said grants: *Provided*, That payments of such instalments of the appropriation herein made as shall become due to any State before the adjournment of the regular session of its Legislature meeting next after the passage of this act shall be made upon the assent of the Governor thereof duly certified by the Secretary of the Treasury.

SEC. 10. Nothing in this act shall be held or construed as binding the United States to continue any payments from the Treasury to any or all the States or institutions mentioned in this act, but Congress may at any time amend, suspend, or repeal any or all the provisions of this act.

Approved, March 2, 1887.