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Agricultural Experiment Station

BULLETIN NO. 4.

S. M. TRACY, DIRECTOR.

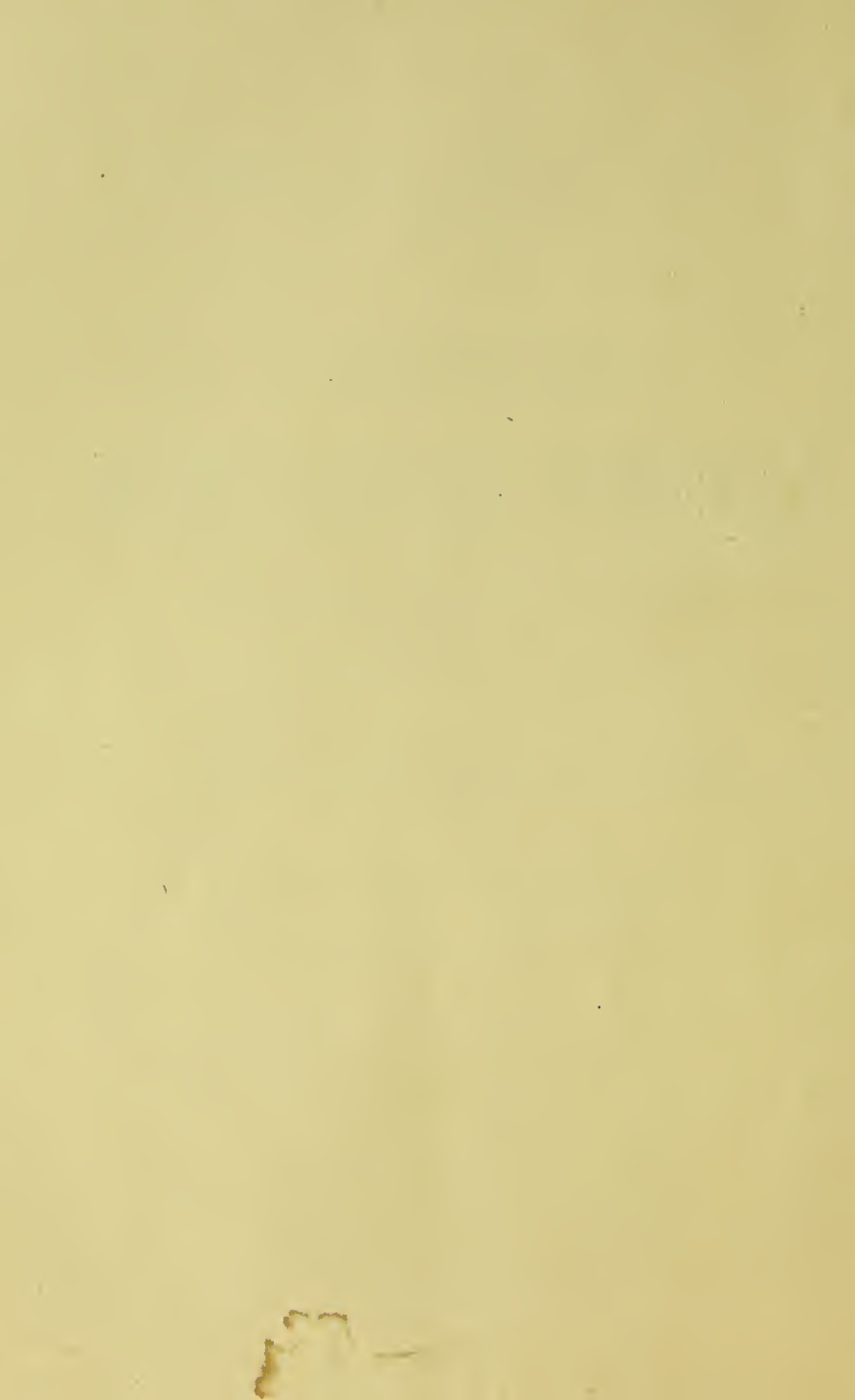
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THE MARLS OF MISSISSIPPI.

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W. L. HUTCHINSON, Chemist.

NOVEMBER 7TH, 1888.



## THE MARLS OF MISSISSIPPI.

We are an agricultural people. If we would prosper we must become familiar with the principles which underlie successful agriculture. The criminal system of the past which has despoiled and exhausted such extensive areas of once fertile and favored sections must give place to a system of agriculture more rational and intelligent. Realizing the influence which marls may have on the agriculture of a State in which they occur as extensively as they do in this, we have thought it well to collect and embody in a bulletin such information concerning them as will enable every citizen in whose hands this bulletin may fall to properly estimate their value, and to intelligently decide when and where it will be profitable to use them.

Marls consist essentially of carbonate of lime mixed with more or less sand and clay. They frequently contain also small quantities of phosphoric acid and potash. The two latter, with the carbonate of lime, constitute their valuable ingredients.

A brief paragraph on the two classes of chemical manures is given in order that the action of marls may be better understood.

The two classes referred to are known as **STIMULANT** and **NUTRITIVE** fertilizers. Stimulant fertilizers do not serve directly as plant food, nor is their action in the soil similar to that of stimulants in the animal body. Their office in the soil is to dissolve, to bring in solution, to make available the "locked up" plant food ingredients that exist in the minerals of the soil as well as that of

the incorporated vegetable matter. What the atmospheric agencies, and the waters of the soil,—the usual solvents of nature.—would require centuries to accomplish may be done in a few years by the use of stimulant fertilizers. As this class of fertilizers do not contain the ingredients with which they furnish the plant, it is plain that a persistent use of only such fertilizers must result in an early exhaustion of the soil. Lime is prominent as a stimulant fertilizer. Practice for ages has shown that its application on many soils is productive of the very best immediate results; it has at the same time given rise to such expressions as “Lime kills the land.” “Lime enriches the father but impoverishes the son;” or “He who limes without manure will leave his farm and family poor.”

On the other hand true or nutritive manures serve directly as food for plants. They may be supplied from year to year in quantities sufficient for the growing crop or else an excessive amount may be added which will constitute so much increased wealth of the soil. The most economical plan however is to supply from time to time just that quantity which will be appropriated by the crop, as the soluble plant food of to day is the insoluble of to-morrow, and what is worse, is perhaps washed out and lost to the soil and succeeding crops forever. If then, to preserve and in some instances to improve the original fertility of the soil constitutes a rational system of agriculture, then must both these classes of manures be judiciously applied.

Lime, as has been stated is a stimulant fertilizer.—Phosphoric acid and potash are nutritive fertilizers; a marl then that contains appreciable quantities of the latter ingredients, not only releases the insoluble plant food contained in the soil by the action of the carbonate of lime, but furnishes in an available form two of the three ingredients which are soonest exhausted from all soils.

The benefits which have accrued from their use is thus easily explained.

While the solvent action of lime in the soil is perhaps its most valuable property, it is recognized to perform many other important functions. We cannot do better than quote from Dr. Eug. W. Hilgard, former State Geologist, as to the functions of lime in the soil. The following is taken from his report of the Cotton Production in Mississippi, published in the Tenth Census Reports of the U. S. :

(a.) "A more rapid transformation of the vegetable matter into active humus, which manifests itself by a dark or deep black tint of the soil.

(b.) The retention of such humus against the oxydizing influences of hot climates.

(c.) Whether through the intervention of this humus, or in a more direct manner it renders adequate for more profitable culture percentages of phosphoric acid and potash so small that in the case of the absence or deficiency of lime, the soil is practically sterile.

(d.) It tends to secure the proper conditions of nitrification whereby the inert nitrogen of the soil is rendered available.

(e.) It exerts a most important physical action on the flocculation and therefore on the tillability of the soil."

### MARLS IN OTHER STATES.

As the most extensive use of marls in this country has been in New Jersey, we give the following account of their use in that State. This account is taken principally from reports of the New Jersey Experiment Station :

Greensand marls have been the means of restoring large districts of worn out lands to fertility. The texture

of lands too light to be worked profitably has been improved to such a degree as to make them valuable.

All of these greensand marls contain phosphoric acid in combination with iron or lime, forming phosphates of these substances. These phosphatic compounds are insoluble in water, but are in good form to dissolve in the soil. Phosphoric acid does not occur as a constant quantity, but varies from 1-2 to 4 per cent.—These marls also contain from 5 to 7 per cent. of potash.

Marls whose percentage of phosphoric acid is high have given the best satisfaction in New Jersey. Smaller dressings of this marl usually produce equally as good results as larger applications of other varieties.

There are three varieties of these marls. Those containing large quantities of phosphoric acid; those containing carbonate of lime in fine powder; those consisting of grains of pure greensand.

The phosphoric acid which these marls contain seems to be more available than that in ground bone—and those marls containing small quantities of sulphate of lime are preferred to those which are similar in every other respect, but are wanting in this.

The prices of these marls range from 50 cents to five dollars per ton (20 bushels) according to the distance they have been transported from the pits. They have enriched the favored section in which they occur. They require frequent rains to bring out their fertilizing properties.—The best results from their application are seen on sandy loam soils; soils thoroughly drained are improved to a larger extent than are similar soils undrained.

Marls have also been used in Virginia, the Carolinas and in Georgia, with similar good results. They will pay in Mississippi just as well as elsewhere, provided the best varieties are selected and judiciously applied.



## OCCURRENCE OF MARLS IN MISSISSIPPI.

From the Geological Report of Dr. Eug. W. Hilgard, we cull the following in regard to the occurrence of marls in this State. They are classified as occupying essentially four different positions, viz :

1. Cretaceous marls in the North-Eastern Prairie region.
2. Marine Tertiary marls occurring in the Central Prairie region.
3. Clay marls interspersed in patches in beds of the different clays throughout the entire region South of the Central Prairie belt.
4. The calcareous silt which forms the main portion of the hills in the Southern counties are classed as fresh water marls.

We dismiss the two latter classes with this notice of their occurrence.

All of the many varieties of the Cretaceous marls may be embraced under the heads of greensand marls, clay marls and greensands. The greensand marls occur in Tippah, Pontotoc, and Chickasaw. The clay marls of this formation belonging to the Rotten Limestone age, occur in Tishomingo, Itawamba and Pontotoc. The greensands occur in Monroe and Lowndes Counties.

Table 1 gives analyses of marls from this region. In connection with those that have been made in this laboratory, a number of analyses that were made by Dr. Hilgard and published by him in the Tenth Census Reports above referred to, are also given. We have taken the liberty to assign letters to the different analyses made by Dr. Hilgard; those made in this laboratory were made by Dr. B. von Herff, and are given with the station numbers.

### MARLS OF THE CENTRAL PRAIRIE REGION.

Underlying the greater portion of this belt which extends across the central portion of the State are various kinds of marls. Their agricultural value is quite variable. The clayey varieties occur chiefly in the Northern portion. The sandy or purely calcareous varieties are found near the Southern edge.

Table II gives analyses of marls of this section.



[ TABLE I. ]

LOCALITY, DESCRIPTION, OCCURRENCE, ETC.

GREENSAND SHELL MARL, from Sec. 22, T. 4, R. 3 E., 2 miles west of Ripley, Tippah County, crops out in the bed of a small creek.  
 BLUE MARL, from a well in the town of Ripley, similar marls crop out at numerous localities in this region.  
 INDURATED BLUE MARL, from Sec. 21, T. 3, R. 4 E., Tippah County. Somewhat difficult to crumble. For use it should be exposed to the weather for some time.  
 BLUE MARL, from a place southeast of Ripley, exact locality not given. This marl is said to fairly represent most of those occurring in the eastern part of the marl region of Tippah and Union.  
 BLUSH GREENSAND MARL, from an outcrop 1 mile south of Pontotoc, Pontotoc county, ; several feet in thickness; easily accessible.  
 ROTTEN LIMESTONE, from near Okolona, Chickasaw County, a fair sample of the white "Prairie Rock."  
 YELLOW CLAY MARL, from railroad cut southeast of Chewalla station, Alcorn County.  
 GREENISH MICACEOUS SAND, from a bluff on the Tombigbee River near Aberdeen, Monroe County.  
 GREENISH MICACEOUS SAND, from a bluff on the Tombigbee River near Waverly, Lowndes County.  
 GREENSAND, from Columbus, Lowndes County.  
 PHOSPHATIC MARL, from Columbus, Lowndes County.  
 MARL from Plymouth Bluff, Lowndes County.  
 GREENSAND from Shuqualok, Noxubee County.  
 SHELL MARL from Senator Boon, Booneville, Miss.

Station Number	Insoluble Matter	Carbonate of Lime	Phosphoric Acid	Potash	Magnesia	Sequoioxide of Iron & Alumina
A	48.81921	7.65	1	342.2	353	18.510
B	62.441	14.154	.226	703.1	.560	17.714
C	40.855	38.084	.292	.154	.910	12.367
D	78.842	11.701	.180	.797	1.445	5.618
E	49.051	28.919	.199	1.701	1.091	16.055
F	10.903	81.501		.248	.877	3.378
G	55.554	23.66	.114	557.1	314	13.210
H	81.224	8.768	.131	.765	824	7.372
I	88.702	2.402	.328	.204	.723	5.598
38	34.95	49.10	.070	370.2	970	9.42
39	57.55	31.32	2.06	590.1	350	7.50
38	36.73	44.93	.12	390.2	560	10.43
31	4.98	90.30	.59	490.1	.20	2.70
30	52.81	4.60	.42	1513.90	29.00	



An examination of the tables of analyses shows that the best marls in the Cretaceous or North-Eastern Prairie region are to be found in the Pontotoc ridge. Yet in all the counties in which marls occur there are some that can be profitably used, while there are others that would not pay for the expense of even the shortest transportation. The surest way in the selection of any marl for use would be to have it analyzed.

What has been said in regard to the Cretaceous marls will apply to the marls of the Central Prairie region.—Doubtless the poorer qualities in this belt are to be found in Smith and Wayne counties. The “sour” lands South of this belt would be greatly improved by the application of marls. The quantity to be used may vary from 10 to 25 tons (200 to 500 bushels) per acre; and it is usually desirable to accompany an application of marls with the incorporation of vegetable matter, which may be accomplished by plowing under a crop of pea vines, or even of weeds.

Where marls of good quality are to be had for the hauling, as is the case in some portions of the State, they are the most economical fertilizers which can be used—but as so large a proportion of those found in this State contain small quantities of the valuable ingredients, we do not recommend their indiscriminate use.

Potash is worth about 5 and phosphoric acid 8 cents per pound; with these figures it is easy to estimate the value of these elements per ton in the marls enumerated above.

We shall be glad to receive samples from other sources where they are found in sufficient quantities to be of general interest. Analyses of such will be made, free of charge, provided samples are sent in a proper form. A sample for analysis should weigh about two pounds, and must be accompanied by a statement giving exact location, township, range and section, the thickness of the bed, its depth from the surface of the ground, and, if possible, its area.

Send samples by Express, to

**EXPERIMENT STATION,**  
Starkville, Miss.