Bulletin 3.4

THE CONNECTICUT

AGRICULTURAL EXPERIMENT STATION,

New Haven, Conn.

The Station is prepared to analyze and test fertilizers, cattle-foods, seeds, and other agricultural materials and products, for the use and advantage of the citizens of Connecticut. Analyses, seed-examinations, etc., that are for the public benefit, will be made without charge.

The Officers of the Station will take every pains to obtain for analysis samples of all the commercial fertilizers sold in Connecticut, but consumers are requested to send in samples of their purchases early during each season of trade.

Every Connecticut citizen who is concerned in agriculture, whether farmer, manufacturer, or dealer, has the right to apply to the Station for any information or assistance which comes within its province to render, and the Station will respond to all applications so far as lies in its power.

☞ Instructions and Forms for taking samples, and Terms for testing Fertilizers, Seeds, &c., for private parties, sent on application.

☞ Parcels by Express, to receive attention, should be prepaid, and all communications should be directed to

Agricultural Experiment Station, New Haven, Conn.

Laboratory and Office, in East Wing of Sheffield Hall,

Grove Street, head of College Street.

BULLETIN FOR OCTOBER, 1877.

The operations of this Station began July 1st, 1877. Thirty-one Fertilizers have been analyzed; twelve for private parties. The analyses that have any general interest are given below, and those that represent articles in the market are accompanied with a valuation.

	Composition for Vegetables.	Composition for Grass.	Harbor Mud.	Pond Mud.	Bog Ashes.
	Pollard Bros., 3 Custom House Sq. New Haven.		L. Wharf N. Haven 1860.	North Woodstock.	Middlefield.
Station No.	**4**	**5**	X	**8**	**21**
Moisture	15.41	16.72	Dried at 212°	7.000	4.10
Organic and Volatile Matters	12.04	13.92	10.56	10.000	
Nitrogen	(.09)	(.19)	(.52)	(.260)	
Sand and Insoluble	68.12	65.27	77.21*	77.024*	77.50*
Soluble Silica			.42	.088	
Oxides of Iron and Alumina			7.36	4.470	12.59
Lime	1.41	1.38	.73	.248	2.06
Magnesia	.88	.96	.73	.821	1.11
Potash	.46	.15	.77	.242	.51
Soda	1.24	.23	.80	.041	.29
Sulphuric Acid	*trace*	*trace*	.96	*trace*	.72
Phosphoric Acid	.39	.37	.03	.066	.55
Chlorine and Carbonic Acid	.05*	1.00*	.43	*trace*	.57*
	100.00	100.00	100.00	100.00	100.00
Estimated Value	$ .99	$ 1.03			
Cost	$32.00	$32.00			

* By difference.

Nos. **4** and **5** are articles sold by or on the representations of H. M. Pollard, who visits farms, "analyzes" soils by smell, taste and "chemicals" that he carries in his pocket, and writes prescriptions on the spot for the field or crop, or undertakes to mix a fertilizer suited to the case. He carries testimonials and letters purporting to be from respectable persons in Rhode Island. "Pollard Bros." have furnished the "Composition" to customers, in several cases supplying and charging for a considerable greater than the stipulated quantity. The Secretary of the Naugatuck Farmers Club visited the "works," and "found an unoccupied

building," learned that Pollard Bros. "were operating on ground formerly overflowed by tide-water," "saw where the surface of the ground had been removed, and under a shed close by were heaps of sand and mud that appeared to be mixed from this surface soil, and to be the basis of the Fertilizer. Consequently none of the Fertilizer was ordered." In fact, the Composition for grass and vegetables might be made by mixing harbor mud with 1 per cent. of phosphate of lime and 1 per cent. of oyster shell lime, as will be seen on comparing analyses **4** and **5** with analysis X.

Analyses X and **8** exhibit the composition of the sediments found in salt bays and fresh water ponds. In X, the nitrogen is noticeable as equal to that of ordinary yard manure, and is due to various minute animals. **8** is as rich in plant-food as many a good compost, and X is richer. Both, like the street sweepings of a city, are manures well worth using when easy to get to the ground where they are wanted, but like **4** and **5**, not usually worth transporting a mile or two, unless hands and teams have slack employment.

21, from Secretary of Middlefield Farmers Club, is the result of firing the "bogs" or hummocks of coarse grass that grow in swamps. These ashes consist chiefly (90 per cent.) of sand and soil, but with 2 per cent of lime, 1 per cent. of magnesia, and one half per cent. each of potash and phosphoric acid, are rich in plant-food, considered in comparison with the usual farm-resources.

BONE MANURES.

	Station Number.	Moisture.	Phos. Acid.	Nitrogen.	Finer than $\frac{1}{50}$ in.	Finer than $\frac{1}{25}$ in.	Finer than $\frac{1}{12}$ in.	Finer than $\frac{1}{6}$ in.	Coarser than $\frac{1}{6}$ in.	Estimated Value.	Cost.	Dealer.
Dean's Pure Ground Bone	**14**	7.78	19.94	3.80	28	8	12	17	35	$31.40	$30.00	G. M. Dean, Springfield, Ms.
Lister's Ground Bone	**24**	---	24.10	3.49	76	18	6	--	--	46.30	38.00	John S. Wells, Hebron.
Bird's Ground Bone	**25**	---	22.60	3.48	17	4	6	7	66	33.04	35.00	James Bird, Naugatuck.
Peter Cooper's Coarse Bone	**27**	---	29.51	0.95	59	6	9	10	16	44.73	25.00	Peter Cooper, New York City.
Peter Cooper's Fine Bone	**28**	---	19.04	1.91	62	4	6	3	25	33.54	30.00	Peter Cooper, New York City.
Tankings	**29**	6.82	13.79	4.32	--	--	--	--	--	36.59	----	Not in market.

The above are worth their cost, except perhaps **25**, which is chemically good but not finely ground.

SWAMP MUCK OR PEAT.

	Station No.	Water.	Organic and Volatile.	Ash.	Nitrogen.	Locality.
Swamp Muck, air-dried	**1**	11.57	55.95	32.48	1.65	Westbrook.
The same, water-free			63.27	36.73	1.87	
Peat, newly dug, wet	**10**	85.00	13.17	1.83	.30	Ashford.
The same, water-free			87.80	12.20	2.00	
Peat, dug one year ago, very moist	**11**	71.17	26.66	2.17	.41	Ashford.
The same, water-free			92.47	7.53	1.43	

The fertilizing value of peat lies mainly in its nitrogen; but as an absorbent in the compost, and a retainer of moisture in leachy soils it is very useful.

GUANOS.

	Station No.	Soluble Phos. Acid.	Reverted Phos. Acid.	Insoluble Phos. Acid.	Potash.	Nitrogen.	Estimated Value.	Cost.	Dealer.
"Soluble Pacific Guano"	**9**	5.18	0.96	6.12	1.63	2.43	$32.96	$45.00	J. H. Dickerman, Mt. Carmel.
Peruv. Guano, Standard	**13**	5.47	5.20	4.99	4.21	8.62	58.22	53.50	C. L. Willard, Hartford.

SLAUGHTER-HOUSE FERTILIZERS.

	Station No.	Moisture.	Nitrogen.	Phosphoric Acid.	Estimated Value.	Cost.	Dealer.
Blood Fertilizer	**30**	26.37	6.22	6.36	$33.78	$30.00	Sperry & Barnes, New Haven.
Blood Fertilizer	**31**	8.13	9.09	3.36	41.06	30.00	Strong, Barnes, Hart & Co., New Haven.
Hair Manure	**26**	24.61	7.90	2.23	25.93	12.00	Peter Cooper, New York.

DRY GROUND FISH SCRAP, OR "FISH GUANO."

The analyses below, mostly representing cargoes, were made for Connecticut dealers who base their wholesale transactions on the amount of nitrogen without regard to phosphoric acid. The analyses show the usual range of variation in the moisture and nitrogen of this standard article. Phosphoric acid averages about 7 per cent.

	Station No.	Moisture.	Nitrogen.
Dry Ground Fish Scrap	**2**	10.75	8.52
" " " "	**12**	----	8.21
" " " " old, 1876	**15**	16.59	7.35
" " " " new, 1877	**16**	23.95	7.30
" " " "	**17**	----	9.26
" " " "	**18**	----	8.77
" " " "	**22**	19.57	7.98

POTASH SALTS.

	Station No.	Potash.	Muriate of Potash.	Sulphate of Potash.	Bisulphate of Potash.	Sulphate of Soda.	Bisulphate of Soda.	Estimated Value.	Cost.	Dealer.
Muriate of Potash	**19**	51.97	82.31	----	----	----	----	$62.00	$55.00	Southmayd & Gardiner, Middletown.
Sulphate of Potash	**20**	42.31	21.87	30.16	35.27	----	----	67.68	65.00	Southmayd & Gardiner, Middletown.
Niter-Cake, sold as "Carbonate of Potash"	**23**	1.76	----	3.25	----	51.77	24.90	18.00	80.00	H. M. Pollard, Providence, R. I.

20 was sent for analysis because it ruined the potato and melon crops to which it was applied. This effect is due to its containing 35 per cent. of the corrosive *bisulphate of potash*, which destroys vegetation, unless applied to plow-land some time before sowing seed, or mixed with lime or wood-ashes before using. The proper use of this kind of potash-salts is to sprinkle on stable floors or manure heaps to fix ammonia.

23 was sold "at cost" as Carbonate of Potash by H. M. Pollard to a gentleman whose soil he had "analyzed." The "cost" was $4.00 per 100 lbs. The article is no carbonate of potash, but essentially niter-cake, to be bought at 70–80 cents per 100 lbs., and containing 25 per cent. of corrosive bisulphate of soda.

EXPLANATIONS.

Nitrogen is commercially the most valuable fertilizing element. It occurs in various forms or states. *Organic nitrogen* is the nitrogen of animal and vegetable matters generally, existing in the albumin and fibrin of meat and blood, in the uric acid of bird dung, in the urea and hippuric acid of urine, and in a number of other substances. Some forms of organic nitrogen, as that of blood and meat, are highly active as fertilizers; others, as that of hair and leather, are comparatively slow in their effect on vegetation, unless these matters are reduced to a fine powder or chemically disintegrated. *Ammonia* and *nitric acid* are results of the decay of *organic nitrogen* in the soil and manure heap, and are the most active forms of Nitrogen. They occur in commerce —the former in sulphate of ammonia, the latter in nitrate of soda. 17 parts of ammonia contain 14 parts of nitrogen.

Soluble Phosphoric acid implies phosphoric acid or phosphates that are freely soluble in water. It is the characteristic ingredient of Superphosphates, in which it is produced by acting on "insoluble" or "reverted" phosphates with oil of vitriol. It is not only readily taken up by plants, but is distributed through the soil by rains. Once well incorporated with soil it shortly becomes reverted phosphoric acid.

Reverted (*reduced or precipitated*) *Phosphoric acid*, means strictly, phosphoric acid that was once freely soluble in water, but from chemical change has become insoluble in that liquid. It is freely taken up by a strong solution of ammonium citrate, which is therefore used in analysis to determine its quantity. "Reverted phosphoric acid" implies phosphates that are readily assimilated by crops, but have less value than soluble phosphoric acid, because they do not distribute freely by rain.

Insoluble Phosphoric acid implies various phosphates not freely soluble in water or ammonium citrate. In some cases the phosphoric acid is too insoluble to be readily available as plant food. This is true of the South Carolina rock phosphate, of Navassa phosphate, and especially of Canada apatite. The phosphate of raw bones is nearly insoluble in this sense, because of the animal matter of the bone which envelopes it, but when the latter decays in the soil, the phosphate remains in essentially the "reverted" form.

Potash signifies the substance known in chemistry as potassium oxide, which is the valuable fertilizing ingredient of "potashes" and "potash salts." It is most costly in the form of sulphate, and less so in the shape of muriate or chloride.

The Valuation of a Fertilizer signifies ascertaining its worth in money, or its trade-value, a value which it should be remembered is not *necessarily* proportional to its fertilizing effects in any special case.

Plaster, lime, stable manure and nearly all of the less expensive fertilizers have quite variable prices, which bear no close relation to their chemical composition, but guanos, superphosphates and other fertilizers, for which $30 to $80 per ton are paid, depend chiefly for their trade-value on the three substances, *nitrogen*, *phosphoric acid* and *potash*, which are comparatively costly and quite steady in price. The money-value per pound of these ingredients is easily estimated from the market prices of the standard articles which furnish them to commerce.

The following are the trade-values or cost in market, per pound, of the ordinarily occurring forms of nitrogen, phosphoric acid and potash, as recently found in the New York and New England markets:

	Cents per pound.
Nitrogen in ammonia and nitrates,	24
" in Peruvian Guano, fine steamed bone, dried and fine ground blood, meat and fish,	20
" in fine ground bone, horn and wool dust,	18
" in coarse bone, horn shavings and fish scrap,	15
Phosphoric acid soluble in water,	12½
" " "reverted" and in Peruvian Guano,	9
" " insoluble, in fine bone and fish guano,	7
" " " in coarse bone, bone ash and bone black,	5
" " " in fine ground rock phosphate,	3½
Potash in high grade sulphate,	9
" in kainite, as sulphate,	7½
" in muriate, or potassium chloride,	6

These "estimated values" are not fixed, but vary with the state of the market and are from time to time subject to revision. They are not exact to the cent or its fractions, because the same article sells cheaper at commercial or manufacturing centers than in country towns, cheaper in large lots than in small, cheaper for cash than on time. These values are high enough to do no injustice to the dealer, and accurate enough to serve the object of the consumer.

By multiplying the per cent. of Nitrogen, &c., by the trade-value per pound, and then by 20, we get the value per ton of the several ingredients, and adding the latter together we obtain the total estimated value per ton.

The uses of the "Valuation" are, 1st, to show whether a given lot or brand of fertilizer is worth as a commodity of trade what it costs. If the selling price is no higher than the estimated value, the purchaser may be quite sure that the price is reasonable. If the selling price is but $2 to $3 per ton more than the estimated value it may still be a fair price, but if the cost per ton is $5 or more over the estimated value, it would be well to look further. 2d, Comparisons of the estimated values, and selling prices of a number of fertilizers will generally indicate fairly which is the best for the money. But the "estimated value" is not to be too literally construed, for analysis cannot always decide accurately what is the *form* of nitrogen, &c., while the mechanical condition of a fertilizer is an item whose influence cannot always be rightly expressed or appreciated.

The *Agricultural value* of a fertilizer is measured by the benefit received from its use, and depends upon its fertilizing effect, or crop-producing power. As a broad general rule it is true that Peruvian guano, superphosphates, fish scraps, dried blood, potash salts, plaster, &c., have a high agricultural value which is related to their trade-value, and to a degree determines the latter value. But the rule has many exceptions, and in particular instances the trade-value cannot always be expected to fix or even to indicate the agricultural value. Fertilizing effect depends largely upon soil, crop and weather, and as these vary from place to place and from year to year, it cannot be foretold or estimated except by the results of past experience, and then only in a general and probable manner.

WORK IN PROGRESS.

Besides other Fertilizer examinations, the Station has in hand the testing of various farm and garden Seeds, with regard to their purity and vitality—is also making analyses of several kinds of Cattle Food and Forage and is studying the power of Soils to contain and transmit water. The results will appear in due time.

Suggestions and material for investigations are solicited from practical Farmers.