

Yield and Chemical Composition of Clippings from a Green of Washington Bent Grass

By O. J. NOER

CROPPING DATA DEALING with pasture herbage is voluminous. It includes innumerable analyses of grass and yields of dry matter on the acre basis. The information is of doubtful value for golf course and lawn use, because pastures contain many different species, including a large proportion of clover; fertilization is less generous, especially with respect to nitrogen; pastures are not watered and grass is allowed to attain a growth of two to four inches, or more, between sampling for analysis.

Archibald and Bennett grew several species of forage plants. All but Dutch white clover are commonly used on golf courses. They were grown in pure stand on a sandy loam in Massachusetts, but without fertilizer of any kind. Plats were mowed when the grass was 3 to 4 inches high. Clippings were dried in an oven at 60 to 70 degrees C. The following results represent the average composition for three years. Yields were not given.

dried, then weighed and analyzed. Findings were reported in the Bulletin, Volume 11, pp. 106-109 (1931), in this manner: "Results indicate that the amount of field dry material removed from eighteen greens totalling 90,000 square feet (5,000 square feet per green) would be about 4 tons, and contain the following equivalent amounts of plant food: Nitrogen as obtained in 2,000 pounds of 20 percent sulfate of ammonia, phosphoric acid as obtained in 200 pounds of 20 percent superphosphate, and potash as contained in 400 pounds of 50 percent muriate of potash."

These amounts correspond to the following rates per 1,000 square feet—4.44 pounds of nitrogen, 0.44 pounds of phosphoric acid, and 2.22 pounds of potash. The figure for phosphoric acid seems unusually low.

The quantities of fertilizer mentioned above for eighteen greens total 2,600

	Rhode Island Bent
Moisture in Fresh Grass.....	67.55
Nitrogen (N)	2.50
Phosphoric Acid (P ₂ O ₅).....	.87
Potash (K ₂ O)	2.69
Calcium Oxide (CaO)	1.05
Magnesium Oxide (MgO).....	.32

	Red Top	Kentucky Blue Grass	Sheep Fescue	Dutch White Clover
Moisture in Fresh Grass.....	71.99	68.59	65.26	83.21
Nitrogen (N)	2.49	2.32	2.09	4.46
Phosphoric Acid (P ₂ O ₅).....	.80	.87	.76	1.03
Potash (K ₂ O)	3.14	2.56	2.30	2.69
Calcium Oxide (CaO)87	.69	.67	2.25
Magnesium Oxide (MgO).....	.35	.30	.25	.42

The nitrogen of blue grass was very low, so 8-6-4 fertilizer was used at 500 pounds per acre on a part of one plat in the spring of the third year. The average nitrogen in the fertilized grass was 3.51 percent, as compared with a three-year average of 2.32 percent for the corresponding unfertilized turf.

Clippings from fertilized grass invariably contain more plant food than those from unfertilized areas. The effect of nitrogen is most striking in this respect.

The Green Section collected clippings from some of the better treated putting green plats at the Arlington turf garden in Washington, D. C., from June 1 to November 1, 1930. The clippings were

pounds, or 145 pounds for each one. The analysis of the mixture is 15.3-1.5-7.6.

In the spring of 1944 arrangements were made to obtain similar data from the sixth green at the Brynwood CC in Milwaukee. Lester Verhalen weighed the clippings every time the green was mowed. Monthly composite samples were collected by taking exactly five pounds of clippings each week. These samples were analyzed in the Milwaukee Sewerage Commission laboratories under the supervision of H. M. Heisig, chief chemist.

Originally it was intended to determine calcium, magnesium, and other mineral elements in addition to nitrogen, phos-

phoric acid, and potash. The clippings were found to contain a few small pebbles and some sand from a trap alongside the green. The sand in this area is high in lime, so only the three principal fertilizer elements were determined.

The mowed area contained 6,360 square feet of Washington bent grass. The stolons used on the green came from the P. C. Leonard Nursery in Lake Geneva, Wis. His original planting stock was obtained direct from the Green Section in Washington. Phosphate and potash were applied in the spring, and again in September. It was intended to use an 0-14-14, but an 0-8-24 was the only mixture without nitrogen available in the spring. It was decided to use equal quantities of it and 20 percent superphosphate. The resulting mixture would be an 0-14-12. An 80-pound bag of 0-8-24 was applied April 15th, but, due to an oversight, the 80 pounds of superphosphate were not used until June 22nd. Two 80-pound bags of 0-12-12 were applied September 20th.

A 100-pound bag of Milorganite was used each month beginning April 15th and ending September 20th, making 600 pounds in all. The rate was 15.7 pounds, or approximately 1 pound of nitrogen per 1,000 square feet per month.

Both yield of clippings and percentage plant food content are influenced by the quantity and kind of fertilizer used, and by the amount of soil moisture. During the season the following quantities of plant food were applied per 1,000 square feet: 5.64 pounds of nitrogen, 9.37 pounds of phosphoric acid, and 6.04 pounds of potash. The fertilizer program is summarized in Table I.

There was one mild attack of brown patch in August. Dollar spot was never serious and was easily controlled. Drought prevailed during June, and from mid-September through October. Localized dry spots developed in June. They were forked and drenched with water, but 10 to 14 days elapsed before recovery occurred. The green got very little water after mid-September. The lower yields in June may have resulted from localized dry spots, and were due to restricted supply of soil moisture in September and October.

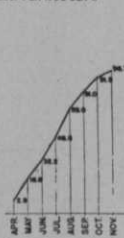
The clippings were air dried and reduced to a dry basis in an oven. Contamination with sand from the trap did not materi-

ally affect the weight of dry matter. The increase due to it was found to be less than 3 percent. The fresh and dry weight of clippings and percentage moisture content of freshly clipped grass are reported by months in Table II. The dry matter produced from April 27 to November 4 was 96.7 pounds per 1,000 square feet, or 8,703 pounds for eighteen greens containing 90,000 square feet. The amount is about the same as the 4-ton figure reported by the Green Section.

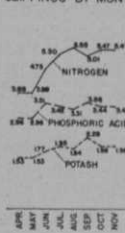
The chemical analyses of the dry clippings and the corresponding amounts removed in clippings from 1,000 square feet are reported by months in Table III. The quantities of Milorganite, superphosphate, and muriate of potash that furnish the corresponding amounts of nitrogen, phosphoric acid, and potash removed in clippings from 1,000 and 90,000 square feet, or eighteen greens averaging 5,000 square feet each are given in Table IV.

The plant food in the clippings from eighteen greens is equivalent to 7,245 pounds of Milorganite, or 2,175 pounds sulfate of ammonia; 810 pounds of 20 percent superphosphate, and 584 pounds of 50 percent muriate of potash. An all chemical mixture (sulphate of ammonia, superphosphate, and muriate of potash) would total 3,569 pounds, or 198 pounds per green. The exact analysis of it would be 12.2-4.6-8.1, or with nitrogen expressed as 15, the ratio becomes 15-5.7-10. The relationship between nitrogen and phosphoric acid is 2.65 to 1, whereas the Green Section figure is 10 to 1, based on their ratio of 15.3-1.5-7.6.

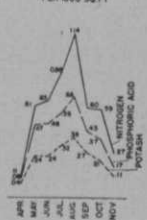
YIELD OF DRY MATTER
LBS. PER 1000 SQ. FT.



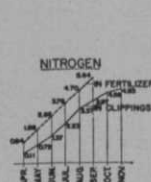
PERCENT PLANT FOOD
IN CLIPPINGS BY MONTHS



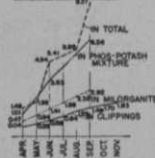
POUNDS OF PLANT FOOD
IN CLIPPINGS BY MONTHS
PER 1000 SQ. FT.



AMOUNTS OF PLANT FOOD APPLIED AND REMOVED - APRIL THRU NOVEMBER, 1944
POUNDS PER 1000 SQ. FT.



PHOSPHORIC ACID



POTASH

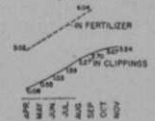


TABLE I.

Fertilizer Used on No. 6 Green at Brynwood, and Quantities of Plant Food Applied per 1,000 Square Feet per Month and for the Season.

(Mowed Area 6,360 Square Feet)

Date Applied 1944	Material and Analysis	Amount Used		Plant Food Applied per 1,000 Sq. Ft.		
		On Green Pounds	Per 1,000 Sq. Ft. Pounds	Nitrogen Pounds	Phs. Acid Pounds	Potash Pounds
Apr. 15	Milorganite 6-3-0.....	100	15.7	0.94	0.47	
May 15	Milorganite 6-3-0.....	100	15.7	0.94	0.47	
June 15	Milorganite 6-3-0.....	100	15.7	0.94	0.47	
July 18	Milorganite 6-3-0.....	100	15.7	0.94	0.47	
Aug. 17	Milorganite 6-3-0.....	100	15.7	0.94	0.47	
Sept. 20	Milorganite 6-3-0.....	100	15.7	0.94	0.47	
	TOTALS.....	600	94.2			
Apr. 15	Commercial Mixture 0-8-24..	80	12.6		1.01	3.02
June 22	Superphosphate 0-20-0.....	80	12.6		2.52	
Sept. 20	Commercial Mixture 0-12-12	160	25.2		3.02	3.02
	TOTAL.....			5.64	9.37	6.04

TABLE II.

Weight of Fresh Clippings and Their Moisture Content. Yield of Dry Matter from the Green of 6,360 sq. ft. from 1,000 sq. ft., and from 18 Greens Averaging 500 sq. ft.

Month, 1944	Fresh Clippings		Dried Clippings		
	From No. 6 Green Pounds	Moisture Percent	From No. 6 Green Pounds	Weight per 1,000 sq. ft. Pounds	Weight per 18 Greens Pounds
April.....	70	74.43	17.9	2.8	252
May.....	395	74.51	100.7	15.8	1,422
June.....	383	77.46	86.3	13.6	1,224
July.....	461 $\frac{3}{4}$	77.53	103.7	16.3	1,467
August.....	443	70.61	130.2	20.5	1,845
September.....	325	76.43	76.6	12.0	1,080
October.....	152 $\frac{1}{4}$	65.00	68.6	10.8	792
November.....	48	65.00	31.2	4.9	441
TOTAL.....	2,278		615.2	96.7	8,703

TABLE III.

Percent of Nitrogen, Phosphoric Acid, and Potash in Grass Clippings by Month and the Corresponding Amounts from 1,000 Square Feet.

Month 1944	Nitrogen		Phosphoric Acid		Potash	
	Percent	Pounds	Percent	Pounds	Percent	Pounds
April.....	3.88	0.11	1.53	0.04	2.96	0.08
May.....	3.88	0.61	1.53	0.24	2.96	0.47
June.....	4.75	0.65	1.77	0.24	3.51	0.48
July.....	5.30	0.86	1.95	0.32	3.42	0.56
August.....	5.55	1.14	1.84	0.38	3.31	0.68
September.....	5.01	0.60	2.28	0.27	3.56	0.43
October.....	5.47	0.59	1.98	0.21	3.44	0.37
November.....	5.47	0.27	1.98	0.10	3.44	0.17
TOTAL.....		4.83		1.80		3.24
Average per Month		0.80		0.30		0.54

TABLE IV.

Quantities of Fertilizer Needed Each Month to Furnish the Plant Food Contained in the Clippings from 1,000 Square Feet and from 18 Greens.

Month 1944	Milorganite (Pounds)		Superphosphate (Pounds)		Muriate of Potash (Pounds)	
	1,000 Sq. Ft.	90,000 Sq. Ft.	1,000 Sq. Ft.	90,000 Sq. Ft.	1,000 Sq. Ft.	90,000 Sq. Ft.
April.....	1.8	162	0.20	18	0.16	14.4
May.....	10.2	918	1.20	108	0.94	84.6
June.....	10.8	972	1.20	108	0.96	86.4
July.....	14.4	1,296	1.60	144	1.12	100.8
August.....	19.0	1,710	1.90	171	1.36	122.4
September.....	10.0	900	1.35	121.5	0.86	77.4
October.....	9.8	882	1.05	94.5	0.74	66.6
November.....	4.5	405	0.50	45	0.34	30.6
TOTAL.....	80.5	7,245	9.00	810	6.48	583.2
Average per Month	13.4		1.50		1.08	

A comparison of the plant food applied in the fertilizer and the amounts found in the dry clippings is interesting. The figures below are based on eighteen greens of 5,000 square feet each:

	Applied in Fertilizer Pounds	Amount in Clippings Pounds
Nitrogen	508	435
Phosphoric Acid	844	162
Potash	544	292

The clippings contained almost as much nitrogen as was applied in the fertilizer. There was five times more phosphoric acid, and two times more potash applied than was found in the clippings. An explanation for the unusually high figure for phosphoric acid lies in the fact that the 8,478 pounds of Milorganite applied during the season contained 254 pounds of phosphoric acid, or 92 pounds more

than was recovered in the clippings. An additional 590 pounds was applied as superphosphate and in the phosphate-potash mixtures.

Since greens are not all of the same size, figures based on 1,000 square feet are the most interesting and useful ones. An application each month from April to September, inclusive, of 13 pounds Milorganite, or 4 pounds sulfate of ammonia, 1½ pounds 20 percent superphosphate, and a trifle over 1 pound of 50 per cent muriate of potash contain the same amount of plant food as was removed in the clippings. These figures make no allowances for plant food added in the top-dressing; losses from leaching, or from fixation as phosphoric acid and potash into difficultly soluble forms by the soil itself. The significance of the results and their application in formulating a fertilizer program will be discussed in a subsequent article.

Dutra Sees Quick Come-Back For Service Pros

In the opinion of Olin Dutra, Wilshire CC pro and former Open and PGA champion, excellent physical condition sparked by a burning desire to get back into the game will work wonders in speeding the readjustment of pro golfers now in the armed services. Dutra says: "I feel certain that most of the good golfers will make an outstanding comeback. And, what do I attribute it to? Simply this: In the first place the boys will be so anxious to get back to golf that they will have a club in their hands day and night. It will be quite a relief from the feel of a heavy old 'war club' they have been handling of late.

"Secondly, The boys will be in splendid

physical condition when they get back and that is quite essential to golf champions. The boys will delight in practicing in view of their strenuous Army or Navy training program, the discipline, and the regular and long hours they have been putting in.

"Yet, it may take the boys the biggest part of the first year to get the feel of things in view of the fact that they have lost the feel of the club, and that they have been coordinating a different set of muscles from what they have been accustomed to. However, it is my humble opinion that these drawbacks will be offset by the terrific, burning desire to get back to the game and hit the 'winning circle.' Add to these deductions the fact that the boys while in the service haven't exactly been on the gravy train and you will see what I mean."