PROCEEDINGS

of

1951 TURF CONFERENCE

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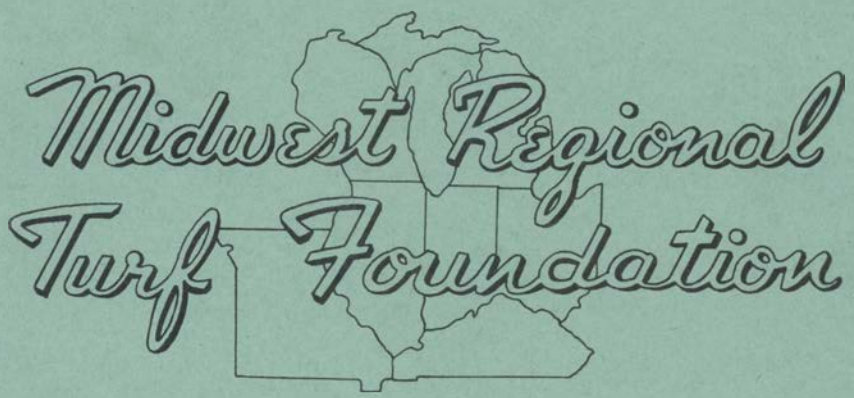

and

PURDUE UNIVERSITY

LAFAYETTE, INDIANA

March 5, 6, 7 and 8, 1951

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Compiled Courtesy of

WEST POINT LAWN PRODUCTS
West Point, Pa.

ATTENDANCE

MIDWEST REGIONAL TURF FOUNDATION CONFERENCE

March 5, 6, 7 and 8, 1951

	Name	Address and Country Club or Company
1.	Adams, George E.	R. 2, Fulton Rd., E St., Canton, Ohio Tam O'Shanter Country Club
2.	Allen, Joe	50 Ferndale St., Cincinnati 15, Ohio Cincinnati Municipal G C
3.	Appleberry, Elbert	1044 Buena Vesta Cir., Chicago Heights, Bloom Township High School Ill.
4.	Arcand, George J.	2721 W. 38th Place, Chicago 32, Ill. Chicago Park District
5.	Bailey, H. S.	2015 Colfax Street, Evanston, Illinois George A. Davis, Inc.
6.	Baker, A. S.	2529 Catalpa Drive, Dayton, Ohio Jacobson Mfg. Company
7.	Becker, Richard	Wolworth, Wisconsin Big Foot C C
8.	Beckstrom, Carl	R.1, Box 62 E, St. Charles, Ill. St. Charles C C
9.	Bell, C. A.	1508 High Street, Logansport, Indiana Dickenyan
10.	Bennett, Wayne F.	R. R. 6, Box 39, Kokomo, Indiana Kokomo C C
11.	Benson, Arthur	Aurora, Illinois Aurora C C
12.	Bertucci, Adolph	1825 S. Telegraph, Lake Forest, Ill. Lake Shore C C
13.	Bertucci, Elmer	345 Highwood Avenue, Highwood, Ill. Old Elm G C
14.	Bild, Peter	Box 103, Lisle, Illinois Woodridge G C
15.	Bishop, Lester L.	R. R. 2, North Canton, Ohio Edgewood G C
16.	Bockoski, Chester	6433 Broadway, Indianapolis 20, Ind. Willow Brook G C
17.	Boone, Howard	Cincinnati, Ohio Hamilton County Park District
18.	Borchart, Gordon	Camp Atterbury, Indiana U. S. Army
19.	Borg, Gus	Springfield, Illinois Illini C C
20.	Borgmeier, C. O.	1126 N. Grove Ave., Oak Park, Ill. George A. Davis Company
21.	Born, Willard	2841 Consaul St., Toledo, Ohio City of Toledo
22.	Bowden, G. L.	Wilford, Ohio Terraca Park C C

23.	Bowman, Oscar W.	7 Algonquin Lane, Webster Grove 19, Mo. Algonguin G C
24.	Bowers, A. H.	Chicago, Illinois Swift & Co., Plant Food Division
25.	Boyd, Taylor	Box 21, Sta. M., Cincinnati 27, O. Camargo Club
26.	Boyer, Harry C.	Cincinnati, Ohio Losantiville C C
27.	Brandt, James W.	101 E. 27th St., Indianapolis, Ind. Indianapolis Muni. Golf Courses
28.	Bretzlaff, Carl	R. 16, Box 641, Indianapolis 44, Ind. Meridian Hills C C
29.	Brinkworth, W. H.	Minneapolis, Minnesota Toro Mfg. Company
30.	Brown, Agar M.	St. Charles, Illinois Nat'l Greenkeeping Supt. Ass'n.
31.	Buckles, Clinton	R. R. 2, Champaign, Illinois University of Illinois
32.	Budin, Danny	12805 Shaker Blvd., Cleveland, O. Hawthorne Valley C C
33.	Buettner, Valentin	20782 Murwood, Detroit 19, Mich. Plum Hollow G C
34.	Burdette, Paul E.	Lombard, Illinois Seed, Fertilizer & G C Supply
35.	Bush, Edwin F.	903 N. Jefferson St., Hartford City, Ind. Blackford C C
36.	Butler, Albert	R. 1, Michigan City, Indiana Pottawattomie C C
37.	Butz, E. L.	Lafayette, Indiana Purdue University, Dept. of Ag. Econ.
38.	Cagle, J. C.	Indianapolis, Indiana Speedway G C
39.	Cahill, Jim	Covington, Kentucky Summit Hills
40.	Canale, Joseph	422 E. Walnut St., Oglesby, Ill. Deer Park G C
41.	Carter, J.C.	Urbana, Illinois State Natural History Survey Division
42.	Cassier, E. W.	Box 422, Sycamore, Illinois Sycamore G C
43.	Chamberlin, Robert L.	1169 S. Schuyler, Kankakee, Ill. Kankakee C C
44.	Chamber, Ardy H.	736 S. Humphrey, Oak Park, Illinois O'Hare Field, Park Ridge, Illinois
45.	Chaplin, R. C.	R. 2, LaGrange, Illinois Edgewood Valley C C
46.	Chord, Edward K.	10400 S. Christiana Ave., Chicago 43, Chicago Park District Ill.
47.	Clarke, William	2541 Prospect Avenue, Evanston, Ill. Northwestern G C
48.	Clauss, Walter L.	529 Marquette Ave., Peoria, Ill. Madison Park
49.	Coble, Clem	New Augusta, Indiana Broadmoor C C

50.	Coghill, John R.	Orland Park, Illinois Silver Lake G C
51.	Cornwell, Ward	1358 Anita, Grosse Pointe 30, Mich. Lochmoor Country Club
52.	Coval, Pete	3158 N. Layman Ave, Indianapolis, Ind. Country Club of Indianapolis
53.	Dalman, George	Lemont, Illinois Coghill Country Club
54.	Daniel, William H.	Dept. of Agronomy, Lafayette, Ind. Purdue University
55.	Darrah, John	R. 1, Matteson, Ill. Turf Development Co., Inc.
56.	Davis, Raymond C.	Medinah, Illinois Medinah C C
57.	Davis, R R.	Wooster, Ohio Ohio Experiment Station
58.	Dearie, Gerald M.	2045 Pratt Blvd., Chicago, Ill. Edgewater G C
59.	Dettling, T. J.	43 E. Market St., Akron, Ohio Dettling Brothers Seed Store
60.	Didier, Ray	6780 Howard Ave., Niles, Ill. Tam O'Shanter C C
61	Dienhart, A. P.	R. R. #10, Lafayette, Indiana Elks C C
62.	Dinelli, Frank J.	1302 Clavey Rd., Highland Park, Ill. Northmoor C C
63.	Donat, J. Donald	R. D. 2, North Canton, Ohio Edgewood G C
64.	Doud, Don A.	3402 Blvd. Place, Indianapolis, Ind. Crown Hill Cemetery
65.	Dowell, Earl	1114 State St., Lafayette, Ind. Lafayette C C
66.	Drachman, P. E.	Evansville, Indiana Evansville C C
67.	Dryfoos, Sidney L.	3108 Mayfield Rd., Cleveland 18, Ohio Oakwood Club
68.	Duehr, Edward J.	Midlothian, Illinois Midlothian C C
69.	Duguid, Robert	Skokie, Illinois Evanston G C
70.	Dunlap, Frank	902 Caledonia, Cleveland 12, Ohio The Country Club
71.	Dunn, Andrew C.	389 N. Delaplaine, Riverside, Illinois Catholic Cemeteries
72.	Engelhardt, Peter	Box 273, Worth, Illinois Westgate Valley G C
73.	Eichar, William G.	30 Rockefeller Plaza, New York 20, N.Y. American Cyanamid Company
74.	Eley, Ernest	Greenville, Ohio Greenville C C
75.	Enfield, George	Lafayette, Indiana Purdue University

76.	Esterline, Walter	R. R. 5, Muncie, Indiana Delaware C C
77.	Fannin, Howard	Cleveland 21, Ohio Mayfield C C
78.	Farnham, Marshall E.	West Conshohocken, Pennsylvania Philadelphia C C
79.	Fenner, Carl	Lansing, Michigan City Forester
80.	Ferguson, Ken	Eau Claire, Michigan Ferguson & Sons
81.	Ferreiro, Angelo	1312 Cedar, Kent, Ohio Twin Lakes C C
82.	Fifield, E.	1236 Rutledge St., Gary, Indiana Gary Parks
83.	Fix, Harold W.	Lafayette, Indiana Purdue University
84.	Fontaine, L. L.	Box 636, Cherokee Sta., Louisville 5, Big Spring G C Ky.
85.	Ford, O. C.	Fowler, Indiana
86.	Forste, Clifford	Cincinnati, Ohio Losantiville C C
87.	Foster, D. A.	215 Stewart St., Rossville, Ill. Hubbard Trail C C
88.	Futerer, Jack	Solon, Ohio Hawthorne Valley C C
89.	Gabriel, Sam. J.	Harlem Ave. & Lake Ave., River Forest, Cook County Forest Preserve Ill.
90.	Genovese, Vince	309 South 21st, Murphysboro, Ill. Jackson C C
91.	Gerber, Raymond	Glen Ellyn, Illinois Glen Oak C C
92.	Gilley, Angus	R. R. 6, Connersville, Indiana Connersville C C
93.	Gillie, David	Fort Wayne, Indiana Fort Wayne Park Dept.
94.	Glissmann, Harold W.	Boys Town, Nebraska Father Flanagan's Boys
95.	Glover, W. H.	Fairfax, Virginia Fairfax C C
96.	Graffis, Joe	407 S. Dearborn St., Chicago 5, Ill. Golfdom
97.	Grant, Gilmore	3265 Robin Rd., Louisville 13, Ky. Audubon C C
98.	Grau, Fred V.	Plant Industry Sta., Beltsville, Md. U. S. G. A. Green Section
99.	Graves, Stan	Clevelans, Ohio Westwood C C
100.	Green, D. C.	R.R. 1, Hoopeston, Illinois Hubbard Trail C C
101.	Greenwald, Taylor C.	Wyoming, Ohio Wyoming, G C

102.	Griener, Clarence	43 S. Delaware St., Indianapolis, Ind. C. E. Griener Co., Inc.
103.	Griesenauer, Gregory J.	Room 330, Muni. Courts Bldg., St. Louis, City of St. Louis Mo.
104.	Grigsby, H. B.	East Lansing, Michigan Michigan State College
105.	Grotti, Dominic	Winnetka, Illinois Sunset Ridge C C
106.	Gruber, Calvin	Cincinnati, Ohio Hamilton County Park District
107.	Habenicht, Carl B.	Box 258, Tinley Park, Illinois H & E Sod Nursery
108.	Hall, F. R.	Lafayette, Indiana Purdue University
109.	Hall, Ray	Pekin, Illinois Pekin C C
110.	Hamblen, Floyd	Tipton, Indiana Tipton G C
111.	Hammerschmidt, T. F.	Lisle, Illinois Woodridge G C
112.	Hannemann, H. R.	Menesha, Wisconsin North Shore G C
113.	Hanson, Harry H.	R. 2, Benton, Illinois Benton C C
114.	Harasty, Louis	Cleveland 22, Ohio Canterbury Golf Club
115.	Hardy, Percy	River Grove, Illinois Indian Boundry G C
116.	Hasbargen, Harry H.	2000 Coff Blvd, Kankakee, Illinois Kankakee C C
117.	Harter, Charles E.	Logansport, Indiana Dykeman Park G C
118.	Hayes, Thomas V.	Overland, Missouri Meadow Brook C C
119.	Helmbold, George	McArthur Ave., Dayton, Ohio Madden G C
120.	Herbstreit, Harold G.	Cleves & Warsaw Pike, Cincinnati 5, O. Western Hills C C
121.	Hewitt, Edwin	Cincinnati 31, Ohio Hamilton County Park District
122.	Hinz, Alvin	Church Rd., Bensenville, Ill. White Pines
123.	Hjort, Carl H.	Michigan City, Indiana Long Beach C C
124.	Hoover, James	Pontiac, Illinois Elks C C
125.	Hosfeld, A.	813 N. Main St., Rockford, Illinois Sinnissippi G C
126.	Hoyt, Walter	LaGrange, Illinois Timber Trails C C
127.	Hovde, F. L.	Lafayette, Indiana Pres., Purdue University

128.	Huber, Lawrence	2605 Tremont Rd., Columbus, Ohio Ohio State G C
129.	Jackiewicz, Joseph	5900 Leader Ave., Chicago, Illinois Billy Caldwell G C
130.	Jackson, Wallace	Rockford Park Dist., Rockford, Ill. Ingersoll G C
131.	Janssen, Elmer	Rock Falls, Ill. Rock River C C
132.	Johnsen, John M.	Chicago Heights, Ill. Bloom Township High School
133.	Johnson, E. F.	Winetka, Illinois Indian Hill C C
134.	Jones, Fred G.	6025 Guilford Ave., Indianapolis 20, Sarah Shank G C Ind.
135.	Jones, LeRoy	1904 W. Mt. Hope, Lansing, Michigan Lansing C C
136.	Jury, Ira W.	Rockford, Illinois Forest Hills C C
137.	Kavanaugh, Marty	Cincinnati 32, Ohio Hamilton Park District
138.	Kingsley, Duane C.	Box 342, Arlington Heights, Ill.
139.	Kirchdorfer, Joe,Jr.	922 Baxter Ave., Louisville 4, Ky. Dixie Lawn Supply Co.
140.	Klauke, Fred	Hillside, Illinois The Catholic Cemeteries of Chicago
141.	Kramer, Francis J.	1008 Sherman, Evanston, Ill. Kramer & Co., Inc.
142.	Kramer, Michael J.	1008 Sherman, Evanston, Ill. Kramer & Co., Inc.
143.	Kramer, John F.	1008 Sherman, Evanston, Ill. Kramer & Co., Inc.
144.	Kramer, Norman W.	147 St & 82 Ave., Orland Park, Ill. Silver Lake G C
145.	Kurek, William E.	412 W. McClure, Peoria, Ill. Northmoor G C
146.	Lamboley, H. T.	Fort Wayne, Indiana Fort Wayne Park Board
147.	Lammert, Joseph F.	Normandy 21, Missouri Norwood Hills C C
148.	Lange, Henry	Golf, Illinois Glen View Club
149.	Lapp, Amos	Elgin, Illinois St. Andrews C C
150.	Lawson, Charles C.	Rushville, Indiana Elks C C
151.	Lawson, Jimmie S.	LaPorte, Indiana Elks C C
152.	Lee, O. C.	Lafayette, Indiana Purdue University
153.	Leonard, Herman O.	Bedford, Indiana Otis Park

155.	Likes, Don	Cincinnati 8, Ohio Hyde Park C C
156.	Lindenschmidt, Robert L.	1513 Dana Ave., Cincinnati, Ohio Hartwell Club
157.	Linkogel, Albert	R. 1, Conway Rd., Clayton 5, Mo. Westwood C C
158.	Longheinrich, Fred	R. 6, Sappington 23, Missouri Sunset C C
159.	Logan, Ralph G.	53 S. Perry St., Hagerstown, Ind. Hartley Hills C C
160.	Lundblad, Nels	Wheaton, Illinois Chicago G C
161.	Lyle, Samuel	Normandy 21, Missouri Glen Echo C C
162.	Lyons, Don	Brook, Indiana Hazeldon C C
163.	Lyons, William E.	1200 Firestone Parkway, Akron 17, O. Firestone Tire & Rubber Co.
164.	MacGregor, John	Chicago, Illinois Chicago Fence & Equipment Co.
165.	Malpede, William E.	R. R. 1, McHenry, Illinois Pistakee G C
166.	Marchi, Gene	Dayton, Ohio Miami Valley G C
167.	Marczinski, Lawrence	Arlington Heights, Illinois Rolling Green C C
168.	Marzak, J. L.	St. Louis, Missouri Mallenckrodt Chemical Co.
169.	Mascaro, Tom	West Point, Pennsylvania West Point Lawn Products
170.	Maschmidt, Fred W.	St. Louis 14, Mo. Normandie G C
171.	Mashie, Emil	Lake Forest, Illinois Onwentsia C C
172.	McCoy, John S.	Cincinnati 8, Ohio Cincinnati C C
173.	McDermott, Joseph	Louisville, Kentucky Seneca G C
174.	McLaren, Malcolm	Cleveland 21, Ohio Oakwood C C
175.	McMullen, Malcolm H.	Columbus, Indiana Harrison Lake C C
176.	McNabb, Dean E.	Wilmington, Delaware Du Pont Company
177.	Meetz, Ted	Michigan City, Indiana Michigan City G C
178.	Mendenhall, Chester	5301 State Line, Kansas City 2, Mo. Mission Hills C C
179.	Mendenhall, Marion	Sta. M, Madisonville P.O., Cincinnati 27 Ohio Kenwood C C
180.	Meyer, Frederick G.	Clifton, New Jersey O. E. Linck Company

181.	Michaud, H. H.	Lafayette, Indiana Purdue University
182.	Miller, Charles E.	Carmel, Indiana W. H. Diddel
183.	Miller, Congress	Pekin, Illinois Park View G C
184.	Miller, Robert	Fort Wayne, Indiana Fort Wayne Park Board
185.	Mitchell, Vertus	West Frankfort, Ill. Franklin Country Club
186.	Midlin, Frank J.	Toledo, Ohio Bayview G C
187.	Monier, C. F.	Charleston, Illinois Eastern Ill. State College
188.	Mueller, H. W., Jr.	Box 217, Montgomery, Ohio Gate of Heaven Cemetery
189.	Musser, H. B.	State College, Pennsylvania Pennsylvania State College
190.	Muzik, E. J.	3412 Harlem, Riverside, Illinois Armour Fertilizer Division
191.	Needham, A. A.	2500 Oxford Street, Rockford, Ill. Rockford C C
192.	Newkirk, Edward	3235 Sutherland, Indianapolis, Ind. Coffin G C
193.	Newton, W. Creighton	6623 Estele Ave., Louisville, Ky. Swift & Company, Plant Foods Div.
194.	Noer, O. J.	P. O. Box 2079, Milwaukee, Wisc. Sewerage Commission
195.	Nuessle, Fred	Flossmoor, Illinois Flossmoor C C
196.	Nugent, W. C.	Brook, Indiana Hazelden C C
197.	Oyer, E. B.	Lafayette, Indiana Purdue University
198.	Parsons, M. M., Sr.	Indianapolis, Indiana Highland G & C C
199.	Payne, Kenyon T.	Lafayette, Indiana Purdue University
200.	Peck, Harold	Battle Creek, Michigan Battle Creek C C
201.	Peck, Roy	Kalamazoo, Michigan Kalamazoo C C
202.	Pelcher, Fred	Burnham, Illinois Burnham Woods G C
203.	Petersen, C. A.	7059 S. Shore Drive, Chicago, Ill. South Shore C C
204.	Peterson, J. B.	Lafayette, Indiana Purdue University, Agron. Dept. Head
205.	Phillips, Raymond	Louisville 6, Kentucky Louisville C C
206.	Pieper, Walter	Malteson, Illinois Flossmoor C C

207.	Plein, Clarence	8901 Page, Overland, Mo. Lakeside G C
208.	Polillo, George	Galesburg, Illinois Soagetaha C C
209.	Quarandillo, Louis	Logansport, Indiana Logansport C C
210.	Ragan, Walter	West Big Bend Rd., Kirkwood, Mo. Green Brior Hills C C
211.	Ray, Robert C.	Michigan City, Indiana Michigan City G C
212.	Reat, William A.	Charleston, Illinois Charleston C C
213.	Reed, H. E.	6601 W. Gunnison, Chicago 31, Ill. Ridgemoor C C
214.	Rees, James D., Jr.	4701 N. Keystone Ave., Indianapolis, Willowbrook G C, Inc. Indiana
215.	Reynolds, A. J.	Dayton, Ohio Miami Valley G C
216.	Reynolds, George H.	Dayton Ohio City of Dayton
217.	Riley, William F.	2121 Madison Ave., Indianapolis, Ind. Riley Lawn & Golf Equipment
218.	Riddle, James B.	Columbus 15, Ohio State of Ohio, Dept. of Highways
219.	Roach, W. J.	Cincinnati 15, Ohio Wyoming G C
220.	Roby, Lewis	Anderson, Indiana Edgewood C C
221.	Rohmann, Carl A.	1000 Mile Rd., Greenhills 18, Ohio Hamilton County Park District
222.	Roseman, Warren J.	2610 Ridge Road, Evanston, Ill.
223.	Rosset, Gabriel	Sunset Ridge Rd., North Brook, Ill. Green Acres C C
224.	Rost, Bert	Park Ridge, Illinois Park Ridge C C
225.	Rowe, D. A.	601 W. Jackson Blvd., Chicago, Ill. Vaughan's Seed Company
226.	Runyan, C. R.	Sta. W., Cincinnati 32, Ohio Cemetery of Spring Grove
227.	Russell, George P.	Louisville, Kentucky Big Spring G C
228.	Ryan, John	Columbiana, Ohio Valley G C
229.	Sartoretto, Paul	1594 Met. Ave., New York 62, N.Y. W. A. Cleary Corporation
230.	Schacht, Robert	Terre Haute, Indiana Country Club of Terre Haute
231.	Schmatzmeyer, August H.	Normandy, Mo. Bellerive C C
232.	Schneider, E.	Stringtown Rd., Evansville, Ind. Evansville C C

233. Schneider, R. J.
1725 S. Washington, Peoria, Ill.
L. R. Nelson Mfg. Co.

234. Schroeder, Clarence J.
R. 1, Meenah, Wisconsin

235. Schultz, W. J.
Graybrook Lane, New Albany, Ind.
New Albany C C

236. Seaney, William L.
809 Fairview Ave., Crawfordsville, Ind.
Swift & Co.

237. Sellers, Everett
Glenview, Illinois
North Shore C C

238. Sharvelle, Eric
Lafayette, Indiana
Purdue University

239. Shaw, T. E.
Lafayette, Indiana
Purdue University

240. Shock, Earl
Dayton, Ohio
Community C C

241. Shryack, Lawson G.
Macomb, Illinois
Western Ill. State College

242. Simmons, Howard E.
Cleveland 22, Ohio
Highland Park G C

243. Simon, E. J.
Rockford, Illinois
Rockford Park District

244. Skinner, John R.
6929 Carnegie, Cleveland, Ohio
Jacobsen Power Lawn Mower Company

245. Smith, Colin
19512 Kings Highway, Warrensville
Heights 22, Ohio
Shaker Heights C C

246. Smith, William
Box 1109, Royal Oak, Michigan
Red Run G C

247. Smith, William R.
1127 Miller Ave., Oak Park, Ill.
George A. Davis, Inc.

248. Snyder, D. E.
910 S. Mich. Ave., Chicago, Ill.
Standard Oil Company

249. Sopko, Mike
29007 Euclid Ave., Wickliffe, Ohio
Pineridge C C

250. Soutar, Jim
Bloomington, Indiana
National Greenkeepers

251. Sprenger, Fred C.
709 Bigelow St., Peoria, Illinois
Peoria Park Board

252. Stafford, Dwight E.
376 N. Holmes Ave., Indianapolis 22,
South Grove G C Ind.

253. Stampfl, John J.
810 N. Rangeline Rd., Milwaukee 9,
Milwaukee C C Wisc.

254. Staten, Earl
Lafayette, Indiana
Purdue University

255. Staudt, Albert J.
2045 W. Pratt Ave., Chicago 45, Ill.
Edgewater G C

256. Stewart, Edward N.
R. R. 2, LaGrange, Illinois
Acacia C C

257. Stewart, Peter
Hinsdale, Illinois
Butterfield C C

258. Stitz, Adrian P.
R. R. #1, Canton, Ohio
Shady Hollow C C

259.	Strand, Donald G.	4540 Harrison St., Skokie, Ill. Westmoreland C C
260.	Strauss, Robert J.	Cincinnati, Ohio Public Recreation Commission
261.	Stupple, William H.	Highland Park, Illinois Exmoor C C
262.	Sylvester, E. J.	Box 133, R. R. 2, Piqua, Ohio City of Piqua
263.	Tait, Dave	Paris, Illinois Elks C C
264.	Teuber, Robert	756 Elizabeth St., Flint 4, Michigan Flint G C
265.	Thalheimer, Wilfred	405 Western Ave., Batesville, Indiana Hillcrest G & CC
266.	Thode, Reuben, H.	Chicago, Illinois Chicago Park District
267.	Thompson, Jack	R. 2, Tippecanoe Rd., Canfield, O. Tippecanoe C C
268.	Uebele, Herman	1708 Michigan Ave., LaPorte, Ind. Beechwood G C
269.	Updegraff, W. E.	1022 N. Roosevelt, Wichita, Kansas Wichita C C
270.	Urzzlinski, Frank	Toledo, Ohio City of Toledo
271.	Valandingham, Robert L.	Hammond, Indiana Woodmar C C
272.	Valandingham, Rube	Hammond, Indiana Woodmar C C
273.	Vaughn, J. H.	1016 Parker Ave., Indianapolis, Ind. Riverside G C
274.	Vaughn, J. R.	East Lansing, Michigan Michigan State College
275.	Verhaalen, Lester	6800 W. Good Hope Rd., Milwaukee 9, Brynwood C C Wisc.
276.	Vial, H. C.	Rt. 2, LaGrange, Illinois Timber Trails G C
277.	Warren, B. O.	Palos Park, Illinois Warren Turf Nursery
278.	Weitzel, Cpl. James E.	Camp Atterbury, Indiana U. S. Army
279.	Wells, R. Lee	6729 Lovett Ave., Dallas, Texas Worthington Mower Company
280.	Wessel, Arnold	R. 2, Thiensville, Wisconsin Ozaukee C C
281.	Wheeler, J. A.	5564 Bartmer, St. Louis 12, Mo. Lakeside G C
282.	Whitcomb, James E.	R. R. 15, Box 743, Indianapolis, Ind. Riverside G C
283.	White, LeRoy H.	334 B Street, Charleston, Illinois Charleston C C
284.	White, Maurice	1906 Indiana Ave., Peoria, Illinois C C of Peoria

285.	Whittle, J. D.	East River Rd., Batavia, Illinois Fox Valley C C
286.	Wingo, Wilbur	Macomb, Illinois Macomb C C
287.	Woehrle, Herman	R. 3, St. Anne, Illinois Hieland Lodge G & C C
288.	Wolfe, Larry	R. D. 7, Akron, Ohio Rosemont C C
289.	Wolfrom, Clarence	11341 Chicago Rd., Warren, Mich. Maple Lane G C
290.	Wood, Howard T.	Indianapolis, Indiana Crown Hill Cemetery
291.	Wright, Alph	R. R. 1, Sharonville, Ohio Hamilton County Park District
292.	Wright, Leland	New Castle, Indiana Westwood C C
293.	Wyman, Allan	R. R. 2, Danville, Illinois Danville C C
294.	Wymer, Ralph R., Jr.	123rd & Bell Rd., Lemont, Illinois Glen Eagles C C
295.	Yanaway, John F.	Charleston, Illinois Landscaping
296.	Young, O. W.	4075 Southern Blvd., Dayton, Ohio Moraine C C
297.	Zellner, Charles F.	Cincinnati 25, Ohio California G C

WELCOME TO PURDUE UNIVERSITY

F. L. Hovde

It's always nice to have one of your staff introduce you because they must say nice things about you. I would first like to express to all of you who are members of the Midwest Regional Turf Conference the appreciation of the University and staff members of this Foundation for the support you give generously to our program of research investigation in the area of grasses and better turfs. I, like most other amateurs, am keenly interested in turf, and as President of the University, am more than normally interested because I see in the investigations the patient attack upon the problem of understanding what goes on in the life growing out of our soils.

I am particularly interested in the pasture improvement program. For Indiana this may mean increased wealth. Increased wealth means increased leisure. Increased leisure means a need for more and better recreational facilities, and particularly those of the kind all of you are interested in. We appreciate the cooperation that exists between an organization such as yours and the University. People out on the actual working site in all the professions are inclined to look down their noses at the professors in the ivory tower of the University, you know what I mean. But I think from your meetings here, you have probably arrived at a better understanding of the role of the university scientist, of the way he attacks his problems; and certainly in your own professional work you do things now as a result of investigation not only here, but in many other of our American experiment stations.

I have my interest in your problems because of my position at the University; but when I'm off duty, I also have a keen interest in the quality of the golf green. I suppose I'm like all other golfers. I've probably cussed the greenkeeper just as much as anybody else, yet I've never done much to help the poor guy. In some respects, being the university president is similar to those of whom are responsible for golf greens-- you get all the hell and none of the compliments.

We at the university are genuinely grateful for the opportunity to work with you because I think my staff in every department of the university learns by being

in touch with those who are out doing things. This university certainly is not an ivory tower. There is not a single department in this university in which investigations are going on that will not produce something that sooner or later will not be useful. Dr. Oppenheimer, the man who directed the scientific staff that produced the atomic bomb, one of the greatest scientific jobs that's ever been done, once said, "Sooner or later all knowledge becomes useful".

One of the problems of those of us engaged in investigation and research is to interpret it, put it in form for trial and use by people who can try it and use it. And I think through the medium of these conferences we have the mechanism by which there is a rapid transition from the laboratories of the university into the hands of those who have the responsibility for doing the job where it is, regardless of where it is. And so in a sense, you help us in a very concrete wnd practical way. I think without these conferences there would be a much greater lag between the transformation of knowledge from the experimental groups into use than we have.

It is a wonderful situation when you have support of the people who want to use and try new methods of doing things. This is one of the great things about our country. Everybody with any get-up and gumption and go has access to information everywhere, and all he has to do is get it, try it and use it. Nobody is going to stop him unless it be the limitations of the operating budget of your particular organization and even that won't stop a resourceful and ingenious man.

From this point of view, those of you who are citizens of the midwest area and receive some benefit from coming here may know that your universities are vitally concerned with improving every aspect of our economic and social life, and I think there is not a single aspect even in our country that cannot be improved if we will put our minds, our best brains, our ability to organize and our get-up and go into it. I think this is also the fundamental which will enable us to meet the problems the nation faces in the future. As far as I have been able to determine, there is not another nation that has this requisite of intellectual and economic freedom to go ahead with the attack on problems, not under orders from somebody, but under the compulsion of individuals wanting to do a better job as each day goes by.

We're a healthy, friendly team here at the university,

and aside from teaching and research and such, we do enjoy working with you who come here for a short period of time-- to be, shall we say, students once again on a university campus. Thank you very much, and I hope you have a grand time at your conference.

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PROBLEMS IN TURF TODAY

Fred V. Grau

I think we are very fortunate that the president of Purdue University addressed us today. These are in a way breathless times. I was accused recently of conducting a rather breathless program in the Green Section. These turf conferences are practically continuous now from November through March and then field days start again in May.

This highlights and emphasizes one of the great problems in turf today. And that is, everything is subservient to the man, to the individual. The man is the uppermost thing in all minds whenever we're dealing with anything in our particular field.

There were golf courses and playing fields before there was any research. We're doing a better job today, we're doing it more easily with better things, better machines, better grasses and better methods thanks to the research and extension that has been done. But we still must keep in mind that the man is the important thing. We must recognize that you are here because you want to improve your mind, improve yourself for the job at hand.

What we need today is better training at various levels. As the national coordinating agency in turf, we have stressed training at the highest level, and that is at the graduate level. You know that we have been solidly behind a program of developing funds so that we could set up graduate fellowships. We have set them up at Penn State, at Tifton, Georgia, at Purdue and at Michigan. Dr. Bill Daniel, of course, is a product of one of those fellowships, joint between the Green Section, the Midwest Regional Turf Foundation and the Detroit District Golf Association. That is the level that we have been stressing because we realize that in order to develop training at the other

levels, first you have to have your top level men. They have to be in the picture to do your training of other groups. There is a tremendous need for college trained men, college graduates, in this field of turf because, as we have pointed out before, turf is big business. It is tremendous when you begin to review it in the aggregate and find out what is included. Golf courses and golf turf are only a small part of the total, a highly important part because the men interested and concerned with golf turf have led the way; they have taken the rocky road, have smoothed it out, improved it, and today it is far easier for turf men to get the education, the training that is needed to help them.

We need, in addition to the top level training of the graduate student, college graduates who will devote themselves to the highly important job of doing practical work. Then, we need some sort of a training system for the in-between, for the practical man, who has not had a chance to go to college. He should receive from here on a great deal of attention. A conference like this is extremely valuable as a refresher but it still doesn't do the big job of education that needs to be done.

Talking about the challenge that exists in turf, I am quite sure that many of you are in the position in which you find yourself by reason of your love for turf. You probably could go out and get more money at other jobs, but the work you are doing presents a challenge to you that you must meet and you can't turn it down. That challenge is encouraging some of your sons to enter into the work.

We're continually broadening the horizon, broadening the opportunities for young men in the field of turf. There are opportunities today in the field of turf that didn't exist ten or fifteen years ago. Probably one of the greatest things that has happened in the field of turf has been the official recognition by the American Society of Agronomy-- setting up two turf sections which are an integral part of the affairs of the American Society of Agronomy. Turf is agriculture. That is how we sold it to all of the administrators of the experiment stations and colleges in the country. And that one thing has made it easier for us to gain the cooperation of the experiment stations. Research has come a long way since we started 30 years ago. On February 10th, just a month past, the Green Section attained its thirtieth birthday.

Last year we published "Turf Research Review", 1950 issue, the first one, listing the workers, the projects, some of the financing and some of the publications of turf all over the United States. The second issue, the 1951 issue, is almost ready for the printer. We had wonderful cooperation from some 27 experiment stations which includes Alaska. In 1940, just 10 years ago, there were less than 12 workers in turf research in the United States. In 1950 there were over 76 workers spending all or part time on turf research. We think that is a remarkable number and it's one of the reasons why you have better things today for turf-better insecticides, better fungicides, better weed killers, better machinery, better grasses and better methods. All in all, there are 161 specific turf projects in progress at 21 experiment stations.

Several hundred turf publications have been written and most of you may have a few in your library. What we're trying to do is organize, coordinate and document all that information which is scattered in these hundreds of publications and bring it together into a condensed version for you. That was attempted in this book Turf Management which the United States Golf Association supported. Burt Musser was the editor with help from O. J. Noer, Marshall Farnham, Herb Graffis and others.

Some of the recent outstanding results in turf recently have been Richard Davis' thesis on physical characteristics of putting green soils, Bill Daniel's fairway studies, Jim Watson's irrigation and compaction studies, Bob Hagen, Davis, California, summary of irrigation practices as it applies to turf, and Ferguson's nutrition studies of Z-52 Zoysia. Seven men received advanced degrees in turf in 1950, and so much of this has been accomplished on a shoe string. The finances to operate the turf research program have been very meager as most of you know. But more people and firms are becoming so deeply interested that it is no longer a real problem to finance a worth while project. We have been remarkably well pleased by the development of our Green Section's service subscriptions. Formerly we were faced with a complete lack of funds to support cooperative research and the development of Green Section's service subscriptions among industry and organizations has provided funds which have been the backbone of cooperative turf research.

Now just a listing of a few of the problems that are being attacked all over the country. There are seven stations working on cool-season, warm-season grass

combinations. There are four aerification projects, probably more. There are quite a number continuing height of cut experiments which are so vitally important because as new grasses are developed, it is important to learn to which uses and to which heights of cut are these grasses adapted. There are 16 different studies on the nutrition of turf grasses. Now we are bringing a lot of that nutrition work into the laboratory where we can get at it more scientifically. There are dates and time of fertilization with relation to weeds, poa annua, best use. We need much more work, basic research, on the difference in feeding value of the conventional types of fertilizers, the organic and the inorganic nitrogen carriers and the so-called liquid fertilizers. To date, there has been no data submitted on the proper use or the use of the so-called liquid fertilizers. There have been in the past quite a few lime and compost studies, and they are being continued. A few years ago we would not have been able to list a single water management study because it was so difficult to conduct. It required so much planning, preparation and detail that nobody tackled it. Today at least 3 water management studies are contributing to our knowledge. At least six different stations are working on physical soil conditions. There are 62 separate studies on grasses being conducted-- well, that's the backbone of turf work.

Musser's work at Penn State with the bents and the fescues and the recent information on the high quality of turf produced by the F-74 and sister fescues is very outstanding. Burton's work with Bermuda, Centipede and Dallisgrass breeding program at Tifton, Georgia, is one of the outstanding things that has been done for Southern turf. Other projects are the bentgrass breeding here at Purdue, as well as tall fescue studies in Kentucky and Oregon. Others include freezing resistance studies of Zoysia japonica and Zoysia matrella seedlings here at Indiana and the breeding of Zoysias at Beltsville. I wish you could see the literally acres of Zoysia seedlings there at Beltsville that are developing under various conditions. The bermudas and the Zoysias moving north and the cool-season grasses moving south has been quite remarkable. Probably one of the outstanding things in the whole research picture has been the development of Merion B-27 bluegrass.

There are 18 different weed control studies in 13 different states. The thing we are working on right now is the possibility of national coordinated crabgrass trials, taking the outstanding chemicals and putting

them out at different stations under absolutely uniform conditions of rate and method of application and evaluating results.

Today insect problems in turf are practically nonexistent if you use the available information. I've heard people say this-- "What are your insect problems?" "Well, we have none. We use Chlordane." I mean words like that.

The disease control studies have made considerable progress since the days of Monteith when he made an everlasting name for himself in the field of disease control in turf. The price of Mercury has jumped practically out of sight. What the situation is going to be on some of these other materials, I don't know but let's look for rough times ahead. Most of you have seen or reported yellow-tufts on greens, especially in the fall. We have found references in South Africa, Australia and England that the cause of these yellow tufts was nematodes, and work that we have been doing at Beltsville confirms this. We have not yet worked out a control for it, but it's interesting to know that we have the association.

A great many of us today are not using the information that is already available. If we didn't do any more research for another ten years but had a core of trained extension men to go out and do a bang-up job of extension, we'd be way ahead because there is just a tremendous amount of undeveloped information that is available to you, to us, that we're not utilizing because we have not been able to set up the extension phase of the turf program. Extension-- we need it worse than we need anything else. It's a slow, long, drawn-out, uphill battle. The big problem is man power and probably if we had had the extension program on as strong a basis as many other phases of agriculture, we would not have some of the problems that are with us today because in the first place, those problems would have been brought back into the college sooner, they would have been brought to the attention of the research people sooner, and something would have been done about them.

I want to close with the thought that it's about time that we got our heads together a little bit better and know how to ask for the things that we need because we are entitled to them. The Penn State program developed the way it did because the people learned early that the squeaking wheel gets the grease. They learned how to ask for what they wanted; and today whenever

there is a turf conference program on the campus at Penn State, the leaders of the turf advisory committee sit down and visit with the top level administrative officers of the university and tell them how much they appreciate what has been done and then suggest that they need this also. And since they've learned how to ask for it, they get it. Always remember that the man is above everything, and we must train the mind to do a better job.

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TURF MAINTENANCE IN WARTIME

O. J. Noer

This subject was assigned, not chosen. I presume the title should be emergency maintenance, rather than wartime maintenance. At the start of World War II many remarks were made about what was going to befall the turf on golf courses. By and large, the courses came through in surprisingly good shape which I believe is a tribute to the golf course superintendent. It seems to me that labor scarcity will be inevitable this year. Those of you who used college men during the summer are probably going to have difficulty getting them because most of them will be at the beck and call of Uncle Sam. Some of you may have to turn to high school boys, provided local state laws permit them to work. Faced with this labor scarcity, you are going to emphasize mechanization more than ever before if you haven't done so up to now.

So far as supplies are concerned, some will be critical. I notice that fertilizers and chemicals are to be dealt with later. We, for example, did not get any empty freight cars while the railroad men were out on strike. Since they resumed work we have been getting one to three cars a day. I understand that others are in about the same boat. And so it isn't always a matter of having the material to ship but having a mode of transport from the plant to you. It looks as though bags are going to be in critical supply; however, as far as we are concerned, they aren't going to be critical unless we get more cars to load. The fertilizer picture, briefly, looks as though it is dependent on sulphur. So far as the chemical fertilizer is concerned, it is the super-phosphate supply that is going to be critical, not because there isn't enough phosphate but because there isn't enough sulfuric acid. There is a fair supply of nitrogen, but you

probably aren't going to be able to buy ammonium sulphate and nitrate of soda all the time because many of the manufacturers are going to utilize their supplies to make mixed fertilizers which is quite understandable. In the fungicide picture I'm told that there should be enough cadmium compounds for this year. With some of the other materials it is a matter of sulphur and chlorine. Only a few weeks ago Calo-Clor was priced at $2.25 and has now advanced to nearly $6.00. High price may have some effect upon supply and demand. With the newer insecticides, again chlorine is a problem and benzol is also critical. I think that those of you who are going to need fungicides and insecticides should make provision to get only what you need in order not to make a bad situation worse. If you need machinery, I understand that there is some machinery around, you had better get your requirements.

The question is raised-- "What is the thing we can do to simplify our maintenance and take care of our golf course with less help, etc.?" When it comes to fairways the first thing that I hear mentioned is that we can stop watering. That, of course, will mean a saving of labor. Where fairways have been watered rather heavily in the past and most of the turf is either poa annua or creeping bentgrass, I shudder to think of what might happen if you suddenly stop watering and let nature take its course. I think that the fairways are going to be worse before they get better again as a result of doing that. It seems to me that the wiser plan is to use enough water to keep grass alive and to water conservatively. Where the outlets are along the edge of fairways, some of you may use the travel-type sprinklers such as the Adamson base sprinkler or the Buckner walking-type sprinkler. They travel about four hundred feet and cover the entire fairway or at least half of it and with an automatic shutoff valve, stop operating when they reach the end of the line. This method saves labor and provides for a more even distribution of water.

It seems to me that we can't make a rigid rule about height of cut on fairways. Each one of you must decide what is best for your own golf course. The faster mowers are operated, the less time it takes to mow the fairways. (Corrugations on many fairways are the result of excessive speed.) Many have gone back to slow speeds and cross-mow once a week. These changes are steps in the right direction. The work at Pennsylvania showed that fall is a better time to spray, broadleaf weed crop form seed in the fall, sometimes even great-

er than in the spring. However, if fairways are yellow in June with dandelions, you had better spray them to satisfy the members. Then after the first year, switch to fall spraying (provided turf does not contain creeping bent) in order to kill both the old plants and the new ones that come from seed. Unless something is done to get grass in the voids left by the weeds, you are sure to have another crop of weeds which may be a different kind. For example, 2,4-D did such a fine job when only plantain and dandelion were present that club members thought 2,4-D was the sole answer. A couple years later they were confronted with a clover problem which was almost worse than the original broad-leaved weed problem. Fertilizer was needed along with 2,4-D to produce a dense turf.

So far as lime and fertilizer are concerned on fairways, I suppose we can dispense with both if the supply and labor situation becomes extremely bad. On the other hand, where the soils are acid, lime is going to help the grass on those fairways during times of adversity. It isn't expensive, is available and can be applied. Also, fertilization ought not be stopped because where grass is properly fertilized it economizes on the need for water.

Now just a few words about greens, roughs and tees. During the last war many clubs thought they were doing the smart thing to reduce cutting on the greens to twice a week. Even though the mowers were set to cut at 3/16 inch, an excessive mat developed. When we came into a bad year like 1949, there was plenty of trouble on those greens. It seems to me that greens should be mowed at least four times a week if at all possible. The mower should be set to mow properly and the combs or brushes should be used often to prevent mat formation. So far as topdressing is concerned, the tendency seems to be to top dress greens less and less. Many clubs are not topdressing at all; some top dress spring and fall. I know many of you have good greens without topdressing. Mowing in such a way as to prevent mat formation is important when greens are never top dressed.

Aeration-- I don't care what kind of machine you use; select the one which suits your fancy best. Aeration brings up soil for topdressing provided the soil in the green is satisfactory from the physical standpoint. As far as watering is concerned, don't use any more water than is needed to keep good grass. The tendency on many courses is to overwater. Avoid such a rigid program that you do not permit watering when

the grass turns blue and starts to wilt. Better put the fire out by applying a little bit of water to keep the grass alive and forget temporarily about a schedule which calls for watering once or twice a week.

Fertilization and disease-- You certainly should not neglect the greens because there is going to be enough fertilizer for them no matter how tough the situation becomes. In my opinion you can supply plenty of potash particularly where manure isn't being used. In my opinion you can supply plenty of potash and phosphate in a good application of complete fertilizer in the spring and again in the fall. Then during the season feeding becomes simply a matter of supplying nitrogen. Of course, if preferred, you may use a little potash and phosphate each month and apply nitrogen along with them.

Tees-- I notice a trend toward using the three-gang mowers on tees such as the Locke and the Professional. It is a step in the right direction. I think that there is a tendency towards enlarging the tees, making one big one rather than two or three small ones, and to design them so that the fairway units will cut the sides and banks instead of having abrupt steep banks. It is another step in the right direction. To repair divots in tees I know one or two have been using ryegrass and bent seed mixed with soil. This practice seems quite satisfactory. The soil mixture should contain enough organic material to hold sufficient moisture to insure germination and initial growth of the grass.

With these brief introductory remarks, I propose to call on the men who have been asked to speak briefly about their plans for the coming year.

Carl Bretzlaff, Indianapolis, Indiana

The only thing that has me stumped is the labor situation; otherwise at Meridian Hills we have all our materials to run us this next season, that is, fungicides, insecticides, etc. We will have enough equipment to run for two years. I don't believe much in hoarding. I have enough repairs for two years and that is long enough. If the situation gets so tough that we haven't any equipment, I doubt whether we will have a job. At the present time I have four college students. School boys which are young have had their parents sign a slip permitting them to work on the golf course. We aren't going to fertilize the fairways much this year but will take good care of the greens.

Bill Glover, Fairfax, Virginia

I happen to be on a golf course where my operation is tied entirely to income. In other words, it is a daily fee course. We can't spend any more than we make. In fact, we don't intend to spend as much as we make. Set up your budgets to conform to what your income is; buy what materials are available. If you consider that your greens are your most expensive item capital-wise, I would suggest that you take care of them the best way you know how and in an inverse way down the line disregarding the parts of your golf course which are the least expensive to renovate and bring back into play. Most of the fellows have replenished their inventories by buying in late fall and winter simply to be protected next year. As far as labor is concerned, I refuse to get scared. We operate on the idea that the man is the thing, as Fred Grau has said. That the education of the man who works for you is probably the most important thing in your labor organization. Make him want to produce,help him to feel that he is a part of your organization, pay him well and I think you will be fairly successful.

Marshall Farnham, Philadelphia Country Club

I think it should be stressed that if and when it becomes time for retrenchments that we should be guided by sound judgment and not by a panicky feeling that we've got to do something in a hurry and then end up by being sorry about it. A few years ago we developed a very fine infestation of various kinds of weeds in our traps, and one of the worst infestations in the traps was crabgrass. We had been playing with sodium arsenite for a number of years, so we simply dumped 4 or 5 pounds of sodium arsenite in a 50 gallon sprayer, put in a couple of pounds of actual 2,4-D to make a shotgun mixture. Any foliage which was present was given a good drenching with the mixture and our weed problem was cleared up without any difficulty.

Bill Stupple, President, Midwest Association

I think those of us who have gone through the depression and the last war on the golf course learned that we can't just let any part of the course go wild; we have to keep the place up. During the last war we tried to cut the greens every other day or three times a week and we made a big mistake. Greens should be cut every day or at least 6 times a week, in my opinion. I don't believe we will topdress very much this year as it takes a lot of labor. We should try to do

as much as we can while we have the labor and the materials to make the course playable and in better shape to last through a restriction period. I expect to be a little short of labor as everybody else is, so we intend to pay our labor well. A man that has worked for a golf course for a number of years is worth a lot to the club, and he should be paid well. We don't expect to lose any men through lack of salary. We found that an economical way to keep a tee is to have a tee large enough and just throw a little ryegrass and top soil into the divot marks. By the time that you are back to the same spot, it is pretty well healed up. I remember back in the old days when we had two men who did nothing but plug tees. We have to keep watering the fairways just enough to keep them green-- not too much watering. We are going to go ahead with our program on the fairways and roughs to keep the weeds in check. If we have to leave anything go, we will probably start with the flower gardens and maybe the trees for a year or two. We have winter sports at my club, so I am able to keep six men the year around which is certainly a big help. I get high school boys when they are about sixteen or seventeen years old and break them in, and I usually have them until they are through college. By that time they are pretty good men.

O. J. Noer - When the last World War was imminent, I recall attending a meeting with the chairman, his committee and the greenkeeping superintendent of a club in Wisconsin. He started out the meeting this way. He said, "It looks as though we are going to be fighting a war, but we've got at least a year to get ready. What I want to do is put this golf course in shape so that if we have to skimp for several years, the grass is going to weather the storm." And I thought that he was a sensible and levelheaded man. And I think that is what each of you should do.

Chet Mendenhall, Kansas City

First I would like to say something about working boys. If you have to go down into the lower ages of boys, I think that it would be a good idea to find out about your labor laws. In our section, it is permissible to work boys down in the younger ages providing you get a permit from their schools. There are restrictions as to what they operate, so I would find out where I stood. We have made it a practice to use a number of high school boys during the summer, and I've been doing something that I've been told I've been sticking my neck out for-- I use quite a few sons

of members from families where I know that if I step on the boy, he can't run home to dad. I've found it very successful. One time I had nine women working on the golf course. Out of that group, I still have two. Women are just as efficient as men and can perform a good many jobs just as well. They are a little more particular than a lot of you men. There is no reason why a woman can't operate a tractor just as well as a man. They can operate a power mower. I have one girl who came to me out of high school during the war, yet she is just as efficient help as you can get. She operates the spray tank and handles all the chemicals. Another source of labor that you should not overlook is men who are handicapped. Some of these fellows are conscientious and they need outdoor work.

Clarence Wolfrom

We have a rather tough labor situation in Detroit. Preparing for this defense emergency, I think started at our club during the last war. Previous to that, during the winter time, all of our men were let out to shift for themselves. Our board of directors learned it wasn't the profitable way to handle the labor situation. They tried to find jobs that could be done in the winter time so that we could keep these men on. Right at the present time, our labor situation isn't too bad. We usually carry ten men and will start the season with seven. Six of them worked over winter. Some of you may be interested in one thing I tell our Board about the benefits of keeping labor through the winter. Two experienced men are worth three of any new men. Both ways, it's still 24 months pay. Do everything you can now and hope for the best.

Taylor Boyd, Cincinnati, Ohio

During the last war, most members were very tolerant. I think that if you tell them that there may be shortages and if there are shortages, tell them what you are up against, do the best you can, and I don't think you will have any trouble.

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RECORDS AND LABOR MANAGEMENT

Don Strand, Chairman

These are two of the most important phases of any superintendent's operation. In the face of the critical periods ahead, considerable emphasis should be made in keeping accurate records. They are necessary in the fulfillment of almost any anticipated program. With accurate records to work from, definite conclusions can be drawn and definite plans can be made, provided your anticipated expenditures are based on an accurate record of costs in the past. The success or failure of any future operation is based on the past records of such operation regardless of whether it is custom cutting of grass, building a green, controlling bonfires, producing better grasses, killing weeds, killing bugs, or even keeping better records. Science and research are very dependent on accurate records. The scientist says, "We did thus and so, and this is what happened." He knows, because he kept accurate records of his operations and we profit by the success or failure of that operation.

However, most records in our own cases are visualized as figures pertaining to cost. We depend more on printed material in the form of articles, bulletins, manuscripts, and books for factual records or depend on our memories. In most cases, memories are fairly reliable, but the more successful executives prefer to verify the facts and figures. At this time I would like to introduce one such successful executive who will speak to you on Records on a Course, Mr. Taylor Boyd.

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RECORDS ON A COURSE

Taylor Boyd

All that I am trying to do here is merely to bring out the fact that when you keep records, you find out things. I am not selling any particular kind of a record; just so you have a record, one that is easy to keep, short, concise and one that the directors will read is the important thing.

Labor today is the worst headache that any golf course has because of the short labor market. Golf courses cannot compete with industry during war periods for

many obvious reasons. Superintendents should have a definite program outlined and this should be discussed with the chairman to be sure that they are in accord. There is another good reason for the chairman knowing the plans as follows on this labor subject. He, in all probability, has labor problems on his own men and has to solve them. He may not know about fertilizers, fungicides, soil aeration and all the other things, but this could be his one chance to really be valuable help to the superintendent. While discussing the labor problem with your chairman, it will help to get him interested if you will present to him a cost-control system, if you don't already have one. Any business today has a very rigid cost-control system, and you can safely bet that your chairman will welcome such a program. Clubs are faced with a very real problem with younger members going into the service and rising costs.

The facts are that you can't control labor without some very easily kept, short, concise record of costs. There is nothing new in the statement that golf machinery saves labor. How much? You don't know without records. It is entirely possible to have too much of the wrong kind of equipment. The cost of maintaining equipment is expensive and if it is not available at the proper time, it becomes more expensive.

Try to select equipment that your help likes to operate; they'll do more work. When buying a new machine, ask the man who uses it if he would like it. The very fact that you asked for his opinion will help his attitude. There are many things that can be done on a course with machinery that no one has taken any time to do anything about.

Every greenkeeper has some gadget that he made himself to save labor. You probably have everything necessary on the job to make some tool that will save labor. As an example, a corn weeder on a Ford or Ferguson tractor will loosen sand in traps as fast as a dozen men and do a better job. Set into the reel area in an old mower, a delmonte raking fork does a good fast job of raking greens. Just remove the regular reel, regular bedknife bar, use the front castor adjustment equipment to give it the desired pressure. Remember, that it is best to give and to receive and it is not smart to have trade secrets. You never get any ideas but your own if you use that procedure.

Laborers today are not the uneducated dummies that they once were. There are many men working in so-call-

ed labor positions who have college degrees. They do this because times have changed; they make more money than they could in a white-collared job. It is usually the superintendent who has to recognize that labor is made up of smarter men. There are books and bulletins written on the subject that are really valuable books to anyone handling labor. This may seem like foolishness to some, but it definitely has its place in modern golf. Purdue University and most schools teach the subject as part of their psychology courses put in simple language. You will have to compete with changed thinking of man. In addition, there is always the idea of being a good fellow with your men and treating them as you would like to be treated-- it works wonders.

Placing responsibility on men has some very beneficial results in most cases. If they are worth having, they will accept some responsibility and it will help them feel that they are a part of the overall picture. This can be done by giving a man all of the care of certain holes and certain duties. This can be helped by taking a man from time to time to see other courses. The other course is either better or worse. In either case, the man gains knowledge. If worse, he is proud of his work. If the other course is better, you can bet that he will improve his work. I have done this plenty of times with good results. This procedure makes the superintendent's work easier because it is easier to check one man for a certain job than to check several.

Another way to get more production from your labor is to transport power mowers to them or build small buildings in some out-of-the-way place to store this equipment. The mowers are serviced in the area to be used, but that is less expensive than transporting mowers every day. A successful housing method saves the price of one green cutting per week over a year. This might not be true if our courses weren't so large and spread over so wide an area. Changes in actual costs with the housing of mowers on the job cost us about $7.48 per cutting. Before the housing was built it cost $9.03, or a $1.55 saved per cutting. Our savings for the year were $335.40 for 228 cuttings.

You are probably wondering why I agreed to talk on this subject. Several years ago I studied accounting with the idea of quitting golf which made me realize that I wasn't a pencil-pusher but retained an interest in the records of operation. I am going to give an exact example as to how it worked to us. Before we give the actual figures you should know that the club

I work for has many diversified activities, such as badminton, horse riding, ice skating, polo fields, tennis, golf, swimming pools. There are about 10,000 feet per green, about 4 miles of roads owned and maintained and also the maintenance of all the buildings that go with these activities. Before we started these records, I think that the average club member thought that the larger part of the maintenance was going for golf. They found that wasn't so. The first year that these records were kept was 1948. The total cost was $44,510.77. The next year, 1949, one of our tough ones, the cost was $36,832.31 or a saving of $7,778.46 and although the saving was great, prices had not dropped. The two figures included the cost of buying new equipment to make the saving possible. The expense of the new equipment was not amortized as it should have been, but remained a lump sum figure today. This record on one sheet usually refers to cost of labor, cost of supplies for 75 different jobs. The same sheet is used for monthly statement, 6 months statement and then totaled for the annual operation. This record can be used at your annual meeting. This item is interesting only because it shows how weather can affect costs. In 1949 rough cutting cost $496.80. In 1950 with an extra 25 inches of rainfall the cost was $1,476.30. This was offset by this: the cost of water and electric power was $4,112.81 in 1949 and only $3,040.72 in 1950, but the wet year of 1950 took $507.31 more gasoline.

If you want to know where money goes, just keep records. You can be sure that you will give your club a better golf course if at the end of the year you can show your club where all the money went.

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LABOR MANAGEMENT ON MY COURSE

W. H. Glover

The value of any discussion about labor management problems on any particular golf course will come from comparisons made between practices under one set of conditions as they parallel or deviate from practices at another golf course operation. It must be understood that practices or problem solutions at Fairfax are different in many respects from those on other golf courses and that no attempt is being made in this discussion to lay down rules which should or could apply to every operational problem.

It is my intention to bring to your attention some of the factors which influence the kind of labor used, how the labor force is handled, what is expected from it, what it expects from the employer and how successful we are in keeping good personnel once we have found it and educated it. It will be helpful to you if I give some of the general background of this particular operation.

Fairfax was designed and built to be operated as a daily-fee golf course. Since it was known from the start that it was to be operated for profit as well as pleasure, much attention was given to the design as it affected the playability and cost of maintenance. The topography of the land made it possible to leave many natural hazards and unnecessary to create new hazards in the way of traps and bunkers. Banks and swales were swept out to permit mowing with proper equipment. Hand work is held to a minimum.

Public golf course or daily-fee course maintenance operations usually differ somewhat from country club or membership club operations because of the extra traffic, time of day at which play starts and the general level of care exercised by the golfer in attention to the rules and etiquette of golf as it affects maintenance. I refer to the replacement of divots, leveling of sand traps, disposal of paper and other wastes. The courtesy which the golfer expects from the labor force is no more important than is the understanding by the golfer of the necessity for the presence of the labor force on the golf course.

As a result of basic planning and construction and the development and perfection of most types of mechanized maintenance equipment in recent years, most every operation requires a man who can operate some kind of motorized machine. Practically every man but the one who takes care of the traps must know how to drive a tractor and have some knowledge of the workings of a gasoline engine. This points out the necessity for either finding men who are familiar with the operation of all types of golf course maintenance equipment or going out in the labor market and finding them and taking the time and affording the expense necessary to adequately train them in the use of and in the maintenance of the machinery they use. Of even greater importance is the intelligent handling of this trained personnel so that replacement is seldom necessary. In todays labor markets the last metnioned point becomes a really big order for every superintendent and every golf club.

Ten years of experience and observation along with some accurate cost accounting has proved the importance of enough equipment and enough men trained in the use of such machinery to keep ahead of play in daily maintenance operations. On a golf course where speed of play can make the difference between showing a profit and a loss, the importance of being organized so that you do not interfere with play and play does not interfere with the maintenance operation, takes on added weight. Every consideration should be given to promoting the enjoyment of every round of golf by every golfer. Patrons of the golf course are the best advertising medium we have. In fact, they are the only advertising medium which produces results.

Experience has shown that mowing operations on greens, tees and fairways annoy the golfer greatly and they are also the operations which can be costly if machines and operators must wait for players to pass by. Watering of greens and the changing of cups are operations where the same thing holds true. It should be easy to understand from the above explanations why our mechanical maintenance operation has been so organized that we are able at most times to keep ahead of most of the play if we have the advantage of having completed the maintenance operation on the first hole on the course.

How can it be done? Flexibility of manpower and enough machines for the men is the answer. With three separate fairway machines and men to operate them the fairways are mowed in multiples of three and it is possible to mow all of the fairways in less time than it takes the average foursome of golfers to play eighteen holes. Therefore, with the advantage of the first hole cut ahead of the first group, we can and do keep ahead of play. With five power putting green mowers and the men to operate them, it is also possible to keep ahead of play if given the same advantage of one cut green. Greens are then cut in multiples of five. Watering is done the same way only in multiples of seven when heavy watering is necessary. That means that we must have seven men who can be trusted to irrigate greens. Naturally, we do not use the seventeen men which the addition of the men used in the three operations would indicate. Instead, we use only the seven men indicated as being used in the hand-watering operation for all of the season except the critical three months from the middle of June through the middle of September.

Besides the equipment already mentioned there is one

other standard golf course tractor and a five gang set of Blitzer rough mowers, a farm type tractor with sickle bar attachment and power takeoff for belt work, two fertilizer distributors, a power sprayer, two rotary type power mowers, two reel-type power mowers, aerating equipment, compost mixer, chain saw and a full complement of small tools. There is probably more equipment on this eighteen hole installation than is considered normal or necessary by most clubs.

The men who work on the golf course are mostly young men with families and live within a few miles of their work. Most of them have come to work at Fairfax be cause one of the men who has worked there before them has recommended them. Each new man serves a probation period to find out whether he will fit into the organization, if he will be liked by the other men and whether or not he has the capability and aptitude to make it worth while to train him and make him a permanent employee. At the end of two or three months he knows whether he likes the type of work, the men he works with, the employer he works for and whether or not he wants to continue. We also have found out the things we want to know about him. After a conference during which all aspects of his job are discussed, some sort of a mutual agreement is reached. The man is either convinced that he wants to continue or he is told that he does not have what it takes to make it worth while for us to spend the time and effort which it takes to train him well enough so he can command top wages and top security in our organization. During this first period the new man is shifted from one operation and from one machine to another with as many different men as is feasible. This gives him the advantage of different men's interpretations on how to do things and how much is expected from each man and each machine.

When it is decided that a man is to be kept in the employ of the club his training begins in earnest and with more specific direction. Reasons for doing certain things in a definite way are explained to him and the anticipated results are pointed out. When a person knows how to do his job and what to expect the result to look like, there is little excuse for him if he does not do his work as it should be done. Sloppy work is not tolerated. For instance, there is no excuse for a man to overwater an area of a green when he knows how much the area will take without flooding. He is cautioned along with another explanation of what damage may occur from too much water. There seldom is a next time. Each man knows that what he contributes

to the best in maintenance is best for the financial gain of the operation and therefore is best for the golfer and is also best for him. The rest of the men in the working crew quite often take the necessary steps to show a man that he is hurting them as well as himself if he does not produce at his best.

What does the employer have to offer as compensation for the best that his crew can produce? There are a great many ways in which a superintendent and foreman can improve the morale and the desire to turn out the best kind of work. Below are some of the considerations which we think are important in keeping any job on our maintenance force one to be looked after rather than just one at which a man can make some kind of a daily wage:

1. Keep abreast of or just a little ahead of the going scale for comparable work in the general area.

2. Guarantee a minimum work week of forty hours for fifty-one weeks and the other week a vacation with pay for men with one years' service and increasing by one day for each additional year of satisfactory employment.

3. Pay time and half for hours worked over the minimum set for each week.

4. Stagger weekend work so that each man gets a full weekend to himself each month during the summer season.

5. Give them credit both privately and publicly for their contribution to the successful operation of the maintenance program at the club.

6. Keep some sort of a library of books and magazines which have to do with the problems of turf maintenance and encourage the men to use them and to ask questions about the application of what they have read to the job which they are doing.

7. Present an opportunity as often as possible for them to attend a field meeting. The men at Fairfax attend the annual field day at Beltsville each year, expenses paid.

8. Make them feel that you have a personal interest in their problems and that you can be asked for advice.

9. Encourage, almost to the point of insistence, that they learn how to play golf and use the golf course whenever they have time.

10. Be sure that each man knows what you want him to do, how you want the work done and how much you expect him to accomplish in return for the pay he receives.

What we expect from our maintenance force in return for the compensations we can produce can be said very simply and in few words. We feel that we have a right to expect a willingness to cooperate in the effort necessary to complete a reasonable work program each day.

We feel that our approach to our labor problem is realistic. We also feel that it has paid well in that our quality of work is high because of the small turnover in the personnel which does the maintenance work.

Golf course superintendents have experienced many of the same difficulties and many of the same disappointments while continuously facing and fighting the problem of acquiring and keeping good men who can be taught how to operate and maintain the machinery used for maintenance on the golf course. Budget makers have contributed to the difficulty by not making it possible to pay enough to attract good men and to give them the security of employment throughout the year. Superintendents have contributed to their own difficulties by not being insistent in their demands for budgets large enough to permit the employment of the right type of men.

Good machinery is expensive to buy. It is folly to purchase expensive machinery and then not be able to insure its best productivity by budgeting enough money to provide the men who are capable of making it produce its utmost over the longest period of time.

If there is one thing which has come from the experience of operations at Fairfax over the ten years it has been in use, it is the belief that enough of the best equipment plus enough of the best men is a combination which can be made to produce high efficiency and the best use of men and machines in any turf maintenance program.

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SUPERINTENDENTS' RELATIONS

Frank Dunlap

My first impression of this subject "Superintendents' Relations" was that I had a cinch and could write a book about it, but Colin Smith and Mal McLaren soon convinced me that you people were not going to be in the least interested in the eccentricities of my in-laws.

Golf is an old game and has gone through many stages. The game as we know it today did not, however, come into its own until 1902 when a member of the club where I am now employed invented the so-called cord ball.

This ball revolutionized the game of golf and brought forth the modern golf course with greater yardage and larger greens. The fact that the player was now playing to the green from hitherto unheard of distances made larger greens mandatory. However, it did create a new problem. The old bluegrass, fescue or what-have-you putting surface was not satisfactory for the long approach putts that were now called for on these greatly enlarged greens. The golfer began to cast about for new and better types of grass, and also for someone who could produce and maintain smoother turf. Thus was born the profession of greenkeeping. Up to this time most anyone who could drive a team or push a lawn mower with a little greater degree of skill than the rest of the crew was the man in charge of the course. These first greenkeepers at once started experimenting with different strains and types of grass. Progress was very slow, for there was no organization and thus no chance for an exchange of ideas and information. On the contrary the situation was quite the reverse. There was much professional jealousy and many were those who were quite sure they and they alone had solved the mystery of growing a putting surface that just naturally led a ball into the cup. During the years this condition existed, the Lord, the weather, and nature in general conspired to shake their confidence in some of their so-called secrets.

In 1925 some of the old-timers who were more far seeing and a bit more charitable-minded gathered at Toledo, Ohio, and out of that meeting came the National Association. The seed was planted and from it grew the modern day golf course superintendent.

The superintendent of today would not exist nor would golf be what it is if it were not for this all important side of superintendents relations--relations to one another.

Through these relations and their exchange of ideas, they soon learned that by giving a little in the form of an idea they were gathering a harvest of worth while information that was producing better and better golf courses for the players of this country. From this realization of the value of communal relations came the desire for more technical and scientific approaches to their problems, so they turned to the colleges of agriculture and thus came about the close relationships that now exist between the superintendent and the many universities interested in the growth of turf.

What is the sum total of all of this? It is a quality of turf and a degree of course maintenance that would give those turn-of-the-century golfers and maintenance men much the same feeling as that of the old colored fellow who was taking his children through the zoo. When they came to the giraffe the kids stood in open-mouthed wonderment until their father said, "Come away from dar, chilluns. Dar ain't no sich animal."

The present day course superintendent is not a scientist nor is he a farmer in the usual sense of the word, but he does a very highly specialized job of scientific farming. Year by year in addition to this he has been called upon to acquire a working knowledge of a greater and more varied assortment of skills than any professional man I know.

What are these skills that he must have in addition to his main job of growing turf? First and foremost he must be a mechanic, for today's course is highly mechanized. He must be a tree surgeon, a landscaper, a gardener, a golf course architect, road builder, painter, carpenter, swimming pool authority, tennis court expert, bookkeeper and labor relations expert. Truly in this last department he must be a magician, for he is expected to keep competent workmen at a rate far below that paid by industry as a whole. The attitude of the club is - if it needs doing turn it over to Joe, he'll find a way to get it done and for less money, too.

Now while Joe has been acquiring all this knowledge and skill, what has happened to him? Primarily he has been so "damned" busy that he has not had time to find

out what was happening to himself and what he was getting out of the deal. He has been so busy looking out for the welfare of others that he has totally neglected his own well being.

The golf course superintendent of today has developed into a full fledged executive and doesn't seem to realize it, and I for one think it is high time he did.

Certainly he is going to have to continue to improve his knowledge of his job, but he is also going to have to spend part of his time letting the public in general and the golfer in particular know just what an important part he plays in the welfare of golf. I say, without fear of contradiction, that the golf course superintendent is the only executive employee of any club that is absolutely indispensible to its continued operation.

Let's take a look at some of the things that a superintendent can do to bring home to his club and people in general just what an important part he plays in their lives.

Unfortunately there are no magic wands to be waved or Aladdins lamps to be rubbed to bring this about. In the main it will be accomplished by a process commonly called "public relations".

Public relations is, when all is said and done, salesmanship and in this case the product to be sold is the golf course superintendent.

To sell any product you must first have a sales organization and that organization must have an advertising department, the duty of which is to get the name of the product before the public. Advertising campaigns cost money and it is a job for experts trained in that field.

We are well prepared to put on a sales campaign. We have the organization in the form of the Golf Course Superintendents Association. It is up to us as stockholders in this organization to provide, through higher dues, the money for it to hire an expert to publicize and advertise our jobs. We also have branch offices in all important cities in the country, the branch offices in this case being our local superintendents associations. The branch office or local association is the point from which the salesman, who calls on the trade, works and in this case the salesman is you.

Now that you are a salesman as well as a golf course superintendent, let us see what it takes to be a good salesman. Primarily he must have a product to sell and that he has. He must have a thoroughly proven product and that he also has, as evidenced by the hundreds of fine golf courses in all parts of America.

A good salesman must be industrious and resourceful and always on the lookout for new ideas and new arguments with which he may convince his customer, in our case the club member, of the value of his produce and their need for it. He must evidence an interest in the things that they are interested in-- in our case, golf tournaments, tennis matches, swimming events, flower shows and the like.

He must be helpful to his customer in ways that will call attention to both himself and his knowledge of his job. He must be civic minded and willing to take part in and lend a hand in the conduct of community affairs and endeavors. If he is asked to speak at a garden club he should do so, or if, as in some cases, he is just not able to speak in public, tell them frankly that it is just not in his line, but that he knows a fellow who can and that he will make arrangements for him to be there. This he can do for he is a member of an organization that can provide the man they need.

A good salesman is a thoughtful man, especially where his customers are concerned. If one of them is ill, he drops them a friendly card. If one of them takes a step up the ladder of success, the good salesman sees to it that he gets a chance to congratulate him. There is no one thing that I know of that makes people feel better than to have someone interested in their success. If you make them feel better about themselves, they will by the same token feel better about you, and after all that was the main idea in the first place.

Letters are one of the most effective tools of the salesman and he strives continually to improve his ability to write good ones. Many business men are more impressed by a good letter than by any other form of sales approach. They very often judge a man's abilities by how well he writes a letter. We as superintendents miss many opportunities to call our club officials' attention to ourselves by our failure to write letters at the proper time.

We should always send a written report to our club as to what we saw and heard that was of interest at con-

ventions and short courses. Suggestions for improvements or alterations to the course should be in letter form. Budgets should always be accompanied by letters of explanation, so also should the yearly summation of expenses.

If any unusual work is to be done, such as construction or renovation that may interfere with play or affect the appearance of the course, a letter explaining the why's and wherefore's should go out to the membership. It will do two things. It will save you a lot of grief from complaints and it will also call their attention to the fact that you are the one who is running their course and you will have become more important in their eyes, and again that is exactly what we were trying to accomplish with this sales campaign of letters.

Anyone who finds it difficult to talk to groups should take one of the many courses offered in all communities to aid people to more easily and forcefully express themselves. Remember that the members of your committees are business men and will give more consideration to and have more respect for your proposals and suggestions if they are properly voiced and in respecting the proposal will in turn have greater respect and regard for the man who made it.

This salesman superintendent of ours is now taking on the aspects of quite a fellow, so let us not neglect that phase of salesmanship which any successful salesman will tell you is of extreme importance, that is personal appearance. It is not necessary that we become fashion plates, but if we are going to be classed as supervisors we are going to have to look the part. A successful salesman must look successful and a successful superintendent must look like a superintendent. If we are ever going to command the salaries we expect and to which our knowledge and experience entitles us we are definitely going to have to command respect and believe me that will not happen as long as the players on our course cannot identify us from the men who work for us.

All of this adds up to quite a bill of goods and I am quite sure that none of us will ever accomplish all of it but if we honestly try we are going to be amazed at the results, and we will have contributed our share in helping to elevate our profession. The same relations that have done so much toward gaining recognition for our fine golf courses will again pay off in gaining personal recognition for ourselves and the profession as a whole.

As an old school teacher of mine used to say, "When building air castles, build them high enough so when they fall there will be something to the ruins."

Let's be respectful, but let's also be respected.

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ROADSIDES AND AIRPORTS

H. B. Musser

Sometimes it is desirable for those of us that are in a very specialized field such as golf turf to stop a minute and take stock. There may be stimulation in realizing that we are a part of a much bigger picture. And so perhaps this afternoon the best contribution that I can possibly make is to show you that sometimes the grass isn't a bit greener over the fence than it is in your own particular daily work--to show you that there are problems in other fields of turf production also.

Highways and air fields present probably the widest variations in grass problems as we are accustomed to thinking of them. While the same principles of growing special purpose turf apply no matter where you are growing grass, the basic principles of moisture, drainage, fertility, compaction and other factors of that sort still apply. Yet in a great many cases we treat them in a much different fashion on these other specialized areas.

There are very specialized problems in the highway field, especially in attempting to maintain turf on steep slopes. Can we find better types of vegetative material than we have been using in the past? This is a close-up of part of our experimental setup where we established a number of grasses to test out, under practical conditions, possible differences in performance. The Pennsylvania Highway Department and many other highway departments have been using a lot of orchardgrass for their bank stabilization in the past, and we are beginning to suspect that maybe it isn't the best possible material for that purpose. We can get an excellent stand for the first year or two and then orchardgrass, being a bunch grass, will begin to thin out and form tufts. The water begins to run down around these individual tufts and gullies develop.

In contrast with that, here is the tremendously heavy cover and the excellent protection that we have secured from creeping red fescue. Creeping red fescue is normally considered as rather a fine type of grass, but it does well on these areas with very little clipping and very moderate fertilization. The fescues as a group are very tolerant to droughty conditions and to low fertility. These soils are practically sterile from the standpoint of any fertility because they are all subsoils. We do have to add a reasonable amount of fertilizer at the start.

This is a plot of Alta fescue. You can see that it is making and has retained an excellent type of cover after a three-year period.

Crown vetch, I think, is by far the most promising material that we have been able to find so far for this type of slope. It is a legume, a perennial legume, that spreads with underground root stocks, is very tolerant of low moisture conditions and poor soil, and has the ability to form a very dense protective cover on the area plus the fact that it is quite spectacular. Those purplish-pink blooms start about the middle of June and the whole area is a mass of color from then on until September. The highway people like it on that account. They also like it because of the excellent stabilization, the excellent control that it gives. Now Crown Vetch is not all "beer and skittles" by any means. There are very definite problems connected with its establishment, less with maintenance. The first problem is the fact that it is slow to develop. The only way that you can get a satisfactory stand of Crown Vetch, that is, a stand that will control slope erosion the first year, is by very close vegetative plantings of the crowns. On the other hand we can establish excellent stands of Crown Vetch from seed if we can afford to wait for the slower development that we get from seedling plants.

Right now the thing that we are primarily interested in is to try to find the best possible grass to grow with the vetch that will give us cover temporarily until the crown vetch has established itself. This is an illustration of one of those first attempts. Here we have a mixture of crown vetch, Alta fescue, orchardgrass and timothy. You can see the small crown vetch plants developing down in there among the grasses. The following year the grass is beginning to thin out, the crown vetch is beginning to take over, and we will eventually end up with the solid plot of crown vetch that I showed you. What kind of mixture can we

grow with the crown vetch? Well, most any kind of grass that won't smother it too much in the early stages. We are not interested in any of them after the crown vetch establishes itself. The fact of the matter is that I have never been able to keep any grass with it.

One of the other important problems is off-season seedings. As you know, many highway jobs are completed at times when we don't usually think about seeding grasses-- either at the tail end of the fall before you go into the winter or in the mid-summer. So one of our problems was to determine whether we had a reasonable chance of success or whether there was anything that we could do that would give us a reasonable chance of success in making off-season seedings. We immediately ran into the problem of where we were making those seedings. Our test was on a new highway where there was a similar cut on each side of the road. The one had a north exposure; the other had a south exposure. This picture is an illustration of the stand of red fescue, ryegrass, tall oat grass and Alta fescue where we made winter seedings that didn't come up until the following spring and were covered with mulch to protect the slope. I don't think that anybody would ask for better cover, a better stand of protective grass than that. By the way, this is one of the poorest soils that I know anything about in Pennsylvania. In contrast this is the situation that developed when we made the winter seeding on the southern exposure. The sun lay in there and warmed it up, took the frost out of the ground several times during the winter when we had mild spells of weather so that we got winter germination. Now red fescue and Alta fescue germinate at lower temperatures than some of these other grasses do. The result was that we got a definitely poorer stand of those grasses from winter seedings on the southern exposure than we did, as you could see from the previous picture, on the northern exposure. That became very, very interesting to our highway people who are charged with putting protective cover on these areas. They had never given it any consideration.

We have practically the same situation for another reason where we make mid-summer seedings. This is a summer seeding with the five grasses that we are using here-- orchardgrass, perennial rye, red fescue, tall oat, and Alta fescue. By the way, we have seedings of crown vetch in every one of those to see whether there is any difference in the establishment of the crown vetch with these various grasses. In this case the

results again were better on north exposures. Moisture conditions were better.

Those are just some of the highlights of a lot of problems. There are a lot of other things that we are tackling, but it may serve as a bird's eye view of some of the things we are up against from the standpoint of trying to establish cover on highways; and the fact that there are just as serious, just as vital problems in turf production in the case of this heavy duty turf as there are of the specialized, intensive type of turf that we are usually thinking of.

Now for the airfield work, I will have to take you back to the war period because we have had very little experimental work on airfields since that time, and the fact of the matter is that most of the work that was done at that time was trial and error. All that I am going to try to show you here are the problems that are involved in attempting to do a workman like job of making conditions satisfactory for operations on an airfield. Now this is not a poor picture-- that is an excellent picture. The story is that the whole picture is clouded by dust. Dust is probably the most important factor on larger air fields where the wind has a chance to blow across and pick up soil from unprotected areas. Another of our problems is that where you have dust and unprotected areas, you have mud. Then we have erosion, where water comes down from higher areas onto the airfield and causes difficulties. That is really a mild type along side some of the situations that developed until we could get a protective cover on them. Here the engineers constructing an airfield are experts in designing the size of inlets, the amount of tile that is required to take the water off; but one thing that they completely lost sight of was the fact that as long as those large expanses of open, flat areas were not protected against wash, the inlets were not doing them a bit of good and they were getting erosion and flooding on the field. Here is another type of erosion. Now that just isn't a mound of soil piled up. That is the end of the approach to a runway. It was leveled out and filled in so that it could be built about level. There was just a little slope on that runway toward this direction. The water collected on it and eventually cut that gully back until it was almost at the edge of the concrete slab itself. In this whole airfield picture turf can do a beautiful job of controlling dust and erosion if the handling of it is understood.

This is an edge of an apron where planes are held to

service them. Mostly the tails are turned back off the apron, and propwash comes back at a hundred miles an hour or more and takes out everything down to a depth of six or eight inches. Then if there is traffic across that area, they rut it still deeper. If that happens along the edge of the runway or at the end of a runway and a plane hits it, you get an accident. Turf can do an excellent job of controlling that situation. This shows where you have the same trouble along taxi areas where planes may be stored for any length of time.

And finally, one of the big problems, particularly in the western areas where you have wet and dry seasons, is fire. On many airfields during the war at least, there was no opportunity to keep them cut down close, and when that grass matures and dries, it may burn with almost explosive violence.

There are some of the problems. Are there satisfactory solutions? The all over turf field can be kept in satisfactory condition for landing and takeoffs of light planes with a good grass cover. You can do a magnificent job with bermudagrass in the south, most any kind of bermudagrass, although the better strains are more desirable. In more northern localities you go to the cool-season grasses. The shoulders of runways are a problem because in many cases those runways have been stabilized to 60 or 80 percent of the bearing capacity of the runway themselves. In the northern area (this happens to be a field up at Syracuse, New York)we did not have very much of a problem in getting a good growth of Kentucky bluegrass-fescue turf with some legume mixtures in it to protect those shoulders. In Florida we ran into the situation of almost solid limestone resulting from coral formations. It was an entirely different problem, and I included this picture just to show that you can do an excellent job of stabilizing those shoulders even with a pretty heavy bearing capacity material on it. The area was ripped up with a road ripper and the bermudagrass sprigs planted in it. This was about 3 or 4 weeks after the sprigs had been planted, and in another month's time it had become pretty well covered.

Now at those inlets I showed you a bit ago where we had the wash, we found that by doing a rather simple job of sodding around the inlet, we could protect our soils from washing so that the inlet would work until the grass that we had seeded out further took effect. If we didn't have sod available, we did a job of seeding, covered it with a straw mulch, and put some of

this grid material on top of it to hold it down in any areas where propwash was liable to blow it out.

Another method of controlling dust and especially wind erosion was by the use of straw mulch. It is simply dry straw that has been tucked into the soil sufficiently so that it will hold. The way that is done is that the area is loosened up much as you would loosen up a seed bed. The straw is spread over it as we have done over there where it has not been packed (this picture was taken before the job was finished) then run a sheep's foot roller or a culti-packer or a dull disk or something like that over it to cut that straw into the soil. I have seen those straw mulches stand a 70 mile an hour wind without blowing out. Another method of control is the cut-back asphalt dressing.

I am glad that I have this picture because it gives me a very interesting and important contrast from the standpoint of cost. That row of dressing along the runway isn't fit for anything but to stop wind blowing and dust. It won't stand traffic at all. It is just a light application of about 4/10 gallon of cut-back asphalt per square yard, and it only is good for about 6 or 8 months in contrast with the straw mulch that will hold up to 16 or 18 months without renewal. The difference in price is about 1 to 6 in favor of the straw mulch.

Finally, another method that I have very little faith in it the gravel blanket. We can't put that gravel blanket all over an entire area of hundreds of miles. Winds bring dust in that will settle in the gravel. Eventually it will become another source of dust. So it is not very satisfactory.

Good temporary dust control can be obtained by rough tillage. It acts like a miniature snow fence. Yes, it will fill up and you will have to do it over again, but as a temporary job, it is an excellent method of controlling dust.

Now, finally, the fire control. A material that did an excellent job of fire prevention by fire-proofing the grass itself, the dry grass, is mono-ammonium phosphate. As you can see, completely burned areas on either side of the strip where we went across with a 20-foot boom sprayer effectually stopped the fire right at that line.

Question: What is best height of cut for turf?

We have maintained all of our strains of grasses at

three different heights, that is, approximately 3/4 inch which checks closely with the type of fairway turf that we like to see, about 1¼ or 1½ inches which checks with ordinary lawn height and then about 1½ and 3 inches. On the basis of very carefully kept records of performance of the same grass under those three heights of cut, we have found that it is much more difficult to maintain a good uniform stand of grass at the 2½ or 3 inch heights than we have at the 1¼ inch or even 3/4 inch heights of any grass that will stand close clipping. I believe that you don't need to worry much about the height at which you cut a great many of our grasses if you will cut them frequently enough so that when you do cut them you don't take such a large proportion of the leaf area off them. Cutting a grass close is injurious to it when it has grown a leaf of about 2½ or 3 inches long and then is cut down to the point where you have removed half to 3/4 of that leaf area. It is a tremendous shock to the grass. Bluegrass and fescues can't stand that shock, can't recover from it because they don't grow rapidly enough. Unlike bent, they don't have enough leaf surface down close to the ground to recover. I think that if we cut frequently and only cut a small proportion of the leaf surface off, we can get our cut a lot lower without injuring the grasses than if you cut at longer intervals and shock them more severely.

(Question about crabgrass)

Answer: The answer to crabgrass control is in shading the ground. Obviously you do a much better job of shading the ground at a 2-inch height of cut than you do at the shorter cut. On a thick, heavy turf you do not have to worry about cutting too short for shading; on a thin turf, you do have to worry about cutting too short. The really important thing there is what Musser brought out-- that how much you are cutting off at any cutting is extremely important.

(Question about watering)

Answer: Well, of course, I know that watering can be overdone. If there is any error made, it seems quite logical to me that it should be on the side of too little water rather than too much.

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ATHLETIC FIELDS

M. E. Farnham

What should be the aim for athletic fields or other heavy use turf areas? Last fall before the Army-Navy game, some of the people from West Point came down to look at the Municipal Stadium in Philadelphia. We also went to Franklin Field and some of the other athletic fields at the University of Pennsylvania. At the end of the tour I asked Col. Reeder, who is in charge of the physical plant for the West Point Military Academy Athletic Association, if he could give me a definition of just what we do want on an ahtletic field. He evidently had given considerable thought to it because quite promptly he said, "What we want is something firm, smooth and green". Now that is a very good definition; I don't think anybody will quibble with it, and it doesn't sound too difficult. However, the further we get into it, the less simple it becomes.

At one time over a year ago, I asked George Munger, Pennsylvania football coach, a few questions about their reactions to various fields that they had played on, trying to find out on what basis they rated a field as good, bad or indifferent. I was very much surprised to have him tell me that looks are of prime importance from the standpoint of the contestants. He told me that in going into a strange field, the players, before ever setting foot on the field, have pretty well got their minds made up whether it is going to be satisfactory or not. In other words, the players, as well as thousands of observers who sit in the stands and have little to judge conditions except by looks, are quite conscious of that looks angle. Mr. Munger went on further to mention some specific fields and I happen to know that one of the fields that in the previous year they had found most satisfactory must have been purely and simply looks because from the turf standpoint they did not have much to offer. Munger said, "I don't know. Maybe they dye the material that is there. But it looked nice and before the boys ever set foot on the field, they had their minds pretty well made up that they were going to like it."

In our consideration of athletic areas we will think primarily of schools, overlooking professional baseball diamonds or whatnot, which really would give an even more complicated program because some of those areas are used pretty much the year around, and it's hard enough when you concern yourself with the school

fields. With baseball, being a spring sport, you often have an opportunity to go into those areas in the fall and do whatever seeding or renovation is necessary and have it in pretty good shape by the time spring comes. And, of course, the limited area of the infield makes that a much smaller problem. A well-known baseball player was asked about what he wanted on a diamond. He evidently is a golfer for he said that he wanted something about like our fairways on the infield, something not quite as good in the outfield. I asked him whether they wanted the grass in their infield because of playing conditions. No, the principal reason that they want grass on their infield is because it cuts down glare. Perhaps I stress the looks angle too much but it is important.

In any sound program on new fields sufficient funds should be provided and sufficient time should be provided so that after the actual construction work the field will have an opportunity to make some turf before it is put into use.

What should we do in soundly preparing soil conditions for the establishment of a new field? One of the prime considerations must be to prevent development of compaction as far as possible, and that means basically that we need to modify the existing soils by the addition of such quantities of organic matter and sand as may be sound procedure to produce a soil which will not compact too freely.

On fields in use the problems become complicated. If the use of a field in the fall finishes in time so it is possible to go in with aerification, fertilization, and dormant seeding, it's a good procedure to do so. If the program doesn't permit that or if conditions get so that you can't do that work in the fall, then obviously you have to do it first thing in the spring even though many of us know that the planting of seed in the spring is not too sound a procedure. It is extremely important that the bare ground on the worn areas be covered. That, of course, aside from such fertilization and aerification as may be in the picture, means the use of seedings. We must consider what grasses we're going to use because too often there is no let-up in use of these areas. You need to have some grass that comes quickly even though theoretically it may have retarding effects on your permanent stand of grass. During the summer time the school fields give you a chance to do some work on them, but nature doesn't offer too much opportunity. In Philadelphia, around the middle of August you can

put in some seedings with a reasonable chance of success, particularly on some of the college fields where they don't get into use until the latter part of September. If it comes down to a case of a practice field where the players come out the first part of September, then that's a horse of a different color.

When we are confronted with areas which become worn and bare from use, your weed problem develops. We have fairly simple weed control material for broadleaf weeds in the form of 2,4-D. The place in the program for 2,4-D on seedlings, however, has to receive a little more consideration than it needs on permanent turf because it is quite well established that 2,4-D applications often are quite rough on seedlings. Crabgrass areas occur on bare ground, and that also justifies the use of considerable quick grasses to cover the soil and compete with weeds. Some of the various chemicals which are being tested for crabgrass have given us quite a little help although we don't know the whole story. There again, we have to keep the seedling grass in mind.

We are hearing more and more about compaction not because it is anything new but because we now are able to do something about it. I've been quite enthusiastic in the past year or so in trying to explain many of the benefits received from aerification procedures by the fact that we are letting air into the soil. Then we go up to Penn State and Professor Alderfer gives us a very striking illustration that sometimes the trouble with our soil is that the air can't get out. Of course, that isn't too critical because after all if your conditions are such that air can get in, it can get out, too. In connection with seeding or renovation programs, aerification procedures should be rather severe.

The question has been asked how deep we need to go. I think it is a sound statement that most of our compaction is at the surface, in the top couple inches of the soil. It becomes progressively less severe as you get down into the soil, so that we don't have to worry about extreme depths for aerification treatments unless there are some conditions of extreme depths which are bad. Even though most of our compaction may be in the top two inches, it probably is sound procedure to aerify at least to the depth of four inches, and I think that becomes self-evident when you cut into some of these holes which are full of white roots following aerification.

The growth of turf alone has been shown to be quite effective in helping overcome soil compaction. Some of our soils are of such a nature that the aerification holes following our aerification procedures close up rather rapidly. In these cases we will need to put some mixture of materials into those holes through topdressing, dragging, etc., to hold them open long enough to permit the satisfactory root growth which we see when these holes do stay open.

As far as aerification procedures are concerned in routine maintenance, I favor rather frequent aerification treatments-- once over an area frequently rather than being too severe in any one time. And, of course, with much of the equipment which we have available today it doesn't take long to go over an area followed by proper matting to put the area back into good playing condition.

Now as far as the matter of grasses is concerned, most of the areas which I've seen are basically Kentucky bluegrass. Of course, we would all be tickled to death if we could get whatever quantities of B-27 or Merion bluegrass that we need. If we can't, it still seems sound procedure to plant commercial bluegrass which is available.

In some areas commercial bluegrass is severely injured by leafspot disease which occurs in spring and very little recovery occurs in the summer which practically cuts bluegrass out of the picture when use is heavy in the fall. I still think that we ought to plant it to be safe rather than sorry. We, of course, are looking forward to available supplies of some of the new selections of red fescue. The ryegrasses quickly cover the ground, and I prefer to use perennial rye rather than a domestic or principally annual type.

Alta fescue seems to be doing an outstanding job in some places, but for me it has been almost a total failure. Musser was astounded last fall to see how little results we had from plantings of Alta at the University of Pennsylvania. I don't know what the answer is, but I wish that I could produce the results which they are getting in some places. I know Charles Hallowell comes back from California and is enthusiastic about everything including Alta fescue.

What grasses don't we want on these hard-use areas? Poa annua, poa trivialis are pretty much in the same class in that they make a very shallow-rooted turf, and they just won't stand the hard wear. Both of them

go to pieces more or less in the summer time and unfortunately, they come back rather vigorously in the fall. Nor do we want creeping bentgrass.

I don't want to go in too much to the possible application of the warm-season grasses-- bermudagrass and Zoysia. Perhaps for hard-use areas, particularly when you take into consideration the speed with which they usually want this work done or the speed with which you have to do it, the Zoysias are slow unless they are put in as sod. The U-3 bermudagrass undoubtedly fits into the picture somewhere and in some locations. We put some test strips of U-3 down at the University of Pennsylvania a year ago last June. We put them in one-inch strips, set three feet apart at Franklin Field. After the two growing seasons (the rest of 1949 from June on was a good season for bermudagrass; 1950 was not so good even though the nitrogen program on the field was fairly high), the strips on Franklin Field in no cases were a foot wide. The principal thing is that your test of U-3 bermuda, or I might say a test of most anything, needs to be done not only in the locality where you are going to use it but insofar as possible in the actual location in which you are going to use it.

That covers in a rather quick way the program as I see it. I am tremendously interested in the opportunity for some of these contacts in fields of turf other than those on the golf course because I think that it makes the whole turf program much stronger. We have been fortunate in developing several turf research fellowships at Penn State and feel that we are really getting somewhere. Then the state highway department gets interested and has contributed more than the sum total of the other fellowships. Any of this work which we can promote in the broad turf field certainly makes us all stronger in our individual applications.

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SHADE TREE CARE

Carl Fenner

From the dome of the Capitol Building in downtown Lansing, the city appears to be in a forest, yet 100,000 people live beneath this forest. Such a background has made it possible to develop a scientific tree-care program over a period of 40 years with which I am associated.

Now as to something practical as to how to take care of your trees. This gentleman is cutting off a huge dead limb. His first cut is under the branch and he cuts, undercut we call it, until the saw pinches. Then he goes on top and cuts through until the branch falls off. The final cut he has made is entirely flush with the parent limb; then he paints it. Be careful who you have to do your tree work. If you want to do some of the simple parts of the tree work, you can learn how in this little lecture today. This beautiful elm tree with all of its five trunks is covered with little sucker growth-- with feathers, we call them. Don't ever cut any of those off. That is the beauty of that elm tree-- all those little suckers or feathers up and down the trunks.

You know the old idea of trimming a tree down from the top to make it spread out and get bushy. This tree was topped about 40 years ago and you can see where the dark bark ends and the light bark starts. Initially the tree looked broad, fat and plump; but now new sprouts have grown at the tips and they are dismal branches. Now it is a tall tree that is dangerous and will break in a storm. Instead, just give it a haircut to make it look a little decent.

All the primary wires in our city are on 70-foot poles-- that is, 62 feet out of the ground. Then our men go into the tops of the trees and simply cut away those portions of the trees that are actually interfering with the wires.

When you see a V-shaped crotch in your elms or some of your maples, bore a hole through there just below the crotch. Drill the hole about 3/4 inch in size and put an iron bolt right through the heart of the tree. You will save yourself a lot of good trees.

An automobile or mowing equipment could knock the bark or part of the bark off the tree. The first thing we

do is to take a sharp jackknife and trace the wound; in other words, cut off the ragged edges of the bark. Then we put nothing on that wound. We put this little fence of burlap around it (notice that the burlap is held about six inches away from the trunk and nothing touches the wound.) The cover is on there simply to prevent the sun from drying out the cambium layer. If that smooth, slippery cambium layer is protected from the sun, it will thicken up into natural bark. We leave the shade on for four weeks. Ordinarily that would take about 5 years to grow bark in from the edges. If you fail to treat it within 24 hours and the sun does dry out your cambium layer, it dies. Scrape it off with your hand or chisel and trace the edge of the wound, shellac the edge and put paint on. That will then grow over in the old-fashioned way from the sides.

When your tree is off-color, get in touch with someone who knows about tree diseases. In this particular tree the top leaf is normal green, the bottom is off-color, and it came out of the ground like a post. We found a strangling or girdling root, literally shutting off the life stream of that tree. Since the root had not grown into the tree, it was taken off, the tree fertilized and watered and it came back.

We do a lot of things to upset the balance of nature when we bring a tree into the city. Here is a golf course where we quickly rush out and pick up all the leaves. Sometimes when trees in a city, on a golf course or on a street have gone too far-- have slipped too far in health-- we feed them artificially by boring holes in the ground. First we inject an air gun in the holes and fracture the soil; then a man pours in the fertilizer, reinserts the gun and distributes the fertilizer through the soil. All the holes are left open-- there are about 50 holes under each tree-- then the whole thing is covered with water to further distribute the food. Sometimes our trees when brought into the city on a golf course or street need extra watering. A pipe needle can be made in your own shop so that you can get the water down where the root system really needs it.

The mist blower is the latest thing in spraying for insects in trees or for mosquitoes. The finely broken dust or liquid is blown out of this machine at a very high velocity air current and is distributed over a vast area. It is the cheapest way to cover a large area. There is a saving of about 75% in material alone.

I am sure that you are all familiar with the picture of this nasty stuff coming out of an elm tree. It doesn't kill a tree, but it has that awful looking stuff which is the result of a bacterial action inside the sap stream. We have inserted two pipes past the heart wood and in the point where we figured there was the greatest infection, and have drained out the infected sap. The business end of this little drain is what is important. It is a very simple thing that you can make in your own shop. Drill it full of holes in the side so it can gather more of the infected sap and carry it out away from the bark six, eight or ten inches.

A basswood tree and a red oak and a few others perhaps can be beautiful and healthy on the outside (bark, foliage, twigs) but inside can be almost completely rotted. You need to watch out for them. You can find this rotted tree by merely tapping it with a mallet on the outside. It will give a punky sound.

We should say a word about the planting of trees, I think. You are more likely to succeed in planting young trees on your golf course if you take them out of a field where they have been grown and cultivated and watered. They have been grown a little faster, their roots have been pruned. They have a shorter, denser, more compact root system with less loss of roots when the tree is taken up and moved onto the course. Because of the transplanting shock and the loss of some roots, it is necessary to reduce the top. Cut off all the big limbs, leave the little ones on, and in a few years the tree will assume its former shape. Cut and cut until it hurts and then cut some more. In the planting of a tree there are just a couple of things that I want to say. We make the hole plenty big, of course; we throw the top soil in one place and the subsoil in another place. When we replace the dirt in the hole, we put the top soil around the roots and fill it up with the subsoil. One precaution-- don't plant your trees too deep. Plant it about the same height it was in the nursery.

We protect all the maples and elms by wrapping ordinary building paper around them and tying it snugly in place for two years after planting. Otherwise the flat head borer will get under the bark and destroy your tree. A newly planted tree needs a couple of good waterings per summer. We dig a trench two feet from the trunk and flood on 15 to 20 gallons of water at one time.

Now a few trees that I like especially well. The good old sugar maple in fall coloring is at the top of my list. It is a slow grower but we advise putting in a certain proportion of the finest tree that grows--sugar maple. It isn't a rapid growing tree. It is a medium growing tree and quite subject to certain diseases. Sweet gum can grow right along with the maples and they have a brilliant fall coloring. Don't buy a sweet gum with bare roots. Don't even take it as a gift. It has to have a ball of soil. Here is the good old American elm which I am sure you have all heard may possibly be wiped from the American scene. I don't know whether it will or not. It has a couple of terrific diseases, but it still is one of the grandest trees in existence. I don't hardly know whether to advise you to plant them or not. We are still planting a few in strategic places, but we expect in a few years to have to spray them a couple of times a year all the rest of their lives.

Here is a sassafras. It is one of the world's most beautiful trees. It grows at a moderate pace, has no enemies, but brother! try to transplant it. If you buy any locust be sure to make your nurseryman guarantee that it is both seedless and thornless. Poplar--well, let's not smear this tree too quickly. Sure it grows up fast and grows away from you fast, but you will get 20 years of very good service out of them in certain parts of your course as borders and screens. Another upright growing tree is the Norway maple. It is an upright growing type which grows in small spaces and they grow at a good pace and apparently have no enemies. Again, they have to be planted with a ball of earth. Don't plant Chinese elm in this area. They do grow up quickly, but they will just get up big enough to shade you in your rocking chair and, bingo, down they go. In some of the low rainfall areas of the west the Chinese elm grows slower and is a pretty good tree.

About putting copper in trees. I drove 1½ pounds of copper nails in one soft maple tree. Each copper nail killed a small area around its head. That was about 20 years ago and those wounds healed over and the tree is healthy and happy today.

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RECOGNIZING AND COMBATING DISEASES

J. C. Carter

Tree diseases are usually classified according to the part of the tree that they effect. They may be divided into leaf diseases, cankers and diebacks, wilts, wood rots and root rots.

LEAF DISEASES

Powdery mildew-- Powdery mildew is a fungus disease that occurs occasionally on trees but seldom causes serious damage. It develops as a white powdery mold-like growth on the leaves. Control consists of applying dusting sulfur when mildew becomes apparent.

Leaf spots-- Black leaf spot of elm is one of the more common leaf spot diseases. It produces small, circular to irregular black spots that appear early in July. These spots, confined mainly to the upper leaf surface, become gray with numerous black pustules by late summer. Leaf spot diseases usually cause insufficient damage to require treatment.

Rusts-- Most rust diseases have two hosts-- evergreens and deciduous trees. On deciduous trees rust usually produces yellow to orange-colored spots on leaves, but on evergreens it produces greenish-brown galls on twigs. The more common rust diseases can be controlled by spraying with Ferbam and sulfur. See spray chart.

Scorch--Foliage scorch, caused by internal physiological disturbances, unfavorable weather conditions or frost injury, develops as yellowing or browning of tissues between the veins or along the margins or as complete browning and withering of the leaves. Most frequently, scorch develops when the roots are unable to furnish sufficient water to compensate for the moisture lost from the leaves during prolonged dry periods. Drying winds, when the temperature is high, increase the amount and severity of scorch. Although trees affected with scorch may lose many leaves during late summer, they should not die. Most shade trees are subject to scorch.

CANKERS AND DIEBACKS

Canker and dieback diseases produce dead areas of bark on twigs, branches and trunks. Cankers are localized dead areas, especially in the bark and are usually

oval in shape. They may continue to enlarge until they girdle the affected stem and the stem dies above the girdle.

Dieback is the gradual dying of a twig or branch from tip to base. Canker diseases frequently occur on weakened trees of various species. Branches affected by canker diseases should be removed. To treat trunk cankers all diseased bark and wood should be removed. The margins of the canker should be traced back to living bark to make an oval exposed region of wood. The exposed edges of bark should be painted with shellac. Then the exposed wood surface should be protected by painting with a wound dressing. Large wounds should be painted once or twice each year until they are healed.

Trees in low vigor should be fed. Two common ways of feeding are dry feeding and liquid feeding. In dry feeding the tree food is placed in numerous holes under the branch spread of the tree and heavily watered. In liquid feeding the tree food is dissolved in water in a spray tank and forced into the soil under pressures of 300 to 500 pounds.

WILTS

Wilt diseases are commonly caused by parasitic organisms-- fungi, bacteria or viruses-- which invade the wood through which the sap flows. Wilts cause the leaves on one or more branches to wilt and die, or the entire tree may be killed. Frequently, it appears that wilt of leaves is caused by toxins produced within the plant by the parasitic organism.

Dutch elm disease

This fungus disease affects all of our native species and all European species of elm. Leaf symptoms may appear any time from late June until October. Affected trees show curling, yellowing, wilting and death of leaves. Usually wilt occurs on one or a few branches and spreads gradually to other branches until the whole tree is affected. Occasionally affected trees wilt and die within a period of four to six weeks. Brown discoloration develops in the sapwood of wilting branches, especially in the current-season wood. This discoloration may appear as streaks or as diffused browning of individual wood rings. Since other elm diseases cause similar discoloration of the sapwood, a positive diagnosis must be made by laboratory culture tests of diseased specimens.

To prevent the spread of Dutch elm disease, bark beetles which carry the fungus from diseased and dead trees to healthy elms should be controlled. The DDT spray formulations recommended for elm bark beetle control are as follows: Hydraulic sprayer formula, 16 pounds technical DDT, 4 gallons xylene, 1 pint Triton X-100. Mist blower formula, 20 pounds technical DDT, 5 gallons xylene, 2½ gallons acme white oil, 1½ pints Triton X-100. Concentrates of these formulations made by several commercial chemical companies are on the market.

Trees must be sprayed twice during the spring and early summer to control bark beetles. The first spray should be applied before the elm flowers or leaves appear. This spray for hydraulic sprayers should be a 2% emulsion of DDT. This spray for mist blowers should be a 12% emulsion of DDT. The second spray should be applied 10 to 12 weeks after the first spray. This spray for hydraulic sprayers should be a 1% emulsion of DDT. This spray for mist blowers should be a 6% emulsion of DDT.

All dead, dying, or recently cut elm wood, which may serve as breeding material for elm bark beetles should be destroyed. This material may be burned or all bark surfaces may be sprayed with DDT in No. 2 fuel oil. This solution contains 8 pounds of DDT in each 100 gallons of oil. Since elm bark beetles can fly several miles, these sanitary measures should be applied to relatively large areas in regions where Dutch elm disease occurs.

Elm phloem necrosis

This virus disease is widespread and destructive to American elm in the midwest. It also kills the Moline vase, Holly-leaf and all other cultivated varieties of American elm, and can infect the winged elm.

Earliest visible symptoms of phloem necrosis usually appear as drooping and curling of leaves followed by yellowing, browning and finally by defoliation. Elms which show these leaf symptoms from late June to early August usually die during a single growing season. On elms that are killed within two or three weeks, the leaves do not droop and turn yellow, but wilt rapidly, turn brown and remain attached to the branches. Elms which show leaf symptoms after the middle of August frequently live over winter, produce a sparse crop of leaves the next spring and die during late June or July. Since these leaf symptoms frequently can be con-

fused with those caused by other elm diseases, field diagnosis of phloem necrosis is based upon the color and odor of the inner bark. The thin layer of inner bark in contact with the sapwood, especially at the base of the trunk and in the buttress roots, becomes yellow to butterscotch in color. The butterscotch color can be detected only in freshly cut samples of bark since the inner bark from diseased and healthy trees turns brown within a few minutes after being exposed to air. The odor of wintergreen emanates from the discolored bark.

There is no spray, chemical injection, trunk paint, soil treatment or fertilizer known to have any beneficial effects on elms infected with phloem necrosis. Healthy elms can be protected from infection by spraying for the control of the leafhopper which carries the virus from diseased to healthy trees.

The DDT spray formulations recommended for elm leafhopper control are the same as the spray formulations recommended for control of the Dutch elm disease insect carriers. Trees must be sprayed twice during the growing season to control leafhoppers. The first spray should be applied as soon as the spring leaf crop is fully mature, usually between June 15 and June 30. The second spray should be applied immediately after the midsummer or second growth of elm has occurred, usually between July 20 and August 5. For these two sprays a 1% emulsion of DDT should be used in hydraulic sprayers and a 6% emulsion of DDT in mist blowers. An average large elm, 50 feet high, will require from 25 to 30 gallons with the hydraulic sprayer or 4 to 5 gallons with the mist blower.

The effectiveness of spraying to prevent the spread of phloem necrosis will not be apparent for a year after the spray program was started, as trees are infected with the virus one year or more before they show the disease. No tree infected with the virus when the sprays are applied will be benefited. The spray protects against infection only during the year in which it is applied. For continuous protection trees must be sprayed each year. The cost of annual spraying may be less than the cost of removing dead trees.

Success in preventing phloem necrosis depends on spraying with such absolute thoroughness that no leafhopper bred in a diseased tree is left alive long enough to feed on a healthy tree.

Where both Dutch elm disease and phloem necrosis occur

the two spray programs recommended for the two diseases can be combined into one spray program consisting of three sprays. The first spray is the same as the first spray for the control of Dutch elm disease. The second spray combines the second spray for Dutch elm disease and the first spray for phloem necrosis. The third spray is the same as the second spray for the control of phloem necrosis. The timing and concentrations of these sprays remain the same as suggested above for Dutch elm disease and phloem necrosis.

Oak wilt

This fungus disease affects all of the important native species of oak in the midwest. Recently it has been reported affecting Chinese chestnut in Missouri. Wilt usually appears first on branches in the upper portion of the crown. Wilt of leaves progresses downward and inward until all of the foliage is affected. Leaves on red and black oaks become dull or pale green and the margins may curl upward. These symptoms are followed by yellowing, browning or bronzing of the leaf tissues which spread from the margins toward the midrib. Affected leaves may fall at any stage of leaf wilt. Mature leaves usually remain stiff and fully expanded during the different stages of wilt and after death. Immature leaves curl, droop, turn dark brown to black and remain attached to the branches. Leaves on wilting bur and white oaks usually turn light brown or straw color, curl and remain attached to the branches.

In red and black oaks, brown to black discoloration usually develops in the sapwood or wilting branches, especially in the current season wood. This discoloration may appear as streaks or as diffused browning of individual wood rings. Similar sapwood discoloration has been observed in wilting bur oaks.

Affected red and black oaks may wilt and die in four to six weeks, or at least during a single growing season. Occasionally, large branches of trees infected late in the summer live over winter and produce a few scattered leaves before dying the following spring. Bur and white oaks usually die slowly over a period of years.

In localized areas control of oak wilt has been obtained by poisoning healthy oaks adjacent to diseased trees or by trenching between diseased and healthy trees. These treatments interrupt an extensive under-

ground system of intergrafted roots through which spread of the disease from tree to tree might take place. Removal of the first wilting branches in white oaks may keep the trees healthy for a few years, but they are subject to reinfection. Effective control measures to prevent the spread of oak wilt over long distances have not been developed.

CHLOROSIS

Chlorosis develops when a tree cannot get sufficient iron to manufacture green chlorophyll. This causes the leaves to become yellowish-green. Chlorosis can be corrected by supplying iron (ferrous sulfate) to the tree. This material may be injected into the trunk or fed through the soil. For trunk injections ferrous sulfate is used at the rate of 5 grams per inch of trunk diameter. For soil treatment a 50-50 mixture of ferrous sulfate and powdered sulfur is applied at the rate of 1 pound per inch of trunk diameter. This material is placed in holes as suggested for feeding trees.

CHEMICAL INJURY

Chemical injury to plants may result from the use of weed killers such as 2,4-D and 2,4,5-T. Leaves on injured plants may be curled, cupped upward or downward or distorted into ram's horn and various other shapes. Great care should be taken in spraying lawns with weed killers to prevent injury to trees and shrubs.

SPRAYS FOR CONTROL OF SOME TREE DISEASES

The following spray chart does not represent a spray schedule to be followed each year. It is given to show the relationship between the time of year and the order in which fungicides should be applied for the most effective control.

SPRAY CHART

Season	Plant	Diseases	Material in 100 gallons of water	No. of sprays	No. days between sprays
March-May	Sycamore	Anthracnose	Puratized Ag. Sp. 1 pt.	3-5	7
April	Hawthorn, crab, etc.	Fire blight	Bordeaux 2-6-100	1-2	5
"	"	Rusts	Ferban ½ lb., wettable sulfur 3 lb.	4-5	7-10
"	Juniper	"	Elgetol 1 gal. or Bordeaux 8-8-100	1-2	7
April-May	"	Twig blight	Bordeaux 8-8-100	5	10
"	Pine, spruce, Douglas fir	Tip blight	Bordeaux 4-4-100	3	10-14
May-June	Horse-chestnut	Leaf blotch	Bordeaux 8-8-100	3	10-14
"	Oak	Anthracnose	"	2	10-14
June-July	Elm	Black leaf spot	Bordeaux 8-8-100, or commercial sulfur sprays	2	14
"	Walnut	Leaf spot	Puratized Ag. Sp. 1 pt.	2	21
June-August	Elm	Leafhopper (phloem necrosis)	Special DDT formulation (inquire for folder)	2	35-40
July-August	Juniper	Rusts	Ferban ½ lb., wettable sulfur 3 lbs.	3	21-28

TREE HABITAT

T. E. Shaw

One of the things that has always impressed me as a forester has been the magnificent flora that we have in the central part of the United States. Why don't we use more species in shade tree and ornamental plantings? On this campus you may notice all the bald spots where elms have died within the last three years. Over half of the trees on the campus of Wabash College at Crawfordsville are American elm. In contrast at Earlham College, Richmond, Indiana, over half of their trees are maples. Yet we have a magnificent flora of at least fifty good species adapted to your uses.

In the tree habitat of the forest the soil profile is entirely different from the one which you find out in the open fields. It is characterized by three main differences: the first, the soil is so porous and full of organic matter that the moisture-holding capacity may be 50% more than the moisture-holding capacity of soils in open fields. So in planting deciduous trees I fill the holes with about half dirt and half compost, well mixed. Now it is different with the conifers-- the evergreens. If you study their forest soil conditions in the forest, they pile the organic matter up on top of the soil and create a big thick layer of litter and humus. So if I help a farmer plant a windbreak, I am apt to encourage him to mulch the evergreen trees. All that I am doing, you see, in both instances, is taking a page out of nature's book; and if you will keep that one thing in mind, I think you can help trees.

Now let's take shade. If we take a tree which is a shade lover and stick it out in the open, we should wrap it so it won't get sunburn. What about competition? In forestry, if we start off a plantation with 1200 trees to the acre in the seedling stage, we end up with just a few hundred at maturity, all of them long-boled with samll tops. I would certainly use wide-spacing of shade trees for your type of planting, as you want to get good crown development. I hope that you don't ever fall for this old fallacy that you want to plant the trees close together, say thirty feet apart, and later take out every other one. In the development of tree windbreaks, we thought we could have a six by six foot spacing and then thin to a 12 by 12. A beautiful plan on paper-- the only thing is that is

never worked. Why? Because when a farmer had grown those trees up to a point where they needed that thinning, they were his own creation. They were his trees.

There has been a lot of misinterpretation of the possible range of trees. The text books say that sweet gum is native only as far north as Jackson County, Indiana, and yet it is growing in Lansing. They say that bald cypress reaches its northern limit in the lower Wabash Valley around Vincennes, Indiana, and yet you have some in southern Michigan. May I suggest, however, that if you do use a tree north of its range, you should try to get it from a source in the northern part of that range.

If you look at the habitat under which a tree grows naturally, you will get some index as to where to plant it. Dogwood, I think, is a prime example of that. If we put it out in the open where it is not accustomed, we don't have too much success with it. When we transplant it from the woods, we had better take some woods soil because it has a little attachment on the roots which enables it to get nitrogen. If it is pulled out bare rooted, you usually don't get that.

Another thing is the matter of tree size-- little trees, medium-sized trees and big trees. In the big tree size, I think that the prime example is the sycamore. Now, here is a fellow with a little city lot, and he plants a sycamore. Isn't he building up a beautiful bunch of grief for somebody? All he has room for is a small or a medium-sized tree at the best and if he will use one of these small to medium-sized trees (a list of which I can give you but will not enumerate now), he will adapt something to his lot and he won't have to go to this barbarous custom of topping which is one of the curses in Indiana.

A medium-sized tree only gets up to about 35 or 40 feet in height. Right out in front of the Purdue University Library is a yellow wood. Its bark looks like beech. In May and June these drooping racemes of white flowers are simply beautiful. But it is a rare tree. Few people know it. The only place that it occurs naturally in Indiana is down in deep ravines in Brown County.

When we talk about these trees, we talk about things that we like, just the same way as we like clothes. One fellow likes one kind of a suit and another fellow likes another. I know of two very gnarled and twisted

Scotch pines. They evidently are from a seed source in southern Europe, where Scotch pine trees grow in every direction. These trees have grotesque shapes and are not attractive to me, but the owner likes them. Lots of people want something very graceful and symmetrical some people want them nice and straight and clean. Of late, I have been thinking more and more in terms of using a wider variety and of choosing those species which are freer from diseases. Sassafras is free of disease, has character. It is one of the most beautiful things here on our campus in the fall of the year.

I commend the following to your attention: The matter of tree size is important. Fit the tree variety to the area and position you have. In my book, any tree worth planting deserves very good care for at least two years after planting until its roots are very well established. Look over the site and pick trees best adapted, using as many of the fifty varieties as possible. And lastly, read the pages out of nature's book and simulate her conditions.

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ATHLETIC FIELD TURF MANAGEMENT

M. E. Farnham

This morning we are trying to aid the thinking of each one of us rather than giving you too many specific, iron-clad recommendations. I want to stress again from the angle of new fields that, if it is desirable to make an artificial mixture to improve the natural soil with which we are concerned, it is absolutely essential that the materials be well mixed. It is entirely possible that if we are not going to take care of that angle in the way it should be done, then we might be better off to leave the mixture out because if you have pockets of differing materials, materials in layers, those very conditions do far more harm than good.

The football stadium at Rutgers in New Jersey to the best of my knowledge used no soil mixtures, but they did bring in enough soil from one of their very best draining soils in the state. Covering of the field in advance of games becomes rather academic. The soil on the field drains beautifully, and I think the good conditions of this field emphasize how important that is.

Even aside from the desirable effects of organic matter in the soil, we should be careful not to go too far to the extreme of excessive organic matter because we want the soils not to hold too much water, particularly at times when they have to be used. Whether we are talking about athletic fields or turf problems in general, I want to call your attention again to the fact that the book, "Turf Management", offers much to each one of us. I think of it primarily as a reference book. After you have thought through a problem you do have that book to go back to and, using it as a reference book, check your thinking.

We have discussed somewhat the possible place in the picture of warm-season grasses along with our cool-season grasses. The place in our picture we can only decide for ourselves. I feel strongly from my experience that it is essential not only to make our own test plots, but to make those plots, wherever possible, in the actual portion of the property in which we are going to use them.

We continually are asked what is the proper height of cut. It is quite obvious that a heavy turf will support a mower and keep the mower from cutting as closely as it will on a thin turf when set at the same

height. Again, a turf that is thick will stand closer mowing. On our golf fairways many of us feel that we need to go to bent, but I feel quite sure that bluegrass mixed with bent will stand, to a certain extent, a shorter cutting than bluegrass alone will. The really important thing that should be stressed is that

it is not only the height to which you cut the grass but the really important thing is how much grass you are cutting off in each clipping. The plan should be to make mowings frequently enough so that, regardless of the height of cut, in any one cutting we are not cutting off an excessive proportion of the plant tissues. Severe cutting is obviously quite a shock. When you decide what your proper height of cut is, definitely keep in the picture the frequency of the mowing and cut frequently so that light clippings are taken off rather than heavy ones.

We haven't said too much about fertilizing in our discussion so far this week. I think that it is pretty well agreed that phosphorus is very important in connection with new seedings. We seldom see results of potash applications, but it probably comes into the picture more than we realize. It may well be important in the disease control or the production of turf which is less susceptible to the disease. That definitely is the case with tobacco. I think that we can keep our thinking clarified on that angle to a considerable extent if we follow some of O. J. Noer's continual advice about that. You will recall that he mentioned the fact that phosphorus-potash applications can be confined to spring and fall applications. The rest of the season applications may well be nitrogen. Personally, I am much inclined towards the use of organic nitrogen. I think that much of the work at State College has pointed out that in many cases applications of inorganic nitrogen in the spring, particularly in the case where you are only making spring and fall applications, the resulting turf by midsummer or perhaps fall is poorer than the turf which received no nitrogen. It is quite possible by spreading the number of applications of inorganics you can even out that growth picture. The organics probably offer a considerable safety factor in that they are not as subject to unusual weather conditions as are inorganics. For the past couple of years we have been using more and more nitrogen even during the growing season, particularly from June on.

I was very much interested last week to see some figures by Dr. Davis from the New Jersey Agricultural

Experiment Station on large brownpatch. We aren't thinking too much perhaps of large brownpatch on athletic fields, but this past season's work has showed a decided decrease in the amount of large brownpatch when he has made an application of nitrogen, and particularly organic nitrogen, a week or ten days in advance of each fungicide treatment. As I remember it, the fungicide treatments were on at a frequency of ten days to two weeks. We have often thought that by using nitrogen during the summer, we not only may feed our crabgrass but we may soften our turf. If Dr. Davis' work continues to hold similarly to the results of the past season, we've got to revise our thinking along those lines too.

Aerification tools now offer a much-needed aid for overcoming compaction. Their function in helping the infiltration of water doesn't need much actual scientific proof because you can so easily observe it. However, I would point out that in some of Dr. Alderfer's work at Penn State it is striking how a limited amount of trampling rapidly reduces or prevents the proper infiltration of water. I emphasize the point that has already been made - that our aerification program needs to be not a seasonal treatment, but possibly a continuing program.

When turf needs watering, it should be watered sufficiently to wet the soil at least six inches and not leave any dry layer down there, and then the watering should not be repeated until perhaps the grass begins to suffer a little bit, or at any rate shows signs of shortage of water by beginning to discolor. We probably need to give more consideration to the rapidity with which we can put water on because, going back to Dr. Alderfer's figures again, he has figures showing that with two rates of applications of water, 1.4 inches per hour and 2.8 inches per hour, that there was less penetration or infiltration of water into the same soils with the 2.8 inches application per hour than there was with the 1.4 inches per hour. Of course, 1.4 inches is a lot of water, but I believe that he took that figure because the soil he was working with would take that amount of water even at that fast rate. When he doubled the rate of application, he got less water entering the soil than he did with the single rate of application. We are always in a hurry to get things done, and when we want to go out and water we find the biggest sprinkler that we can find and throw the water as fast as we can and our hurry is causing a lot of harm.

Let's talk just a little bit about crabgrass. It has been my good fortune to be able to watch Burt Musser's treatments from day to day for the last two years. In 1949 a series of treatments were put on our practice fairway using sodium arsenite, potassium cyanate and PMA. The arsenite was put on both in dry and spray treatments. As often happens in experimental work, the principal thing that we found out in that first year's work was that potassium cyanate deteriorates very rapidly if not properly stored.

Perhaps we can summarize the thing rather briefly by saying that one of the striking things was the value of sodium arsenite. I have used sodium arsenite since 1937 on various scales. We recently have been thinking about dosages as small as a pound to the acre and have some rather striking results from it. We should have watched the moisture conditions of the soil more closely than we did because we know the injury, or perhaps the burning I should say, resulting to the desirable grasses from sodium arsenite is much more severe when the soil moisture is not in good condition. In spite of that fact, we didn't kill any grass with our sodium arsenite applications, and the end of the season presented a rather striking picture. There were from 1 to 5 applications made during the season starting on the 22nd of June with one treatment in July and three treatments in August. A brief summary would say that the result of 3 to 5 applications of sodium arsenite at 1 pound to the acre and 3 to 5 applications of potassium cyanate at 8 pounds to the acre gave about the same end result. The arsenite was a day or two behind the cyanate in the development of the discoloration, and the recovery was a little bit behind too. We did make applications of Scutl. In general, we found that the double-strength application of Scutl was necessary to produce any results. One application was followed within a few hours by a thunderstorm. We got absolutely no results from that even though spray applications of PMA made at approximately the same time schedule did produce satisfactory results. We found, particularly in 1949, that 5 pints of PMAS per acre wasn't enough. 10 pints did a pretty good job; 15 pints to the acre was pretty severe on the grass. The applications this last year were made at the weaker dosage of 5 pints, and with 5 applications the end results were quite satisfactory. One thing we have still not been able to explain. There were also a series of plots on which a single application was made, one on one date and another plot on another date, and one 10-pint application of PMAS made in July gave us striking results. When we had a Field

Day that was the outstanding plot. I would hate to try to repeat it again. I think the principal factor at that time was the unusually satisfactory conditions of the soil moisture.

Perhaps I shouldn't say too much about cost, but it should be pointed out that for a single application on an acre basis, Scutl would cost $50 or more; a single application of PMAS or potassium cyanate at 5 pints to the acre and potassium cyanate at 8 pounds to the acre might cost around $10 or $12, while sodium arsenite at 1 pound to the acre costs you 25 cents. Obviously there is quite a difference there, and I would be much happier to be able to confine my activities to sodium arsenite and put the rest of the money in the weed control program into my salary.

Sodium arsenite has a further role. We never got to first base in trying to introduce bent into Poa annua, clover-infested turf until we did something to check them, and thus give the new grass seeding a chance to start at least on an even scale. Without changing any other renovation programs we were successful in getting a stand of turf on fairway conditions with an infestation of Poa annua and clover when we used 3 or 4 applications of sodium arsenite, wet or dry. The same procedure may be even more essential when trying to introduce slower growing bluegrass into inferior turf.

We have pretty well come to the opinion that maybe we have been making a mistake in worrying about killing 100 percent of the crabgrass when we treat areas. If by these various treatments you can keep the crabgrass from taking over the turf, keep it from smothering your desirable grasses, and at the end of the season keep it from producing seed, you are making progress.

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PLANT FOOD SUPPLIES FOR 1951

A. H. Bowers

My message to you can be stated in one sentence. It is: "If you haven't already ordered your plant food needs, do so as soon as you get home."

It's no fun to come down here with a sad story about how "things are tough all over"--yet, two of the three years that I have been on your program, that's been my general theme. In 1948, plant food industry was faced with a severe shortage of nitrogen-- the very element that pinches turf men the most. In 1949 foreign commitments of nitrogen by the government were greatly decreased, new nitrogen plants were brought into production, and there was plenty of everything for everybody. In 1950 the situation was even better and there was no use in coming down here to tell you about that.

We thought last fall that this happy state of plenty would continue on into 1951 but such was not to be. What's the trouble this time? Well, it is something that nobody envisioned as ever causing a shortage of plant food. The shortage is sulfur.

Early last fall, the sulfur producers announced that there would be a 20% reduction in the amount of sulfur available in 1951. It seems that heavy exports to Europe and tremendous industrial demand in this country teamed up to deplete above-ground sulfur stocks faster than the producers could get it out of the ground. Since, as a security measure, our country must keep on hand a stock pile of sulfur for war emergency use, this cut-back becomes necessary. As a result, only 75% of the sulfuric acid available prior to January 1st will be available during the coming year. This situation may last for a good two years or more depending on the rapidity of development of new sulfur sources.

This hits the plant food industry in two places where it hurts. First, is in superphosphate manufacture and the other is in supplies of sulfate of ammonia. As many of you know, superphosphate is produced by treating phosphate rock with sulfuric acid. Also, large quantities of sulfate of ammonia are needed to make the high nitrogen grades that greenkeepers like.

The net result of this 1-2 punch is this: Many manufacturers are cutting down on or discontinuing entirely such high phosphate grades as 4-24-12, 10-20-0,

8-32-0, etc. It is true that this phase of it doesn't bother you people. But here's something that will: Because of the sulfate of ammonia shortage, regular grades of 12-8-6, 10-6-4, and 8-8-8 have become increasingly hard to get. In fact, some companies have stopped making any plant foods that contain over 4% nitrogen. Fortunately, my own company is not one of these. It is expected that ornamental goods containing 6% nitrogen may be somewhat easier to obtain than farm grades although their availability decreases as their nitrogen content goes up.

As the spring shipping season goes on, we don't look for things to improve too much and the state experiment stations are warning farmers as never before that the bird that places the early order has the best chance of getting what he wants. Professor George Enfield emphasized early ordering and off-season buying, in the January issue of "Midwest Turf News and Research". To his article I want to add an emphatic "Amen".

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CHEMICAL OUTLOOK FOR TURF FUNGICIDES

J. L. Marzak

It's a pleasure to participate in the Sixth Annual Turf Conference of your Midwest Regional Turf Foundation. When Bill Daniel invited me to talk on the chemical outlook for fungicides, my immediate reaction to this somewhat muddled situation was that someone from the chemical section of the National Production Authority would be in a better position to supply you with the information which was desired. However, it did not take me too long to convince myself that anyone could be as confusing, so here I am.

Mr. Bowers presented a very good insight into the outlook for fertilizer. Personally, I thought the picture there would be much brighter, but the sulfur shortage certainly does appear to be serious. I still envy him for in many respects his assignment was less complicated.

I would like to say at this point that the information to be presented to you is not an expression of opinions by the Mallinckrodt Chemical Works, but rather personal views based on information and data with which I attempt to keep up-to-date in my day to day work.

The most objective approach in giving you some basic information on the outlook for fungicides, would be to divide the known commercially-available products into categories; each based on the important raw material which is essential to continued production. Actually, crude materials and their availability will in turn govern the availability of the fungicides. For example mercury is necessary for the production of Calo-Clor or PMAS, while Cadminate and Crag 531 are dependent upon cadmium.

In the first group are those products containing mercury. This includes Calo-Clor; Corrosive sublimate or mercuric chlorides; Calomel or mercurous chloride; PMAS or phenylmercuric acetate; Puraturf or mercury trienthanol ammonium lactate; Puraturf GG, an organic mercury cadmium complex; and Special Semesan or hydroxymercurichlorophenol. We will know from previous experiences during the last war that the use of mercury for fungicide manufacture was prohibited. Thus far, the National Production Authority has not issued a mercury order restricting any one use of mercury compounds. It may be that the product in which mercury was used during World War II is now obsolete or replaced by one not requiring mercury.

On the other hand, this product may not be needed at the present time according to the production timetable. One of the most important and largest uses for mercury during the last war was in the manufacture of mercury batteries for the armed forces. Whether there will be a need for this type battery during this emergency, is not known.

Perhaps the reason for controlling the uses of mercury in the past war was due to the vulnerability of our chief mercury source. You may or may not know that Spain is the most important supplier of this raw material, and when Spain is in enemy hands, this source is lost to us.

It might be worthwhile at this time to give you some background on the recent price advances for mercury. The group which has a strangle-hold on these important sources of mercury also controls its price. This is accomplished to some extent much in the same manner that the diamond monopoly maintains the high price levels for diamonds. In short, the supply of diamonds placed on the market never quite meets the demand. Approximately five months ago, mercury was selling for about $85 per 76 pound flask. My latest information on mercury prices, which is not necessarily current,

was that quotations were in the neighborhood of $225 per 76 pound flask. We have domestic sources of mercury but these are considered marginal producers. A marginal producer cannot operate profitably until the price reaches a certain level. In the case of our domestic mercury producers, I believe this price level is in the neighborhood of $190 per 76 pound flask. It is quite possible that the mercury prices may stabilize with the entry into the market of these marginal producers, but this is only a guess.

The second category includes the cadmium containing fungicides such as Cadminate or cadmium succinate; Puraturf 177 or p-amino phenyl cadmium dilactate: Puraturf GG, an organic cadmium mercury complex; Crag 531 or F 531, both are the same product chemically, which is a cadmium zinc copper calcium chromate. Undoubtedly, you note that Puraturf GG was also included in the mercury category. The National Production Authority recently issued an order on cadmium salts prohibiting their use in certain pigments, and this order goes further in listing unrestricted uses. Although fungicides were not included in this order, the general interpretation was that cadmium could be used in manufacturing this important group of products. Some people are evaluating the issuance of this order as an omen of further restrictions, but again, this is purely conjecture. Cadmium is not nearly so abundant as such metals as copper, lead or zinc. Fortunately, sources of this important raw material are available domestically and in friendly South American countries.

The third category lists those products which can adequately be described as organic fungicides, such as Spergon W or tetrachlorobenzoquinone and Tersan or tetramethylthiuramdisulfide. The key raw materials needed for Spergon are chlorine and benzine which are currently in tight supply. If either item is required in larger quantities by the Government, production capacity would be enlarged in the case of chlorine, while benzene can be produced synthetically, although it will command a higher price. It appears that the critical material for Tersan is sulfur which is currently being produced in diminishing quantities. Mr. Bowers delved into the sulfur situation and there is no need for me to say anything further. However, I recently noticed in a chemical journal that new sources of sulfur would be available by a new process at some time in the future. The ingenuity of the chemical industry is truly amazing. It seems that no barriers are too difficult to surmount when the problem is important ehough.

I would like to say something briefly on the nature of the chemical industry which certainly has a profound effect on the availability of basic raw materials. The tremendous amount of research and development which is constantly being conducted, usually results in new products. In some instances these new products replace old products, thereby in many cases increasing the availability of the raw materials which were required for the old products. On the other hand, these new products may use raw materials which are not abundant, thus creating controls during periods of emergencies. This is being brought to your attention merely to show you that the picture on availability of products can easily change overnight when periods of emergencies are in effect.

I would like to summarize the information presented to you, and this certainly should not qualify me as a prophet. It is not my intention to deviate from the information that is currently available to make long-term predictions.

1. Let's take the easiest first-- the organic fungicides should not present too much of a problem. The outlook here is good.

2. For the mercury-containing compounds-- the outlook is uncertain. If identical circumstances were to prevail as they did during World War II, the outlook would be obvious to you.

3. The information available for the cadmium category does not permit me to say anything more definite than that the outlook is also uncertain. Of course, we have no previous experience upon which we can rely. In the case of Cadminate, it appears that my company will have sufficient material to meet demands through 1951. This may also be the case for the other cadmium fungicides.

I believe that the best statement which could be made relative to the outlook for chemical fungicides in general was given to you by Dr. Grau in his talk Monday afternoon. I would like to repeat this. He said, "Let's look ahead to tough times, and if they do not come, we can breathe a sigh of relief." I hope that I have given you an insight into the many factors involved and with these, you may be able to understand the situation more clearly. Certainly, if any of you have some inside information which is not general knowledge, you can now more easily make your own predictions.

INSECTS OF TURF

G. E. Lehker

Many folks are hoping that cold winter weather here in the midwest has killed most of the insects, but unfortunately, this is not true. Most of the soil inhabiting species which are native to this part of the country such as white grubs, ants and webworms, are well accustomed to this climate. First, permit me to say a word about turf insects in general. Many of you were here last year when John Schread of the Connecticut Experiment Station gave his very excellent discussion on turf insects and their control. You will recall that 15 or 20 years ago we did not have anything very good to control, for example, such insects as white grubs. Now there are so many chemicals which will kill grubs and other turf insects that it is a question of which one to use. Here is one principle we should bear in mind -- any chemical giving a quick kill usually has a short residual action because of its volatility. Likewise, chemicals having a long residual action are often less volatile and, therefore, kill more slowly.

I believe that Chlordane, Toxaphene and possibly Aldrin and Dieldrin will be our most useful insecticides on turf since they have long residual action and will kill a great variety of insects. Chlordane, for example is very good for white grubs, and sod webworms and also excellent for controlling ants.

Question: Is Chlordane effective against moles?

Answer: Yes, in that moles are primarily insect and earthworm feeders. If the insect and worm population is eliminated, there is nothing for the moles to eat and they move out of the area. You have probably seen a well cared for green having little or no insect population. Moles may move in 3 or 4 feet looking for insects on which to feed, but if they do not find them, they move out and go someplace else where the hunting is better.

Question: Do we know anything about the new material for moles known as Mole-go?

Answer: Permit me to say first that I am not an expert on control of moles. That problem is left to Mr. G. C. Oderkirk of the Fish and Wildlife Service, who is located in our building here on the campus. Mr. Oderkirk says that moles have a very sensitive smell equal to

that of most any animal in existence. They have a tendency to avoid foreign materials rather than come in contact with them or eat them. Your Mole-go may get results, but Mr. Oderkirk believes the best method of mole control is trapping until poisoning methods have been thoroughly worked out.

Question: What is the cheapest method of getting rid of night crawlers in fairways?

Answer: Chlordane applied at the rate of 10 pounds per 100 square feet. Lead arsenate is probably better, but it is quite expensive and with the Chlordane treatment you are also getting grub and ant control and are killing several birds with one stone.

Question: How about cutworm control?

Answer: There are many kinds of cutworms. Here in Indiana there are over 120 species. Some kinds are killed with DDT and others with Chlordane and nearly all with poisoned bran bait. Insofar as the new chemicals are concerned, the best overall kill can be obtained with Toxaphene. It has been tested against cutworms on a number of crops (not so much on turf) and is also a comparatively cheap material. When used at the rate of 2 pounds of actual chemical per acre, it usually does a good job. Your question brings to mind another subject. Most of the new insecticides come in three forms, namely, wettable powders, emulsions, and dusts. The wettable powders work very nicely in hydraulic or so-called high pressure sprayers. If you are using a low pressure weed-type sprayer, the wettable powders are not very satisfactory. They will clog the nozzles and cut out the gears.

If you are intending to apply any insecticide on fairways with a low pressure type sprayer, you will want to be sure and get the emulsion type of insecticide rather than a wettable powder.

Question: How long will DDT sprayed on trees and shrubs remain effective against mosquitoes?

Answer: The chances are they will remain effective not over a very few days and possibly not that long. Mosquitoes breed in stagnant water and a number of them will fly in and annoy your players and customers without ever settling down on sprayed trees and shrubs. We have found that if one is arranging a lawn party or concert that spraying or dusting trees or shrubs with DDT usually cleans out the mosquitoes but it is decid-

edly a temporary thing. Mosquitoes are also big problems on golf driving ranges. Fogging machines are now on the market which cost about $500. One machine, the Silver Creek model, lends itself to small area treatment. It is operated with an electric motor and a long extension cord. During periods of heavy mosquito flights, this machine could be sprayed two or three times every evening if necessary and on other occasions it might not be needed for several days. On golf driving ranges and around club houses where people sit outside, I believe that one of these little machines would prove to be a good investment. They operate on the same principle as the big ones and will give immediate but temporary control of mosquitoes. The machine I mentioned is manufactured by the Silver Creek Precision Corporation, Silver Creek, New York.

Question: Is DDT effective on bagworm?

Answer: No, it is not very effective, at least not the bagworm here in the middle west. In the vicinity of Lafayette bagworms hatch around the first of June. While they are small they can be killed with a nominal strength of lead arsenate, but as they mature they become more resistant and are difficult to kill. There are two chemicals that do an excellent job on the mature worms. The best is Parathion at the rate of 2 pounds of a 15 percent wettable powder in 100 gallons of water. The other material that is less dangerous is Toxaphene, used at the rate of 4 pounds of 50 percent wettable powder in 100 gallons of water. I know that many of you are afraid to use Parathion, but virtually all of our fruit growers and greenhouse men in Indiana are using it. You, too, can use Parathion if you are willing to buy a respirator and wear it and also follow the other directions on the Parathion package. When you spray with this material use your respirator and protective clothing. Button the shirt sleeves around your wrist and wear natural rubber gloves and a hat. In other words, do not purposely expose your body to Parathion. Stay out of the spray drift and if you get Parathion on your hands or body, take time to wash it off before you fill the sprayer again. When you are through spraying, take a bath and do not re-wear the clothing until after it has been washed.

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CONTROL OF TURF DISEASES IN MICHIGAN

Dr. J. R. Vaughn

You may not be familiar with the "melting-out" disease, but a number of the superintendents up at Michigan had a great deal of trouble with it two years ago. When the disease first appeared and was finally distinguished from large brownpatch, which most of us first thought it was, we found that none of the usual fungicides had any effect on the disease. It just continued until the weather stopped it. Since we couldn't order up the weather, that wasn't very satisfactory control.

This last summer the only place we had any great amount of melting-out in Michigan was on one golf course. At that location, infection got as high as 30 percent. Thirty percent of the green was entirely in the black-brown stage. One of the differences between this and large brownpatch is that the turf in the center of the patch is dead. With large brownpatch, if you stop the disease, the turf will start to grow again. After melting-out attacks, the only way the turf recovers is to grow in from the outside. If the patches are very large, of course, you have to resod that particular area.

On one green the area sprayed with Acti-dione did have melting-out come in, and by July 10 it affected about one percent of the area, but never got any larger than that. (See Chart I) On the area treated with phenyl mercury acetate about 10 percent was affected by June 26 and this increased to more than 25 percent by the first of August. Patches were put in before the first of August, but in spite of that, the disease continued to increase (grow away from the patched area) until about the second of August when the weather turned very dry and quite hot (hot, dry weather is the best weather you can have to stop this). That stopped the disease on this green and the patches took hold and the green recovered. The green sprayed with the Acti-dione held the disease in check in spite of the weather.

Chart II shows dollarspot control on one of the golf courses at Holland, Michigan where we had an experimental plot. We used Acti-dione on four greens and copper zinc chromate (Crag 531) on the other greens. Each one of the little dots represents .01 percent of the area of the entire green. The number of spots is more important than the size of the patch because one

CHART I-"MELTING-OUT", HELMINTHOSPORIUM SPECIES, INCIDENCE AT RED CEDAR GOLF COURSE, 1950. LANSING, MICHIGAN

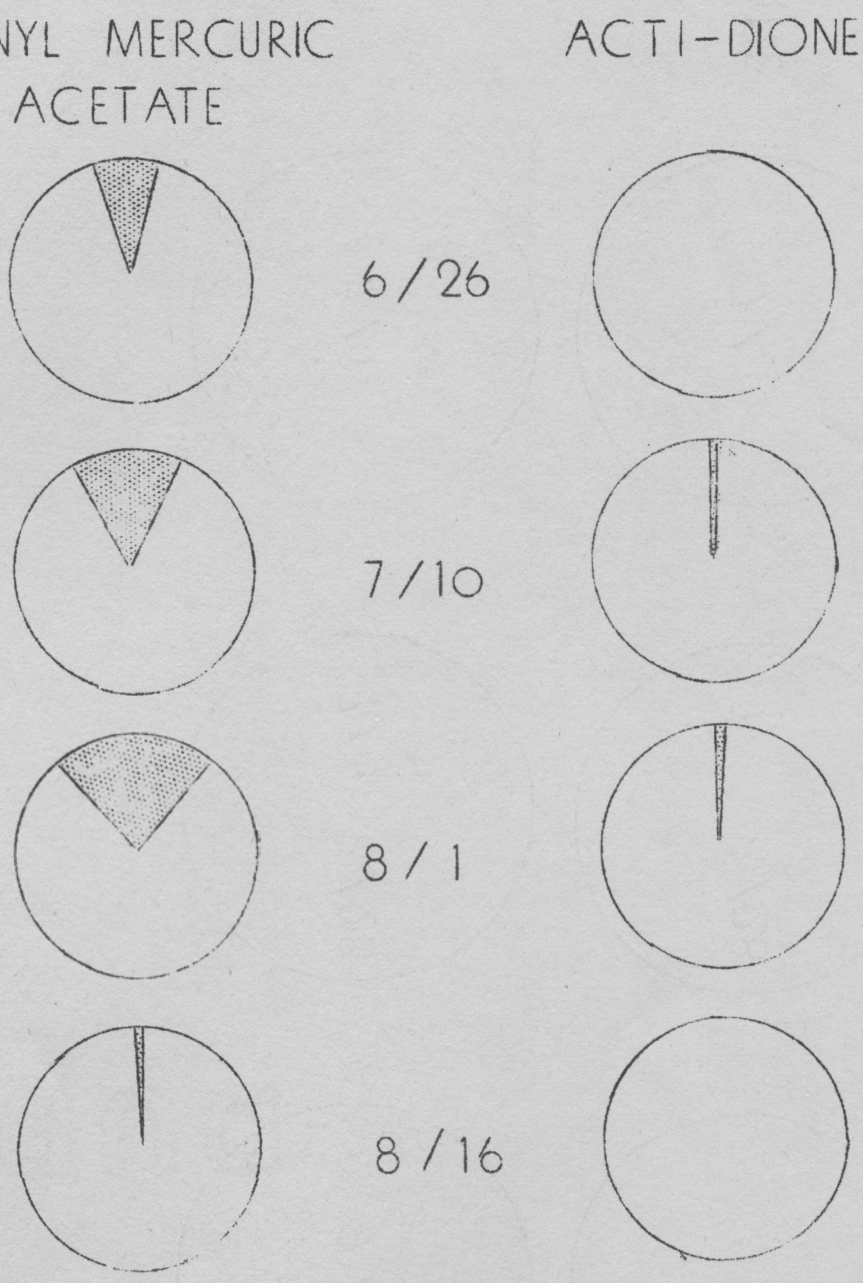
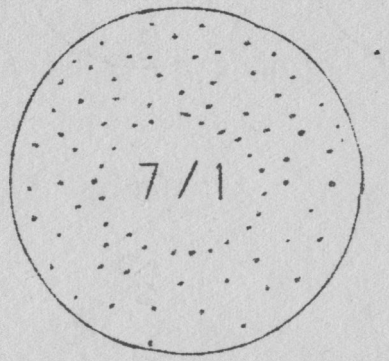
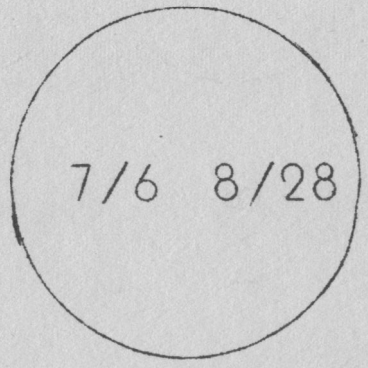
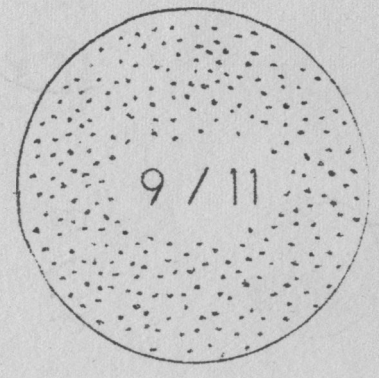


CHART II-"DOLLARSPOT," SCLEROTINIA HOMEOCARPA, CONTROL AT AMERICAN LEGION MEMORIAL CLUB, HOLLAND, MICHIGAN, 1950.

CRAG 5 31







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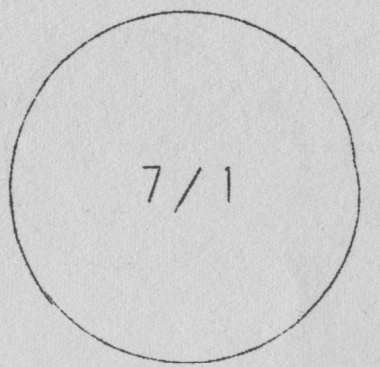
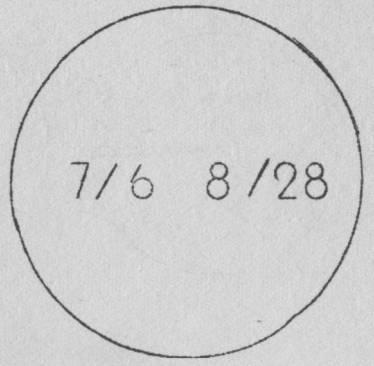
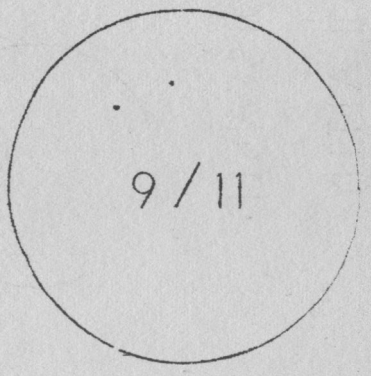






1 ST SPRAYED 6/21

EACH DOT = 0.01% OF AREA OF GREEN

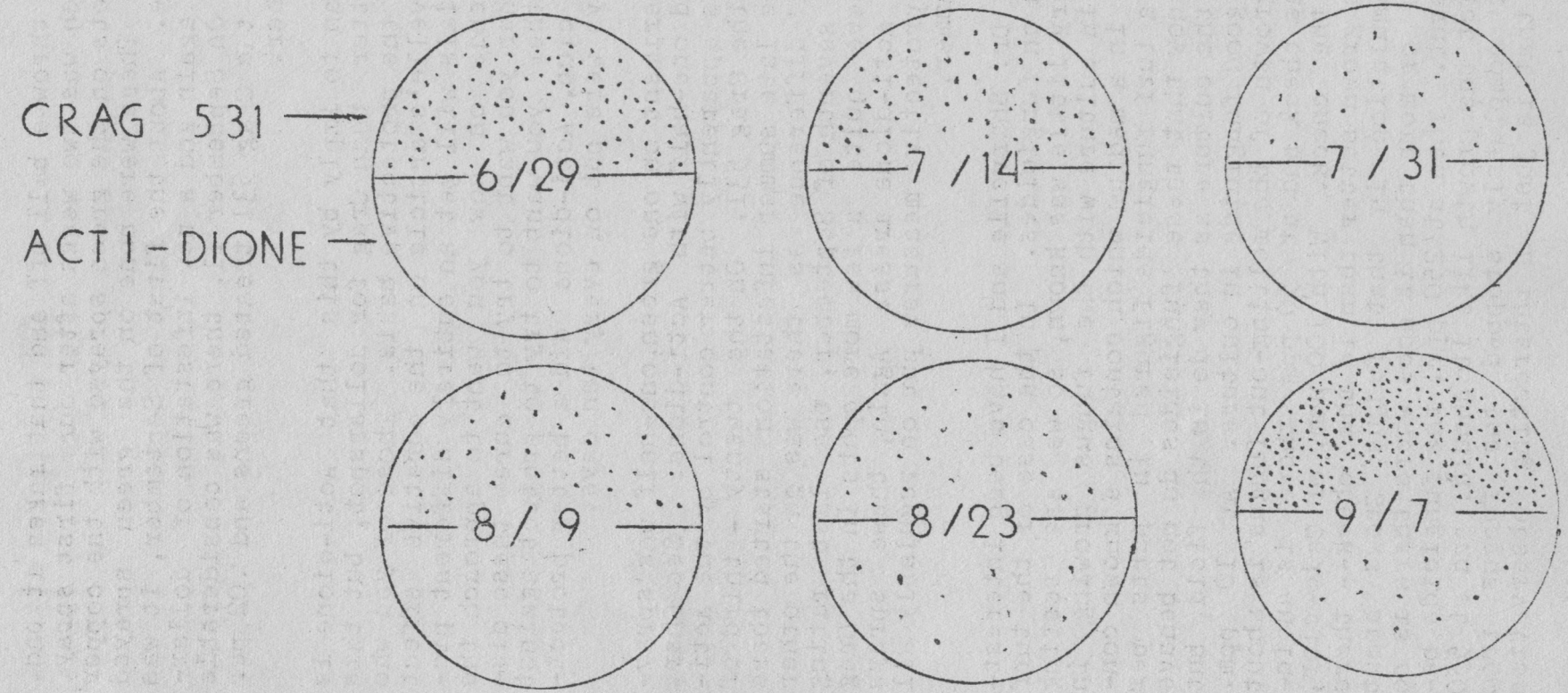
dollarspot can throw a ball off and that makes it bad. On July 1, which was two weeks after our first spray, there were dots on the green sprayed with the copper zinc chromtte. There were none on the green sprayed with Acti-dione. About the first of September, it was moist and cool again and a new infestation of dollarspot occurred. On September 11, there was considerable infestation on the Crag 531 treated greens and .02 per cent on the other.

Now I don't mean to imply by this that Acti-dione is that much better than Crag for dollarspot, but this was put out on the protective basis. Those of you who have seen Sharvelle's article on the curative effect of these materials will get an entirely different picture. It depends on how you want to approach the problem-- whether you want to try to cure these diseases, or whether you want to try to protect against them. At this club, Acti-dione did a better protective job. Sprays were put on every ten days.

In another experiment on one green, one-half was sprayed with 531 and one-half with Acti-dione. (See Chart III) There was apparently better control by the Acti-dione than by the Crag 531. On the twenty - third of August when the late summer infestation started there wasn't as much difference as there was on the other dates. On the seventh of September, the last rating date, there were quite a few more spots in the Crag than in the Acti-dione areas. Again, these sprays were based on protective measures put on regularly all through the summer.

For some time, Dr. Sharvelle and I have been interested in research on fungicides. In the case of the turf fungicides, very little was known, so we are testing the materials in culture with the fungus growing in petri dishes in a medium which contains a known concentration of a turf fungicide figured in parts per million. We know that these fungicides do not behave the same in the culture as they do in the field, but we can tell a good fungicide in culture. At 10 ppm. of Calo-clor, growth of the melting-out fungus is about the same as the check and at 50 ppm. there is an increase over the check. With 100 ppm. of Calo-clor, the fungus has grown better than in the check-- there is actual stimulation in that fungus, grows about twice as much or more than it does where there is no fungicide present. Then at 250 ppm. the fungicide begins to restrict the growth like it should, and at 550 ppm. it almost completely stopped the fungus from growing. Now that is just an interesting observation

CHART III - "DOLLARSPOT," SCLEROTINIA HOMEOCARPA, INCIDENCE AT BURROUGH'S FARMS, BRIGHTON, MICHIGAN, 1950.



1 ST SPRAYED 6/16

EACH DOT = 0.01% OF AREA OF GREEN

and is one of the things that we are trying to find out about these fungicides-- what do they actually do against the fungus itself.

The Acti-dione at 50 ppm. completely inhibits Helminthosporium; the Calo-clor at 50 ppm does not. They both completely inhibit the dollarspot, perhaps a little better for the Acti-dione than with the mercury. At 10 ppm. the Acti-dione completely inhibits the Helminthosporium and both inhibit dollarspot.

Acti-dione is an antibiotic fungicide. That means that it comes from the same sort of process as does Penicillin, Streptomycin and the so-called wonder drugs. It is a drug for the green. We have reported our results to the company, and we have suggested that we think there is a market for it, that there is a need for it based on our tests. That is not only in Michigan but last summer we had tests in Ohio, West Virginia and Indiana. We think it compares with the other materials on dollarspot and brownpatch control, and it is the only one that we have found that will control melting-out. The drug companies are able to sell all the Penicillin, Streptomycin and drugs that they can make and more, so if they go into the fungicides manufacturing business, they will have to quit making some of these drugs to make this. They have to decide that. It is not on the market yet. I think it is worthwhile to mention these new materials even though they aren't available. If they decide that they are not going to make it there is no use of further tests. If it is never going to be available to you, we don't care how good it is. If the company desires to make it, it won't be available on a large scale until a year from this next season.

Question: What time of the year does melting-out start? What time of day is it most noticeable?

For one thing, it needs a lot of moisture. You have to have rainy weather or foggy weather or very heavy dews. It doesn't need such hot weather as brownpatch. We found that when we produce it in the laboratory, where we can do it under control, there are two critical temperatures-- one for infection and one for the disease to show symptoms. The temperature at which infection takes place is around 72 degrees. The temperature for it to develop and kill the grass is about 80 to 85 degrees. It is earlier, probably, than brown patch, doesn't need quite as hot weather and is probably more sensitive than brownpatch to moisture. The early stage has sort of a bluish, smoky tinge to the

grass. I think that you can see it best early in the morning or in the late afternoon when the light is sort of at a slant.

Question: Is this Helminthosporium confined to bentgrasses or does it also occur on bluegrass, and if so, what is the difference?

We know that there is a difference. The one on bluegrass is what they call eyespot. It is a definite species of Helminthosporium, has been identified, and we know what it is. The species that causes this melting out is not the same thing. It is a very close relative and belongs in the same family, but it hasn't been named yet. One of the things that we are working on now is to try to get that thing separated from these other Helminthosporiums. Helminthosporium is sort of like the Smith family -- there are all kinds of them. Every grass that you can think of, including crabgrass, has two or three Helminthosporiums that will attack it. Usually, they cause leafspot like they do in the bluegrass. This melting-out also causes a leafspot and a crown rot. It is a specific Helminthosporium and as far as we know, it hits nothing more than bentgrass. We haven't found any bentgrass that is resistant to it, but we haven't gone into that as thoroughly as we will in the future.

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THE 1950 FUNGICIDE TRIALS

E. G. Sharvelle, Chairman

Insects and Diseases

In the last five years you have seen appear in the turf program picture a number of new fungicides. These fungicides are of three major categories: we have the organic materials which all of you are familiar with; we have the material such as Dr. Vaughn discussed - the 531, cadminates; and then we have non-mercurial fungicides such as Spergon and Tersan. You are aware of the fact that there has been some confusion regarding these materials and last year, for the second year in succession, there was a nationally-coordinated program designed to test these materials. We reported on this in Chicago several weeks ago, and as a result of these coordinative tests, we feel that we are in a better position to talk about the relative value of

these different fungicides. There were ten states which took part in this work in 1950. In 1951, I would like to take this opportunity to announce that Charley Wilson in Fred Grau's office will be the coordinator, and the prospects look as though we will have at least 15 states working on a coordinated program in testing fungicides. John has discussed the diseases. Glen has mentioned the insects. Glen has also mentioned some of the new insecticides. I have tried to mention some of the fungicides. John has also pointed out how, by research in the laboratory, we perhaps can find more leads, and now we are ready for your questions.

The cadminates are groups of materials - Crag 531 and F-531. It isn't fair to use the name Cadminate because that is a brand name. Let's talk about the cadmium compounds. Here are typical results that we obtained throughout the country in 1950 on dollarspot control with the different fungicides. These results from Iowa are very characteristic of all the states that tested chemicals for dollarspot control. On the unsprayed plots approximately 80 percent of the area was involved with dollarspot, and as the season progressed, where no sprays were applied, the disease progressively got worse and worse throughout the season. As contrasted with that, the cadmium compounds gave the most effective control. Three of them mentioned here are Cadminate, Puraturf 177, and Carbon and Carbide 1025. These materials performed the best in Iowa, Indiana and California and other areas. The mercurials were intermediate and in this particular work Tersan was not as effective. Now that is the situation, gentlemen, nationally. Everyone appears to be in agreement that the cadmium-type compounds including cadminate, Carbon and Carbide 1025, Crag 531 and F-531 are the materials that are the safest to use and the most effective on dollarspot.

Question: When you get into your hot weather and large brownpatch becomes a problem, will the cadmium compounds do the job?

Answer: No, they won't. On an unsprayed area 22 percent of the total area was involved in large brownpatch. You will notice that the best standard material was the mercuric chloride, that is, it gave the least brownpatch. A new chemical, 406, gave good results but is not available. It is a California spray chemical company product. From Spencer Davis' work in New Jersey you will notice that the cadmium compounds, when it comes to large brownpatch controls are at the low end of the scale. In general, the material that has

been most effective for large brownpatch is Tersan. Tersan 75 is relatively the same product as the Tersan that you are familiar with. It was a 50 percent active ingredient and it is changed to a 75 percent active ingredient. The cost will remain about the same, and you won't apply quite as much. I think that it is well worth mentioning that the method of application is quite important on most all of these chemicals. Personally, I like to see the least amount of water used on any of the chemical compounds for non-mercurials as possible.

That is the situation on brownpatch. There is very little difference in the performance of some of these materials and it comes down to the point of sorting out very fine differences.

Question: Will the use of iron sulfate control greasespot?

Answer: Now grease spot is an entirely different disease. Greasespot happens to be a disease caused by pythium, a fungus, and will only be a problem in years of high humidity and high temperature. It will not appear until the temperatures get up to 85 or above; and so long as the temperatures remain above 80 with high humidity, greasespot or pythium (some call it spot blight) will be a problem. None of the materials that have been so far tested (we don't have this disease every year so we can't test the value of fungicides against it) have done the job of preventing greasespot. It is called greasespot because it looks as if you've gone out there and drained the oil out of an automobile, and you've got these greasespots all around. Dr. O. J. Noer suggested the use of iron sulfate at 1 pound to five thousand square feet in 30 gallons of water. This rate will speed recovery from greasespot and there are certain greenkeepers who have tried it and have found that it speeded the recovery from greasespot. Now let me offer this suggestion. We hear all these names - melting-out, greasespot, spot blight, and all those other names - and it is important that the superintendent know exactly what the cause of the trouble is.

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PMAS ON TEES, MY EXPERIENCE

M. M. Parsons

Dr. Daniel asked me to tell you what I tried to do at Highland Country Club on our tees in 1950. To start with, we have about any type of grass that grows around Indianapolis--Poa annua, seeded bent, bluegrass, planted bent, Alta fescue, U-3 bermuda that has been played on this last summer, and the crabgrasses. We have small tees, fairly heavy play. We started with a treatment of 2 ounces of PMAS in 20 gallons of water per thousand square feet at two-week intervals.

First treatment: Crabgrass discolored, clover leaves were discolored. Chickweed was almost completely killed.

Second treatment: Crabgrass was very sick. Some discoloration of our grasses with the exception of U-3 bermuda. (Two slides shown). We put six treatments on at two-week intervals of this. I wouldn't say that we had control; what I was after was to kill the crabgrass in the seedling stage and that is why we put it on every two weeks. We watered heavy for two nights before the application went on. After it went on, we kept water off for three or four days and we followed up with a fertilization plan to help bring back the color of our grasses. I was a little discouraged with our so-called hard or silver crab. It nipped it down some and stopped the growth. The seed head didn't seem to mature the way it did when it hadn't been treated. The thing that I am interested in and hope for is that we are sterilizing our soil so this crabgrass seed will not germinate, as well as killing the crabgrass plant that comes up.

We also used on some tees, one ounce of PMAS to one ounce of sodium arsenite in 20 gallons of water and we got about the same results and maybe a little better than we did with the straight PMAS.

As we said yesterday, we know very little about crabgrass, when it germinates, so therefore, it is quite a job to try to eliminate it. If we can stop it in the soil and keep the seed from germinating, I think that a lot of our trouble will be over with. But it is like a fellow who works for me said. When he was a kid down in southern Kentucky his dad used to make him get out with a grubbing hoe to dig out the Johnsongrass, pile it up, dry it, dig out all the roots and burn the whole thing. They would set that on fire and every

place the smoke hit the ground, it took root. It can be likened in that way to crabgrass. I hope to follow this plan if labor will permit this next year and start along in May and apply a treatment every two weeks on through September. The reason for the two-week interval between treatments is to let the seed down there germinate and get those shoots above the ground to burn those off. The same rates may be varied a little in water-- I was told yesterday that I might be using a little too much water. I am going to use 20, 15, 10 and even 5 gallons of water per thousand square feet in different months. I am going to cut down the water and try some high pressure and low pressure.

Question: When do you think crabgrass starts germinating?

In 1950 the first that I found on our tees was just a little bluish-green spike maybe a half-inch long coming through the second week in May.

The tees are cut ½ inch, mowed 3, 4 or 5 times a week. If we can whip it on the tees, then we will go on the rough and banks. I am going to play with sodium arsenite a lot more next year.

In 1946 we went through a scorched earth policy at our club to get rid of the grasses that we thought we did not want. There was an awful lot of creeping bent on the fairways that had become fluffy, so right after the Purdue meeting in the spring of 1946 we had Grau and Mott come down and we went over the course and we set up a program for $8400 worth of material which the board approved. We burned every spear of grass off our fairways. We let them have the course on the fourth of July and on the morning of the 5th we started putting on chemicals. By the first of August there was no more grass on those fairways which I hope never to go through again as long as I live. We burned it off, we followed up with 300 pounds of arsenate lead to the acre, 300 pounds superphosphate to the acre, (we used Milarsenite at 1200 pounds to the acre to burn), and put some humus in it. We seeded 60% bluegrass and 40% Astoria bent, by weight.

The next year we had a bad year and didn't have enough water, it went down quite a little and we got quite a lot of Poa annua. The seeded bent has taken over very well and it has got so at our club that if they see a dandelion or weed on the fairway, I hear about it. So boys, if you get your course to what is called a per-

fect green, God help you, because you haven't much to look forward to.

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SUMMARY OF CHEMICAL CONTROL MEASURES FOR CRABGRASS

B. H. Grigsby
Michigan State College

Examination of weed control literature shows that, while a large number of compounds have been used experimentally in the last few years, only a limited number have given results that were satisfactory. Among these which have given partial success there are many conflicting reports ranging from no control to 90% or better control. Likewise, varying effects upon turf grasses have been reported.

Results obtained in the north central states are often different from those reported in the north eastern states and no consistent pattern is evident in either region. Climatic differences, soil factors, species of grass and stage of growth at the time of application all play some part in the wide variation of reported results. The method of evaluating results has not been uniform throughout the reports and this makes comparisons difficult.

The chemicals used for control of crabgrass are generally contact herbicides and exert their toxic action upon the foliage of sprayed grass or upon the root system of grass in treated areas. A few compounds are effective only upon germinating seedlings and one or two appear to be translocated in the grass plant. Evidence for translocation is very limited but the possibility of this type of action cannot be dismissed at the present time. All are compatible with 2,4-D.

Arsenical compounds, alone or in combination with fertilizers, have been used on crabgrass longer than any other type of compound. The results that can be obtained and the difficulties involved in their use are so well known that it is scarcely necessary to include them in this discussion. However, they do make a convenient "yardstick" for use in evaluating new crabgrass killers and probably should be included in most experimental trials.

Of the newer herbicides, phenyl mercuric, (PMA) has probably been used more extensively than any of the others. PMA was first reported as a suitable herbicide

by DeFrance from Rhode Island and later by other investigators in the northeastern states. These reports have generally indicated satisfactory control when at least three applications are made and when the treatments are started when crabgrass is small. The compound appears to be effective when applied as a spray or as a dry powder incorporated with a suitable carrier.

In the midwest, results obtained with PMA have not been as good as those in the east. There are, however, some reports of excellent control from experimental and commercial applications. The technique of application and timing appear to be critical in this area. Dry applications of PMA, while less likely to cause discoloration of turf grasses, frequently give less control of crabgrass than liquid applications of the same compound.

The available reports on the use of PMA lead to the general conclusion that this compound, when used under favorable conditions will give control of crabgrass but under other conditions may give poor control and may cause some injury to certain turf grasses. Unfortunately, there is not enough evidence to permit a statement of what constitutes favorable conditions and consequently general recommendations for regional usage cannot be made.

Potassium cyanate, (KOCN) was used quite widely in the 1950 season. The results obtained by the various investigators exhibit a pattern of variation similar to that with PMA. Some reports indicate that early summer treatments are better, while other results were better when the chemical was applied after midsummer. In the majority of the reports, some temporary burning of turf grasses was found. When weather conditions were favorable for crabgrass seed germination, reinfestation of KOCN treated areas frequently occurred.

The method of application, use of a sticker and temperature appear to have considerable effect on the results obtained with KOCN. Sprinkling can applications were generally unsatisfactory. At least two treatments and a dosage rate of 12-16 pounds per acre plus some adapted wetting agent were found to be needed. The type of wetting agent is important and data concerning such materials in the midwest are inadequate.

The injury from KOCN was reported to be a rapid and severe browning of bluegrass and other turf grasses. Recovery was usually rapid, except where excessive dosages were used and can be facilitated by the use of

fertilizer and water when rainfall is limited.

Petroleum oils, ranging from commercial kerosene to light naphtha distillates, such as are used as the base for certain insecticides, were used by a number of investigators, chiefly in the north central states, and again the results ranged from poor to excellent. While the oils may not always control crabgrass, they seldom cause injury to turf grasses, unless very heavy dosages are used.

An evaluation of kerosene is difficult to make because of the great variation between lots of commercial products. No two samples are identical and the data do not indicate what the effective components may be. Oils which are effective in killing crabgrass have generally fallen within rather narrow physical characteristics. A distillation range of 350-500, API gravity of 40-48 and aromatic content of 1-3 percent have been reported for some of these oils. The term "specialty oils" has been used in some reports but it is not specific enough and some of the less favorable results may have been due to the use of oils which were too heavy, had too much aromatic materials or contained other toxic compounds. The toxic action of oils on crabgrass appears to be chronic in nature but the exact mechanism of action is not known. Two applications generally are required and no effects on ungerminated seeds have been reported.

Reports on the use of maleic hydrazide as a foliage spray for control of crabgrass were uniformly disappointing. Rates of application which had any effect on crabgrass were injurious to desirable grasses and lesser rates were a waste of time and materials. It should be noted here that one of the effects of maleic hydrazide is that of stunting the growth of sprayed plants but there appears to be little, if any, possibility of getting turf to a desired height and then holding it at that point by spraying with the chemical instead of mowing.

A rather extensive list of experimental chemicals was used in crabgrass control trials but most of these are not available for commercial use. Dichloral urea is perhaps the most outstanding compound of this type and has given rather promising results when applied to the soil at or before the germination period of crabgrass seeds. Further work with this compound, with TCA, Endothal and 2,4-D appears to be desirable but no evaluation of these compounds is possible from the limited data available.

A survey of the reports on crabgrass control by chemical methods shows that a fully satisfactory method has not yet been found. Some four or five types of chemicals have considerable value but all have some objectionable features, chiefly with respect to the perennial grasses in the turf. The results show that basic data on the response of crabgrass is very limited and this lack of information prevents our establishing principles for the proper evaluation of crabgrass herbicides.

An ideal herbicide or combination of herbicides for grass control in turf should provide for the immediate kill of crabgrass, prevent germination of dormant seeds and have no effects upon permanent grasses. Obviously, the ideal has not yet been reached but some progress toward that ideal has been made. Further research under conditions which will facilitate comparisons on a regional basis will be necessary before a reasonable chemical control program can be devised.

Question: How about using oils in renovating and how does it affect Poa annua?

We've used those oils for renovation under circumstances which were critical. We took a calculated risk in that we anticipated that we might have lost all of the grass on those areas. The thing that we were using was an aromatic oil called Stoddard solvent. It has the property of burning the foliage of all grasses. In Poa annua it will burn the Poa to the ground, but the crown may be left alive and a regrowth will take place. The reason we haven't said much about it in connection with Poa annua is where you want to control Poa annua and you have other grasses with it we know that the solvent would cause rather severe injury. One case in particular we used the Stoddard solvent on a particular fescue with lots of crabgrass. It cleaned out all of the crabgrass and what fescue and bluegrass he had in the lawn was burned to the ground. But within two days, regrowth was taking place. We were disappointed with Poa annua-- it is a stinker, as you know. When we found that the oils were effective only on annual species, we thought that we had the answer because it isn't going to hurt these other grasses. The unfortunate thing is that Poa annua is just as immune to the toxicity of those oils as is bluegrass. It does not work on them although the thing is an annual grass. If you can tolerate the top burning that will go along with the use of Stoddard solvent, that is the quickest way I know to get the grasses out. Two applications would probably eliminate the Poa annua.

Use 80 gallons to the acre of Stoddard solvent and two applications.

Question: What rate would you put on the oil and how would you put it on?

The oil usually is applied at the rate of two gallons to the thousand or 80 gallons to the acre. It goes on as a straight spray-- not mixed with anything. Any sprayer will apply it.

Question: What is the cost per gallon of this oil?

The cost of these new products is somewhat higher than they would be after usage is established. Last year, if it were bought in 50 gallon quantities, the oil would have cost about forty cents a gallon.

Question: Is that the same Stoddard solvent that they are using in machine shops?

The term Stoddard solvent is pretty wide, but the thing that has been used to clean electric motors and things of that sort, that is the type of Stoddard solvent that is used for weed control in carrots but not the thing that we use on grasses.

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TESTING FOR BETTER GRASSES

F. V. Grau

There are several ways of finding better grasses. One is through breeding and selection. That requires the services of a highly trained plant breeder, a geneticist, a plant physiologist, a cytologist. Another way to find better grasses is to select those that nature has developed over a long period of time under a given set of circumstances. Actually, most of the improved grasses we have today are selections from these. Nature developed Merion bluegrass and it was because of an observing golf course superintendent that we have Merion bluegrass today. Joe Valentine noticed a patch of improved grass on his No. 17 tee which stayed good at all times of the year and kept crowding out weeds. He gave a plug of it to the Green Section. We started working with it, increasing it, put it into nationwide testing and find that it was the best bluegrass available.

In the testing of better grasses the experiment sta-

tions and universities can go up to a certain point. Then each of you take those improved grasses, place them under your conditions, under the wear to which the turf will be subjected and give the final testing there.

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GOLF GREENS, GOOD AND BAD

R. R. Davis

Most golf courses have one or more "problem greens". Greenkeepers insist that all their greens are problem greens, but they readily admit that "number 5 is the first one to give trouble". There must be a reason for everything so there are one or more reasons for a troublesome green. Some likely causes are poor physical condition of the soil, poor drainage (both soil and air drainage), proximity of trees and diseases associated with these conditions.

Poor physical condition of the soil is recognized as one of the basic causes of poor turf on greens. With this in mind, a detailed study was made of the "best" and the "poorest" greens of some golf courses in Indiana and Illinois. It was hoped that some measurement could be made to determine if a green would be troublesome. In addition an estimate of the soil mixture needed to construct a good green could be made.

Soil cores 8½ inches long with the turf intact were taken from each "best" and "poorest" green. The rate of water movement (percolation) through these soils was measured to get an estimate of their drainage characteristics. Percolation was ½ inch per hour faster through cores from the "best" greens.

Another measurement was large pore space in the long cores to determine soil aeration. The "best" greens had 6.2% large pores while the "poorest" greens had 4.9% large pores, the difference being statistically significant.

After percolation and pore space measurements were made, the cores were sliced into horizontal sections and the moisture content of the sections determined. A series of slides shows the irregularity of the moisture curves when layers are encountered in the greens. An organic layer causes a high peak in the curve because of its high water holding capacity. A uniform curve represents a uniform soil which we should strive for in golf greens.

Similar soil cores were washed over screens to separate roots from soil and the quantity of roots was measured. Only living roots were included. The average weight in miligrams of roots from the "best" and the poor greens are shown on the following slide:

Grass Roots (mgs)

Green

Course	"best"	"poorest"
1	46.6	21.6
2	20.5	11.4
3	192.7	5.7
4	40.5	12.3
5	5.4	1.0
6	88.7	35.1
7	47.0	20.8
8	55.3	52.1
Avg.	62.1	20.0

The poor root systems in the "poorest" greens are considered an effect rather than a cause. This merely indicates that the greenkeepers knew what they were talking about when they picked the "poorest" greens.

Another type of sample was taken at four depths in each green. Pore space, volume weight, organic matter and particle size determinations were made. The average percentage pore space of all greens sampled is shown on a slide.

Depth (inches)	% Large Pores	% Small Pores	% Total Pore Space
1 1/4 - 3 1/4	7.0	41.6	51.2
3 3/4 - 5 3/4	9.6	35.1	47.0
6 1/4 - 8 1/4	9.5	34.0	45.7
8 3/4 -10 3/4	10.0	33.4	45.4

The important thing shown on this slide is the strikingly small amount of large or aeration pore space near the surface of the green (1 1/4 - 3 1/4 inches). If it were feasible to take a sample closer to the surface, the difference would undoubtedly be more striking. The soil particles are pressed close together (compacted) under traffic making small pores instead of the badly needed aeration pores. There was apparently no effect from compaction below about 3 1/2 inches.

Volume weight varied with the organic matter content

of the soils. The higher the percent organic matter, the lower the volume weight. The "poorest" greens had more organic matter and a lower volume weight than the "best" greens. Volume weight was an indication of organic matter and not a measure of compaction.

The soils of the greens sampled were generally poorly mixed sandy loams. The percent sand in the greens varied from 72% to 29%. Coarse sand (greater than 1/4 mm) varied from 46% to 3%. There was no consistent difference in the mechanical analysis of the "best" and the "poorest" greens. The average analysis of all the greens sampled was: 2.9% organic matter, 2.1% gravel, 20.4% coarse sand, 34.7% fine sand, 21.2% silt and 18.7% clay.

Certain relationships are worth noting. Coarse sand in a green caused an increase in the amount of large or aeration pore space. On the other hand, organic matter caused many small pores, apparently at the expense of the large pores.

A chemical analysis showed that the condition of the "poorest" greens was not due to a lack of fertility. They were more fertile than the "best" greens.

A lack of aeration pore space is thought to be the soil factor most often causing poor turf on greens. Anything that will break up or loosen the top 3 - 3½ inches of the surface soil should temporarily help this situation. The use of coarse sand in soil mixtures for greens will make more aeration pore space. Under green conditions, organic matter is slow to break down to form true soil humus and some types of organic materials are likely to be harmful rather than helpful in improving soil condition. My personal conception of a good soil mixture for constructing a new golf green would be an ordinary loam topsoil with coarse sand (½ to 2 millimeters diameter) added until the mixture contained 40 to 50 percent coarse sand. The same mixture would be used for topdressing in later years.

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EXPERIENCES WITH U-3 BERMUDA

Al Linkogel

As you may know our main trouble is St. Louis is crabgrass and goosegrass. Any grass which will compete with these is certainly of interest to that area. My

experience with U-3 bermuda goes back to 1947 when we built a couple of practice holes. We put bermuda on one tee in July and within three weeks time we had a pretty stand of crabgrass. But we kept it watered and fed and by August you could see the bermuda coming up all through that tee. By the end of September that tee was 90% bermuda.

We have one tee of less than 1000 square feet where plugs were placed at eighteen inch centers. When fall came I couldn't see the bermuda because the golfers teed their balls off the plugs. The following May I noticed some bermuda coming through on this tee. It was fed heavily and the following fall that tee was 50% bermuda with all the abuse it got. This past fall it was 100% bermuda; one of the finest tees on the place.

In the meantime I was trying to figure out different ways of introducing bermuda into the tees. Plugging was pretty slow, so I advanced the idea of making a narrow replacement sod strip. (Slide) This is a 30-inch power mower with a strip cutter in front. In our spare time we cut strips of sod in the nursery and transferred them over on the tees. We "striped" another par 3 hole tee in June when Poa annua was just starting to go out and it was the worst tee on the course. The strips of bermuda that were taken out of the nursery and put in on 18-inch centers were then fertilized and watered. We fertilized again the latter part of June. The tee appeared to be solid crabgrass about three weeks later. I used sodium arsenite at the rate of two ounces per thousand square feet on one of the hottest days we had in July. (Slide) This is the result. All the green grass is bermuda; the sodium arsenite killed at least 95% of the crabgrass. (Slide) This is the same tee two weeks later. You can see how the bermuda is crowding in although it didn't cover completely that year. This past year it did cover completely. Strips which are 18 inches apart are a little far as the tee is under heavy play. I suggest putting the strips in at 12-inch intervals so that you can get a cover in one season. If you had a big enough nursery, would you sod the tee? Yes, at present. If I were to transfer tees over now, I would just plant enough area in the nursery to sod all of my tees. It would be the cheapest in the long run.

I do believe that the combination of B-27 and bermuda is going to work swell, but we are going to have to learn how to feed it. I once read that B-27 and bermuda were fed heavy over the summer and B-27 didn't

come back the following fall. This piece here had no feed over the summer. Only fed in spring and fall, the B-27 came back. This is the second winter it came back and right at present this piece of grass which is about 10,000 square feet is about 98% green.

Here's a big U-3 bermuda nursery at Algonquin Country Club in St. Louis. Oscar Bowman is sodding the majority of his tees with U-3 bermuda. Some nursery rows at Westwood Country Club were planted in July and a lot of crabgrass and weeds came up. We sprayed it with sodium arsenite. Everything was wiped out and the bermuda stayed nice and green.

Here's a close-up of a mixture of C-19, C-1 and U-3 bermuda. This is cut at ¼ inch. No water was used this past year. Over July and August it was pretty well all bermuda, very little bent. As the cool weather started this fall, the bent came through and right at present it is 95% bent. The fact is, you have to look close to see any bermuda in it. I tried this spot at the suggestion of Dr. Grau and it really has been an excellent piece of turf.

There are going to be several U-3 putting greens grown in the St. Louis area this year on private estates and practically all of the golf clubs in that area are using U-3, especially for their tees. Tees have been our biggest problem down there and U-3 has proven to be the only type of grass that we can keep on our tees.

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TESTING FAIRWAY GRASSES

D. E. Likes

This is a report on a fairway experiment which was started at Purdue in 1948. Most of the information was obtained in 1949, a relatively dry year and one very bad in severity of leafspot attacks. Twenty-seven different turf grasses were selected with characteristics that showed they have possibilities for fairway use. Three different heights of cut, ½, 1, 1½ inch, were used to determine what would be the best height of cut for each grass. The outstanding grasses in this test were Merion bluegrass, C-6 creeping bent, C-56 creeping bent and C-232 (Elk-16) creeping bent. They were the most disease resistant, the most drought resistant and had better healing qualities than the other grasses.

Merion (B-27) will hold its color better than any other bluegrass, partly due to its leafspot resistance. In comparing C-56 creeping bent with Astoria, the creeping bent has held its color better than Astoria. This slide was also taken during a dry period, and no artificial water had been applied to these grasses. This slide shows C-6 creeping bent, another outstanding bent, compared with C-44 creeping bent. As you can see, it held its color much better than C-44. The latter was off-color and also had quite a bit of dollarspot on it during a good part of the season. However, there was no crabgrass in either grass since both had a turf cover.

Seaside bent held its color better during the dry periods than the Astoria. However, as you probably know, Seaside tends to be matty and grainy. I think the Astoria would make a better playing surface, especially if you have watered fairways. The creeping red fescue is thinned out by leafspot and consequently crabgrass and bentgrass have come in. Here is another chewing fescue compared with C-56 bent. It's the same story again of leafspot disease attacking fescues.

You will find redtop in several of your lawn mixtures. This was planted in the fall and in the spring the redtop was beautiful. Along about midsummer it went out at the same time the fescues went out with leafspot.

To determine grass recovery rate we made an extremely large divot, so that we could get more information from the grasses on the rate of heal. When bent isn't watered, it doesn't heal quite as well as Merion bluegrass.

To summarize, the outstanding fairway grasses in this experiment were C-232 (Elk-16), C-56 and C-6 creeping bent along with Merion bluegrass. The fescues were least impressive of all the grasses. This includes Alta fescue, Red fescue and the chewing fescues. More leafspot resistant strains of fescue need to be developed. The optimum height of cut varies for the different grasses. Bluegrasses did not do well when cut closer than one inch although Merion will withstand closer clipping than other bluegrasses. When cut at ½ inch, it was unable to resist crabgrass infestation. The creeping bents performed best at ½ inch. The colonial bents apparently should be cut slightly higher, possibly 3/4 inch. The fescues that are now available should not be cut closer than 1½ inches. When cut closer than this, they receive considerable damage from leafspot.

CHICKWEED CONTROL IN LOUISVILLE

Pat Russell

In the fall of 1948 and the spring of 1949, common chickweed became noticeable in fairways and lawn areas on all the golf courses around our section. By the spring of 1950, we really had a crop of it. However, at this time we hesitated to do anything about it because the previous fall we had seeded Astoria bent. Through the summer of 1950 we had a lot of hot, humid weather and lost some bluegrass and a little bent.

In August O. J. Noer went over the fairways with us and we decided there were enough permanent grasses left so that it was not necessary to seed the whole area, only some small places and possibly some approaches and bunkers. We treated these areas with sodium arsenite on September 15 at the rate of $1\frac{1}{4}$ pounds per acre. We seeded with Astoria bent just before treating with the same amounts of sodium arsenite on October 1.

We decided on a program to eliminate chickweed in the rest of the areas and this program was outlined to start the weeks of October 12, 19, 26 and November 2 with treatments of Milarsenite at 150 pounds per acre. We had used 1500 pounds Milorganite per acre on September 15. When the first application was put on, it resulted in the slight burning of all the grasses. The second one gave a little more severe burn and by the time we put the third one on, everything browned out. We decided to wait a little longer between the third and fourth treatment. Right now we at Big Spring feel that we have about 80% less chickweed than we had this time last year.

A very interesting thing happened down there last week during the Kentuckiana Greenkeepers meeting. In walking over the fairways, some of the fellows noticed some irregular strips ranging from two inches wide to three or four feet. Now in treating those fairways four times, it is not reasonable to think that you would skip the same areas all four times. So the only thing that we can figure out is that those areas were skipped one time, but which time we do not know. This procedure of eliminating the chickweed in our fairways has worked very well for us down at Big Spring.

Question: Did you have any knotweed along with the chickweed infestation?

No, we didn't have any knotweed to speak of. Knotweed is a weed that 2,4-D will do a good job on in the spring. After the knotweed gets large in summer, 2,4-D isn't as effective. Even at that time of the year, sodium arsenite will kill it. The best time to kill it is in the spring when it is in the two to three leaf stage. If it has not gone to seed, you can use 2,4-D; however, if those areas are thin and you propose to put a little seed in there, then you had better not use 2,4-D because of the danger of 2,4-D inhibiting germination of your grass seed. If you will use sodium arsenite spray at ½ ounce per thousand square feet, it will take it right out.

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CHICKWEED AND CLOVER CONTROL ON OUR FAIRWAYS AT LANSING COUNTRY CLUB

LeRoy Jones

The need for better turf on our fairways was realized back in 1939 and even before the time. But it was not until 1941 that actual work was started.

It was decided that we would take one of our fairways for the trial treatments. Then if this proved satisfactory, we would go ahead with the rest. Renovation of our second fairway we felt was justified because of the clover and weeds and very little perennial grasses.

So treatments were started using Milarsenite at 300 pounds per acre. The first treatment was applied on August 23, 1941, followed by other treatments at intervals of about two weeks depending on newly formed leaves or dandelions. Then they would attain a length of about 1½ inches.

After the third treatment we spiked the fairway thoroughly to prepare the seed bed. We used a seed mixture of 85% Kentucky bluegrass, 10% Astoria bent and the balance redtop, using about 100 pounds per acre. Following the seeding the last treatment was applied.

In the spring of 1942 I applied 1000 pounds of Milorganite per acre. That was the last fertilizer this fairway had until 1945. We had a long period of cool, wet weather in 1942 and by fall the bent had actually

taken over. The club members were well pleased with the results but due to the war, treatments could not be continued. It was gratifying to see how well turf on this fairway had stayed despite the fact that nothing had been done to it since the spring of 1942. There was some clover but this was eliminated by three more applications.

We again started our treatments in August of 1945 on all the other fairways that needed treating. Our #1 fairway was badly infested with chickweed. I have never seen chickweed as thick as it was on this fairway. The same treatments were applied as before, only in seeding we used Astoria bent at ten pounds per acre.

Since these treatments we have fertilized our fairways each year and have aerified our fairways spring and fall since 1947. We feel that much has been accomplished by the use of Milarsenite and proper fertilization. A lot of credit is due to Dr. O. J. Noer for his helpful suggestions.

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CHEMICAL CONTROL, A SUMMARY

O. J. Noer

I am glad that two practical talks preceded me and that you heard something about actual accomplishments in the field. Lansing Country Club, as I recall, installed a water system and expected to have better turf. Instead they lost all their fescue. They ended up with lousy turf and a good crop of dandelion, buckhorn, plantain, clover and chickweed. That is why renovation was in order there.

In the first place, a few comments about the characteristics of chickweed and clover. There are two types of chickweed, the mouse-ear and the common. The mouse ear is blue-green in color. Its leaves are narrow and somewhat longer. They are what the botanist says pubescent; that is, they have a hairy fuzz on the surface of the leaves. It is not nearly as difficult to eradicate as the common chickweed which is the bad one. It has an apple green color. The leaves are somewhat pointed and are broader at the base. Common chickweed produces seed throughout the year. Mature plants possess everything from seeds near the base to flowers near the growing tip. Common chickweed is a

very profuse seeder, so once it gets started, it really goes to town. We cannot rely on maintenance practices to rid the turf of chickweed. In other words, fertilization will not cause the grass to choke them out. Common chickweed will invade the grass and reduce the turf population, so some type of herbicide or chemical treatment is necessary, particularly on watered fairways.

Clover is a surface grower; that is, the stems creep near the surface. Roots are shallow so superficial watering and an open turf encourage its development. Clover is a legume and does not depend upon soil to supply nitrogen. Therefore, in nitrogen deficient soil, clover grows at the expense of grass. Clover control is a matter of growing grass to resist the invasion rather than the use of chemical herbicides. Chickweed in greens must be eliminated by resodding the patches or by using a chemical. Lead arsenate is about as good as anything. Dusting the patches with it will kill the chickweed without damage to the grass. We get many letters asking about chemical control of clover in greens. For my part, I think maintenance practices should be scrutinized first to find out why the clover is growing better than the grass. Grow good grass and keep it dense and thick. This is the best way to solve the clover problem permanently. Where clover is bad because of a low soil level of nitrogen, one approach is to use a little sulphate of ammonia first at three pounds per thousand square feet to scorch it. The best scorch is obtained by waiting one or two hours before watering. It will turn the grass brown as well as the clover, but if properly done, there will not be any permanent damage to the grass. One can also use sodium arsenite but you had better have a man who knows what he is doing or you may end up with less grass and more clover.

Where fairways have been allowed to get so bad that chickweed, clover and Poa annua are the principal ground cover, the problem resolves itself into one of renovation. After a good coverage of desirable grass is obtained, clover can be kept in check by following good practices with respect to fertilization, mowing and the use of water. Chickweed may come back because the soil may be heavily infested with seed. Even with a 90 or 100% kill of chickweed, you had better not become complacent because the very next year there is apt to be a reappearance of chickweed in patches. For example, at Milwaukee Country Club where the fairways are good and consist of mostly bentgrass, John treats six to eight fairways for chickweed control each year.

He treats with sodium arsenite in October and November. There is almost no discoloration because the patches are small and grass had started to go dormant. There is no inconvenience as a consequence.

About chemicals - When 2,4-D was first discovered and during the preliminary experimental days, it was said that 2,4-D was the answer to the clover and the chickweed problem. 2,4-D checks both of these weeds, but it does not eliminate them with one treatment. So, the results as far as these weeds are concerned have been disappointing. If successive treatments are made at the ordinarily racommended rates, 2,4-D may do considerable damage, particularly to the creeping bents in the fairways. Therefore, it is questionable whether one would be justified in using 2,4-D say 2, 3 or 4 times in order to completely eliminate clover or chickweed. I have seen places where 2,4-D was used at very light rates of less than a quarter pound to the acre to keep the clover in check and to prevent it from producing bloom. At these rates even successive treatments have not eliminated the weed. Last fall I saw some work in the Chicago area where 2,4,5-T was being tried on clover. 2,4,5-T is a brother or a sister of 2,4-D. Chemically, the only difference between them is that there is one more chlorine in the benzene ring with 2,4,5-T than there is in 2,4-D. In other words, the D means di, the 2 and 4 refer to the positions in the ring where the chlorine is; and so 2,4,5-T (T is for tri) means that there are three chlorines in the 2,4,5 positions. The rates used on the fairways varied from ½ to 1 pint of 40% emulsion-type 2,4,5-T per acre. For the first two weeks or so there was no noticeable effect and then in some instances the clover disappeared but in others it was not entirely satisfactory. Some details require clarification so far as this material is concerned before it can be generally recommended. The 2,4,5-T is often referred to as brush killer.

The arsenicals commonly used are sodium arsenite and arsenic acid. Either one of them will do the job on all three of these weeds. Both kill Poa annua also but not the seed in the ground. Arsenic acid is a liquid which is about twice as heavy as water. It has a specific gravity of about 1.75 and most of the commercial products contain about 75% of arsenic acid. Using these figures as a basis, it is easy to calculate the liquid volume required to furnish whatever amount of arsenic acid you wish to use. Arsenic acid resembles sulfuric acid and should be handled with respect. It produced burns, so workmen should use gloves, etc. It

usually comes in carboys and should be removed with a siphon such as the ones sold by auto supply houses to garages for handling the sulfuric acid used in batteries. The best way to handle arsenic acid is to siphon it off into bottles of appropriate size. Arsenic acid is not readily obtainable. Those who use it probably get their supply from people like Sherwin-Williams, Dow Chemical Company, Pittsburgh Plate Glass Company--in other words, firms who manufacture lead arsenate.

Sodium arsenate is available on the market as such in two forms--the gray and white powder which differ only in the degree of purity, and as a liquid formulation. Chipman Chemical Company, for example, put out a liquid sodium arsenite under the trade name of Altacide A. It comes in drums of about 55 gallons. The material contains five pounds of sodium arsenite per gallon, so for each quart there is 1¼ pounds of sodium arsenite. The liquid material is very convenient for spray use because there is no sediment to clog the nozzles of the sprayer.

Then, of course, there is Milarsenite, the material mentioned and used by Roy Jones and Pat Russell. It is dry sodium arsenite coated on Milorganite. The content of sodium arsenite is 3%. At present prices it is not a cheap source of sodium arsenite because you pay 40 to 50 cents apiece for the bags which you are told to destroy. I think that recent developments will eliminate Milarsenite. Before the discovery of 2,4-D Milarsenite was used to kill not only weeds such as clover, chickweed and Poa annua which are easy-to-kill weeds but also to eliminate dandelion, plantain, crabgrass and other weeds. That is why Roy used 300 pounds per acre instead of the 150 pound rate which was applied at Big Spring. The trend now is toward light rates, somewhere between 1 and 2 pounds per acre of sodium arsenite as a liquid spray with or without a sticker. Frank Dunlap did an exceptionally fine job at Cleveland in the elimination of clover and chickweed from the fairways at The Country Club. The first treatments were just under two pounds per acre. After that he dropped to about 1¼ pounds or 1 quart of the liquid sodium arsenite per acre. He used a low gallonage sprayer, using approximately ten gallons of water per acre. With a high pressure sprayer, don't use any more water than is necessary to give satisfactory coverage. Forty to fifty gallons per acre should suffice.

So far as method of application is concerned, uniform coverage is important by the dry or the liquid method. Overlapping should be avoided because of the greater

injury to the grass. Treatments in spraying are best done across the fairways. Lengthwise applications should start at the center and work toward the edge to avoid overlap along the center. It is also important to have some kind of a marker so that the driver will not overlap. Where a spreader is used, the outlet spouts should be close enough together so that the curtain of material dropped is uniform; otherwise the fairways will look like a zebra. All these details are important to obtain satisfactory results.

If there is nothing but weeds or clover and no grass, it means a renovation program including some seeding. Begin by using 2,4-D in May or June to kill off the broad-leaved weeds and do that long enough in advance of the other treatments so that the 2,4-D will not inhibit germination of the grass. Then before July prepare the members for some terrible looking fairways. Sodium arsenite or arsenic acid treatments should start that month to kill the Poa annua, clover and chickweed. The spacing of the treatments is important particularly with respect to clover.

The method of kill by arsenicals is not like that of 2,4-D. With arsenicals you defoliate the plant, burn off the leaves, then the plant utilizes the reserves of sugar and starch in the tissues to build new leaves. Repeated defoliation exhausts the reserve supply of carbohydrates. The plant dies when it does not possess the stored food needed to initiate growth. When the interval between treatments is too long, the new leaves make enough extra sugar to replenish the reserves in the storage tissues. Then you might as well forget about that application because nothing was accomplished. An interval of about 10 to 14 days is about right. In that time clover leaves are about 3/4 normal size.

Don't expect the pound or pound and a half rate to completely defoliate the plant the first time. If clover or chickweed growth is dense, only the top leaves will be burned. They are the only ones that come in direct contact with the herbicide. Because the leaves underneath are untouched, you naturally think enough material was not used. Don't worry because you can never get complete defoliation the first time unless the rate is so heavy that it is apt to permanently injure the good grass. One can seed immediately before the last treatment as Roy did. In fact Pat did some treating at light rates even on the young grass seedlings when they were about a month old. After a good turf coverage is obtained, you can safely treat in spring as Pat proposes to kill the small a-

mount of chickweed that develops from seed. He has enough grass so that it will close in and not create a crabgrass problem.

The amount of burn or the amount of discoloration on an area of turf is going to depend upon a number of factors. First is the matter of soil moisture. If the soil is bone dry, even a rate of 1¼ to 1½ pounds per acre may discolor bent very badly. That is why it is advantageous to have water available for a renovation program, particularly if there is a high content of good grass. The soil should have enough moisture to grow good grass. The kill on the weeds will be best if they are growing. Where coverage is nothing but clover and chickweed, the area is going to look brown after it has been treated because there isn't anything left after they have been burned. If there is only a scattering of clover and chickweed, the discoloration will not be noticeable at the above rate because discoloration of the grass will be very slight. It is always desirable to have at least twelve hours without rain following an application although by using a good spreader and wetting agent, a pretty good scorch will be obtained with these weeds after 4 to 5 hours.

Question: What is your observation on this new F-74 fescue? Can it be cut to a ½ inch height which seems to be what the golfers now demand? Do you think that is going to be a better grass for sandy, impoverished soil areas?

I can't answer that, but from what I have seen of it, F-74 fescue looks very good. By all means try it and do enough with it to see whether that is going to be an answer to your problem. I believe Merion bluegrass is performing very well. Cliff Runyon has used unbelievably small rates of seed per acre. Pat says that Big Springs No. 15 fairway is coming along beautifully and estimated that they have 60% Merion bluegrass and 40% bent. One thing about Merion, it seems to throw rhizomes vigorously and to grow well even when cut at 3/4 inches.

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BREEDING TURF GRASSES

H. B. Musser

Breeding and development of turf grasses is a tremendously broad thing, so I am going to concentrate on just one phase of it. Perhaps you might be interested in seeing what goes into the final product that comes out as an improved type of grass. First, I would like to correct a pretty general impression among laymen that there is something mysterious, something abracadabra about research work of this kind. Most of it is just plain, ordinary, mechanical, every day work. A great deal of it is very routine. A tremendous amount of effort is involved in it. That is part of our job; we love it, or we wouldn't be in it.

I'm going to concentrate this morning on showing you just how we try to reach the end point in the production of an improved strain of grass.

I will use fescue as an illustration of how the breeding program works. Over at State College we are doing some work with the bluegrasses and the bentgrasses as well. Down in the southeast at Tifton, Georgia, Dr. Glenn Burton is doing work on the warm-season grasses. Here at Purdue you have started some work on the bentgrasses. I wish that we had a lot more of that type of work because at the best it is a long, drawn-out procedure, and the more hands we have pushing, the faster we will get somewhere.

The unit in any breeding or selection program is the individual plant. We get those individual plants to start with in many different ways. They may be found by growing commercial lots of seed or they may be found as superior plants growing in established turf, a very good source of material. On the other hand, they may be produced by hybridization of individual parents and therein lies a most interesting story of the study of the parent characteristics and how they may be transmitted. We could talk about that and perhaps enjoy it for a whole half day even if we don't have any special information on it because we all are interested in whether our children have blue eyes or brown eyes or whether they have black hair or red hair, etc. We have the same principles of inheritance applying to the way characters are transmitted in plants. Those are the three primary sources of these individual plants that we start with as our improvement units.

It is not possible to tell very much about what the

general performance of a plant is going to be when it is grown in the nursery with every opportunity to develop to its maximum capacity. And so, after we get the individual plants that look like they might have some desirable characteristics, we have to develop additional material from those individual plants. The next step is the propagation nursery where seed from the individual plant is grown in propagation rows.

Now that seems like a quite simple process and yet it can't be over simplified because of the many problems which we run into even as early as that in the game. You must meet special conditions. In the case of fescue, one of the things that we ran into that gave us lots of trouble to start with was the fact that sometime between the period of the first development of the seed head, the primordia of the seed head, as we call it, and the time when it came out and began to mature seed, we got a check in the development of that seed head. Frankly, we are not sure yet whether it is due to a very minute insect we call trips that burrow down inside of the leaf sheath and feed on the very succulent developing stem of the seed head or whether it is due to a weak type of fungus that that insect carries in there. Fortunately, except that we do want a definite answer, it hadn't mattered too greatly because we found that by burning off the row the previous fall, we could eliminate most of the trouble.

As soon as we have enough material developed, we get the new strain into the test plots. This is a series of test plots where we are trying to determine the quality by detailed records, not only of fescues, but of bent, bluegrasses and some other species on a comparable basis. We use three heights of cut-- ½, 1½ and 3 inches-- in order to get some idea of the performance of these various grasses as they would be handled either on fairways, lawns or on heavier duty turf such as athletic fields, airfields, etc. As you would expect after you have heard so much about it the past two days, here is a plot of Merion bluegrass. Everybody recognizes that varying environmental conditions may effect performance of individual types of grass. We have that emphasized particularly in the case of our creeping bent strains where nearly every section of the country has its own preference. In order to get as wide a range as possible with the facilities that we had available, we also planted our fescue strains down at Beltsville where Dr. Grau could directly supervise their maintenance and handling. There is a tremendously wide range in environmental conditions between State College and Beltsville.

If, eventually, we put our finger on a strain that in

our testing work has given us definite and significant indications of superiority, the next step then is to develop enough seed to get into practical, commercial production. The next step from the propagation rows, multiplication rows that I have shown you previously, is the production of foundation seed stock. These areas are carefully taken care of by the staff at the college in the way of seeing that the material that is being grown is reasonably pure-- from the mixtures-- and equivalent to the material that came originally from the breeding program. If necessary, volunteer plants are rogued out and everything possible is done to see that we have good foundation seed material. Eventually the material goes from the foundation seed stock field to commercial production.

This is a field of fescue out at Imbler, Oregon, where H. L. Wagner is growing thousands of acres of grass for seed. He is doing a very nice job on it as are many of the better growers in Oregon. There is the end point so far as the program of the development of a superior strain of grass is concerned.

I haven't said anything about the time involved. It is a long period. You have to have a year or more in the individual plant nursery and two years to develop sufficient material for your test plots. We like to have turf in a test plot for a three-year period which totals six. After we know that we have something that is satisfactory, there are two more years needed for production of foundation seed stock, in development of the seed for commercial production. And finally, it takes two years to get your commercial planting in seed production which is a ten-year period under the best circumstances. If we run into some difficulties, it adds up to more than ten years.

One of the most difficult things that I have encountered in this whole testing picture is to get a satisfactory yardstick to measure turf quality. It isn't total yield for the season as the ordinary comparisons are made in agricultural materials such as forage crops, corn or cereals, or fruit, etc. We are interested in a lot of intangibles that are not nearly so easy to put your finger on. We used to try and get at it by making observational records-- an all over grade of one plot in comparison with another. Well, that worked fine when we only had six or seven strains of grasses to compare, but when we have anywhere from 50 to 100 of them growing in the same location and showing all degrees of differences, it gets to be a 3-ring circus and your head gets in a whirl before you get over a dozen of them. We, therefore, have developed a

scheme which includes certain things that go to make up this desirable turf quality that we want. Those characteristics are different with different grasses.

In the case of the fescues, we have tentatively picked up such things as cupping to which fescue is particularly susceptible. That is, the opening up of a bare area in a turf. From a golfing standpoint that is a very satisfactory quality because the ball drops down into them. Sponginess applies primarily to our bent types as an indication of turf quality. We say that since turf is usually growing better in the May-June period than in the later period of the summer, we have to measure that quality to see whether it has gotten worse from one period to another. Then, of course, disease is such a tremendously important factor that we take that into consideration; not only the disease itself, but the ability of the grass to recover from disease rapidly. In addition, we are interested in drought tolerance. Weed infestation is an indication of good strains-- of the vitality of your strain. We are interested in cold tolerance and certainly to some extent in texture. Now that isn't the end of it because we are not interested to the same extent in all these characteristics. Therefore, we have tried to rate the importance of them and here is where we get into most of the difficulty.

This is the scheme that we have been using for the last two years in attempting to evaluate these various grasses by looking at one character at a time. The sum of all of it goes into making up that turf quality that we are particularly interested in.

Definitely you must take into consideration environmental conditions and particularly moisture and temperature where you are not applying water through irrigation. I am awfully glad that we have figures on weather conditions because it has enabled us to shorten down on our test period. The environmental conditions, the weather conditions between 1949 and 1950 were so extreme that I think we got as much information on performance of individual grass strains in those two years as we may ordinarily get in a 5 to 6 year period. I usually like to have 3 or 4 years of results, but I am much better satisfied to base a decision on two years of results when the extremes in weather conditions are as wide as they are here.

Just to give you an all over picture of performance between the various species that we have been testing, here are some of the outstanding evaluations. First, we have the Merion, then some of the better strains of

fescues and then the averages of all of our strains under test, including various types of Colonial creeping bent, fescues and bluegrass. The total makes up 60 strains in the test. As far as the average score in 1949 was concerned, as you can see, we had a very appreciable high performance from our superior types of bluegrass, the Merion and our better strains of fescues. You can see that the fescues as a rule performed somewhat better than the others.

This shows you the performance in 1950, and I think that you can see a very appreciable difference. If you will remember the story in 1949, the bluegrasses were very definitely last, the fescues went up a little bit. The colonials were much better in 1950 than they were in 1949. The next slide shows you the detailed performance of the best of our fescues out of those 29 strains that we had to begin with in 1949. The quality grades run from 86 to 76. We have very definite indications that we may have been able to put our finger on some extremely interesting new types of fescue. Here again in the 1950 tests the same strains that were tops in 1949 are again at the top although not in the same order in 1950. Remember the weather conditions were extremely variable between those two years.

What is the availability of the material now? We are going to have to wait until commercial production has developed and I think that you can understand that, after seeing the process through which we must go before we do have commercial seed available. I have been disappointed so many times when I thought we had possibilities of getting something better that I get very, very cagey about this whole picture. But I am almost to the point of being willing to stick my neck out and say that we will have within the next two years some commercial supplies of these strains of fescue which have shown every indication of being improvements over what we have had available in the past.

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