PROCEEDINGS

of

1954 TURF CONFERENCE

Sponsored by the

Midwest Regional Turf Foundation

and

PURDUE UNIVERSITY

LAFAYETTE, INDIANA

March 1, 2 and 3, 1954

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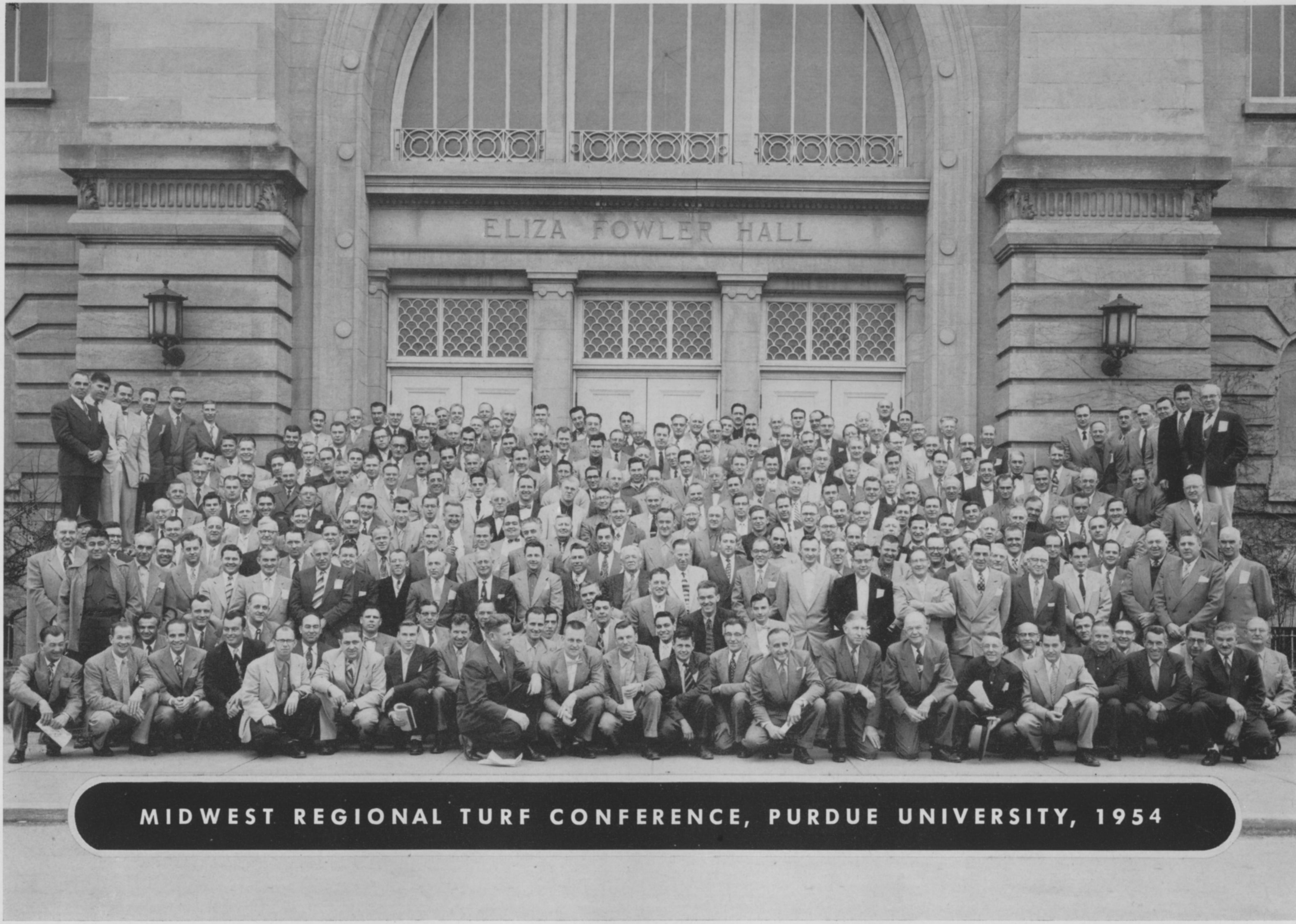

MIDWEST REGIONAL TURF CONFERENCE, PURDUE UNIVERSITY, 1954

ATTENDANCE ARRANGED BY STATES

Those Attending From Illinois

1. Arcand, George J.
2721 W. 38th Pl.
Chicago 32, Ill.

2. Baerwald, Howard J.
1024 Warren Avenue
Downers Grove, Ill.

3. Barron, Gerald
4721 Van Bruen
Chicago 44, Ill.

4. Bertucci, Adolph
1825 S. Telegraph
Lade Forest, Ill.

5. Bertucci, Alfred J.
341 Highwood Avenue
Highwood, Illinois

6. Bezek, M. L.
Butterfield C. Club
31 St. Midwest
Hinsdale, Ill.

7. Bild, Peter
Ogden Avenue
Lisle, Ill.

8. Boettger, John
Matteson, Ill.

9. Borg, Gus
Illini C. Club
Springfield, Ill.

10. Borgmeier, C. O.
1126 N. Grove Ave.
Oak Park, Ill.

11. Brandt, James W.
306 W. North St.
Danville, Ill.

12. Brown, Agar M.
Box 106
St. Charles, Ill.

13. Brown, Vernon
Mattoon C. Club
3445 Western
Mattoon, Ill.

14. Buckles, Clinton
University of Ill.
104 Huff Gym
Champaign, Ill.

15. Burdett, Paul E.
P. O. Box 241
Lombard, Ill.

16. Burdett, Paul W.
Swift Road
Oglesby, Ill.

18. Carr, Charles
Mattoon G. & C. Club
Mattoon, Ill.

19. Carter, Harold S.
1824 E. Main
Danville, Ill.

20. Chaplin, R.C.
5 No. Sleight St.
Naperville, Ill.

21. Chord, Edward K.
10400 So. Christiana
Chicago 43, Ill.

22. Clauss, Walter L.
115 N. Maplewood
Peoria, Ill.

23. Countenman
Angonne National Lab.
Box 299
Lemont, Ill.

24. Coyne, Mike
Fox Lake C.C.
Fox Lake, Ill.

25. Coyne, Tom
Lincolnshire C.C.
Crete
Chicago Heights, Ill.

26. Darrah, John
5757 Lincoln Highway
Matteson, Ill.

27. Davis, Raymond C.
Medinah Country Club
Medinah, Ill.

28. Dearie, Gerald F.
1552½ Juneway Terrace
Chicago, Ill.

29. Dearie, Gerald M.
2045 Pratt Blvd.
Chicago 45, Ill.

30. Dietrich, Carl B.
706 N. 69th St.
East St. Louis, Ill.

31. Daugherty, C.E.
George A. Davis, Inc.
5440 Northwest Hwy.
Chicago, Ill.

32. Dinelli, Frank J.
910 Clavey Road
Highland Park, Ill.

33. Duehr, Donald
131 Ridgeland Ave.
Worth, Ill.

34. Duehr, Edward J.
131 St. Ridgeland Ave.
Worth, Ill.

35. Duguid, Robert
2610 Crawford Ave.
Evanston, Ill.

36. Ebel, John
212 N. Hager
Barrington, Ill.

37. Erwin, Leslie C.
Flora Country Club
Flora, Ill.

38. Garbriel, Sam J.
Cook Co. Forest Preserve
Harlem Avenue and Lake
River Forest, Ill.

39. Galvin, Martin
Taylorville, Ill.

40. Foster, Roland E.
1713 Glenn Park Dr.
Champaign, Ill.

41. Gammill, H. E.
Bureau Valley C.C.
Princeton, Ill.

42. Garceau, Carroll H.
443 Laverne
Hillside, Ill.

43. Gerber, Raymond
865 Hillsdale
Glen Ellyn, Ill.

44. Glomp, Louis
Mohawk C.C.
Bensenville, Ill.

45. Gonderman, Robert L.
907 7th St.
Charleston, Ill.

46. Graffis, Herb
Golfdom
407 S. Dearborn
Chicago, Ill.

47. Gregory, Joseph C.
5830 S. Nordica
Chicago, Ill.

48. Grotti, Dominic
Sunset Ridge Road
Northbrook, Ill.

49. Gruening, Marvin
4714 Yender Ave.
Lisle, Ill.

50. Habenicht, Carl B.
15200 Paulina
Harvey, Ill.

51. Haines, Paul P.
1116 Linden Ave.
Deerfield, Ill.

52. Hammerschmidt, T.F.
Box 103
Lisle, Ill.

53. Hardy, Percy
Box 51
River Grove, Ill.

54. Heivilin, Robert B.
1851 N. Whipple St.
Chicago, Ill.

55. Hinz, Alvin
White Pines
Church Road
Bensenville, Ill.

56. Hosfeld, A.
1140 6th Ave.
Rodkford, Ill.

57. Hoyt, Walter
1611 Plainfield Rd.
La Grange, Ill.

58. Howe, Clifford A.
R. R. 3 Box 160
Belvidere, Ill.

59. Hughes, Kenneth C.
Cormi Country Club
Cormi, Ill.

60. Jackiewicz, Joseph
6665 Harts Road
Niles, Ill.

61. Johnson, E. F.
2049 Lake Avenue
Wilmette, Ill.

62. Jackson, Wallace
302 Garver Avenue
Rockford, Ill.

63. Jannes, Bertram H.
2206 Morse Ave.
Chicago 45, Ill.

64. Jury, Ira W.
5215 Forest Hills Rd.
Rockford, Ill.

65. Kaufmann, Richard G.
FoxLake C. C.
FoxLake, Ill.

66. Kelly, Joseph B.
2205 Schuyler Ave.
Lafayette, Ind.

/ 67. Krafft, William E.
Box 111
Orland Pk, Ill.

68. Kramer, Francis J.
1008 Shermand
Evanston, Ill.

69. Kramer, Jacob
2922 Payne St.
Evanston, Ill.

70. Kramer, John F.
1200 Pitner
Evanston, Ill.

71. Kramer, Michael J.
1008 Sherman Ave.
Evanston, Ill.

72. Kramer, Norman W.
147 St. & 82 Ave.
Orland Park, Ill.

73. Kurek, William E.
1100 E. Arcadia
Peoria, Ill.

74. Lundblad, Nels
814 N. Summit
Wheaton, Ill.

75. Lynn, George
1035 Udell St.
Woodstock, Ill.

76. MacGregor, John
660 Euclid Ave.
Glen Ellyn, Ill.

77. Malpede, Anthony
R. R. #1
Mc Henry, Ill.

78. Malpede, Wm. E.
R. R. #1
Mc Henry, Ill.

79. Mardfin, E.
30 N. LaSalle St.
Chicago, Ill.

80. Marczinski, Lawrence
1327 N. State Rd.
Arlington Height, Ill.

81. Mashie, Emil
Onwentsia Club
Lake Forest, Ill.

82. Maxwell, Joseph H.
9222 Clifton Park Ave.
Evergreen Park, Ill.

83. McIntosh, Dave
131 st. & 80th Ave.
Palos Park, Ill.

84. Meland, Theo. O.
3703 Irving Park Rd.
Chicago 18, Ill.

85. Mendenhall, Floyd
R. R. #7 Box 277
Decatur, Ill.

86. Miller, Lou M.
914 Henry St.
Alton, Ill.

87. Mitchell, Robert V.
Muny Golf Course
R. #1, Box 65
Alton, Ill.

88. Mitchell, Vertus
212 S. Pankhill
West Frankfort, Ill.

89. Mueller, Elmer
Indian Head Golf Club
U.S. 66 & Wolf Rd.
LaGrange, Ill.

90. Muzik, E. J.
3412 Harlem
Riverside, Ill.

91. Naughtin, Dick
Lake of the Woods G. C.
Mohamet, Ill.

92. Nuessle, Fred
18358 Martin Ave.
Homewood, Ill.

93. Pelcher, Fred
Burnham Woods Golf C.
Burnham, Ill.

94. Peterson, C. A.
7059 South Shore Dr.
Chicago, Ill.

95. Pieper, Walter
Flossmoor C. C.
Matteson, Ill.

96. Polillo, George
495 West Tompkins
Galesburg, Ill

97. Popp, Paul
The Sod Nursery
Bartlett, Ill.

98. Purvey, Albert
104 John Street
McHenry, Ill.

99. Roloff, George
Roselle Golf Club
Roselle, Ill.

100. Roseman, Warren J.
2610 Ridge Road
Evanston, Ill.

101. Rost, Bert
Park Ridge C. C.
Park Ridge, Ill.

102. Rowe, D. A.
Vaughan's Seed Co.
601 W. Jackson Blvd.
Chicago, Ill.

103. Runnfeldt, R. T.
320 Auburn Ave.
Winnetka, Ill.

104. Schaper, Alfred
Sod Nursery
Bartlett, Ill.

105. Schramm, Melvin
R. R. #3, 201 st & Ash
Chicago Heights, Ill.

106. Sellers, Everett
North Shore C. C.
Glenview, Ill.

107. Shryack, Lawson G.
1241 E. Wheeler
Macomb, Ill.

108. Simon, E. J.
R. R. #1 Park District
Rockford, Ill.

109. Simonds, R. O.
Division of Highways
Dist. 7
Effingham, Ill.

110. Sordet, R. J.
116 N. Ardmore Ave.
Villa Park, Ill.

111. Sprenger, Fred C.
709 Bigelow St.
Peoria, Ill.

112. Staudt, Albert J.
Fox Valley C. C.
E. River Road
Batavia, Ill.

113. Staup, Harry M.
412 So. 7th Ave.
Maywood, Ill.

114. Stewart,C. E.
7658 Calumet Ave.
Chicago 19, Ill.

115. Street, Don
703 Fairlawn Dr.
Urbana, Ill.

116. Stupple, William H.
543 Michigan Ave.
Highland Park, Ill.

117. T/Sgt. Frank J. Stynchula
Chanute Air Force Base
26 So. Parkway
Rantoul, Ill.

118. Tagliani, Leno
504 Monroe, St.
Charleston, Ill.

119. Tait, Dave
Elks Country Club
Paris, Ill.

120. Thode, Reuben H.
1853 Pine Rd.
Homewood, Ill.

121. Tregillus, C. A.
Argonne National Lab.
Lemont, Ill.

122. Vaughan, G. T.
601 W. Jackson Blvd.
Chicago, Ill.

123. Vaughan, John L.
601 W. Jackson Blvd.
Chicago, Ill.

124. Walraven, Robert J.
183 LeClaire
Tinly Park, Ill

125. Warnicke, M. J.
Evanston Golf Club
Evanston, Ill.

126. Warren, B. O.
Warren Truf Nursery
Palos Park, Ill.

127. Weidenfeller, Ted A.
E. I. Dupont Co.
St. Charles, Ill.

128. White, Maurice
1906 Indiana Ave.
Peoria, Ill.

129. Whittle, J. D.
East River Road
Batavia, Ill.

130. Wiersema, Ted
10359 S. California Ave.
Chicago 43, Ill.

131. Williams, Robert M.
Beverly C. C.
87th & Southwestern Ave.
Chicago, Ill.

132. Woehrle, Herman
Kankakee Valley C. C.
R. R. 3
St. Anne, Ill.

133. Wollenberg, Edwin
21707 Locust St.
Matteson, Ill.

134. Wylie, Harry
Carmi C. C.
R #4
Carmi, Ill.

Those Attending From Indiana

135. Ashworth, Victor
Lawn & Garden Center, Inc.
2311 Division St.
Evansville, Ind.

136. Barnhart, George E.
306 Chandler Ave.
Evansville, Ind.

137. Baker, Harry J.
1412 W. Main
Crawfordsville, Ind.

138. Bola, Lou
Highland Golf C. C.
Indianapolis, Ind.

139. Bond, Gene C.
316 E. Union
Liberty, Ind.

140. Bretzlaff, Carl
Meridian Hills C. C.
7099 Spring Mill Rd.
Indianapolis, Ind.

141. Buckley, Charles
317 S. Rotherwood
Evansville, Ind.

142. Bugh, M. L.
State Hy. Dept.
Landscape Division
Indianapolis, Ind.

143. Butler, Albert
R. #1
Springland Ave.
Michigan City, Ind.

144. Carter, Morgan F.
1010 Maxwell Lane
Bloomington, Ind.

145. Cavanagh, Max
3738 N. Euclid Ave.
Indianapolis, Ind.

146. Cler, W. F.
3026 Lower Huntington Rd.
Ft. Wayne, Ind.

147. Coble, Clem
New Augusta, Ind.

148. Coffin, H.
1810 Kentucky Ave.
Indianapolis, Ind.

149. Cooper, Frank
925 S. Leavitt
Brazil, Ind.

150. Coval, Pete
Ft. Wayne C. C.
R. R. 6 Miller Rd.
Ft. Wayne, Ind.

151. Curran, Leo
South Grove G. C.
5018 E. 11th
Indianapolis, Ind.

152. Daniel, H.
Dept. of Agronomy
Purdue University
Lafayette, Ind.

153. Davies, George
Parks, State of Ind.
Conservation Bldg.
W. Washington St.
Indianapolis, Ind.

154. Davisson, Herman T.
Municipal Golf
606 So. Grand
Indianapolis 19, Ind.

155. Dienhart, A. P.
Elks C. C.
913 Rosemont St.
Lafayette, Ind.

156. Duke, Robert M.
2361 N. Adams St.
Indianapolis, Ind.

157. Easter, Jim
410 S. Main St.
Monticello, Ind.

158. Ehlert, Kurt F.
301 Maryland
Indianapolis, Ind.

159. Elder, Bill
1296 Conner St.
Noblesville, Ind.

160. Esterline, Walter
Box 177, R. R. 3
Muncie, Ind.

161. Fust, Arthur
Campus Maintenance
Purdue University
Lafayette, Indiana

162. Gilley, Angus
R. R. 2
Connersville, Ind.

163. Gilbert, H. W.
Horticulture Dept.
Purdue University
Lafayette, Ind.

164. Glick, Russell
Michigan City G. C.
Michigan City, Ind.

165. Griener, C. E.
43 S. Delaware St.
Indianapolis, Ind.

166. Harvey, George
209 S. Main St.
South Bend, Ind.

167. Hjort, Carl H.
2224 Oriole Trail
Long Beach
Michigan City, Ind.

168. Hoffer, G. N.
Lafayette Life Bldg.
Lafayette, Ind.

169. Jacks, O. L.
Edwood Glen G. C.
R. R. 2
Lafayette, Ind.

170. Jacks, Dick, Jr.
R. R. 2
Lafayette, Ind.

171. Johanningsmier, E.
A. E. S.
Purdue University
Lafayette, Ind.

172. Keeley, C. R.
Rockne Bldg.
Univ. of Notre Dame
Notre Dame, Ind.

173. Kennedy, Richard
P.O. Bos 2542 Sta. A.
Indianapolis, Ind.

174. Lawson, Charles C.
Elks Country Club
526½ N. Arthur
Rushville, Ind.

175. Lamboley, H. T.
603 Walnut
Ft. Wayne, Ind.

176. Lee, O. C.
Dept. of Bot. & P.P.
Purdue University
Lafayette, Ind.

177. Lehman, Wilmer E.
436 Englewood
Ft. Wayne, Ind.

178. Loughlin, Wm. J.
Clearcrest C. C.
Evansville, Ind.

179. Manka, James F.
1016 Sterling
Indianapolis, Ind.

180. Mathews, Homer
241 Court St.
Sullivan, Ind.

181. Meetz, Ted
Michigan City G. C.
Michigan City, Ind.

182. Miller, Robert
1114 Liberty St.
Ft. Wayne, Ind.

183. Mitchell, Homer L.
902 W. McClurg
Frankfort, Ind.

184. Mott, G. O.
Dept. of Agronomy
Purdue University
Lafayette, Ind.

185. Neff, William J. L.
1620 173rd Street
Hammond, Ind.

186. Nugent, W. C.
Hazelden C. C.
Brook, Ind.

187. Ohlrogge, A. J.
Dept. of Agronomy
Purdue University
Lafayette, Ind.

188. Peterson, J. B.
Dept. of Agronomy
Purdue University
Lafayette, Ind.

189. Ozbun, Lee
Hartley Hills C. C.
Hagerstown, Ind.

190. Pion, Argel L.
Leo Road R. R. #1
Ft. Wayne, Ind.

191. Porter, Arnold
43 S. Delaware St.
Indianapolis, Ind.

192. Postlethwait, S. N.
2506 Rainbow Dr.
Lafayette, Ind.

193. Ranft, Harry C.
5325 College
Indianapolis, Ind.

194. Riley, William F.
2121 Madison Ave.
Indianapolis, Ind.

195. Salisbury, A. M.
445 So. Court St.
Crown Point, Ind.

196. Schacht, Robert
Country Club of Terre Haute
Terre Haute, Ind.

197. Schneider, E.
3810 Stringtown Rd.
Evansville, Ind.

198. Scobee, Marvin K.
5555 Grandview Drive
Indianapolis, Ind.

199. Sharvelle, Eric
A.E.S. Building
Purdue University
Lafayette, Ind.

200. Sheets, Carl E.
1735 Bayer Ave.
Ft. Wayne 6, Ind.

201. Sinninger, Jim
Campus Maintenance
Purdue University
Lafayette, Ind.

202. Snyder, Glenn
314 S. Richmond St.
Hartford City, Ind.

203. Soutar, Jim
Bloomington, Ind.
Supt. Bloomington C. C.

204. Spencer, Thomas M.
Huntington, Ind.
Supt. LaFontaine C. C.

205. Streltz, James D.
Box 238, R. R. #1
Indianapolis, Ind.

206. Stonehill, Dorsey
Hazeldon C. C.
Brook, Ind.

207. Van Scoik, Wm. S.
1018 Maxine St.
Ft. Wayne, Ind.

208. Vaughn, H. J.
1016 Parker Ave.
Indianapolis, Ind.

209. Vionoff, Samuel
Dept. of Phy. Educ.
Purdue University
Lafayette, Ind.

210. Whitcomb, James
4823 Atwell Dr.
Indianapolis, Ind.

211. Whitfield, J. Sidney
4525 Cold Springs Rd.
Indianapolis, Ind.

212. Wright, Leland
1125 Lincoln Ave.
New Castle, Ind.

213. Wysong, Al
R. R. #1
Monticello, Ind.

214. Yablonowski, Walter
Cedar Lake Golf Club
Box 141
Cedar Lake, Ind.

215. Yaw, Lowell D.
1219 Prospect
Mishawaka, Ind.

216. Dowell, E.
Lafayette C. C.
Lafayette, Ind.

THOSE ATTENDING FROM KENTUCKY

217. Boggs, Morgan
3532 Woodruff Ave.
Louisville 8, Ky.

218. Bohne, C. O.
1609 Ellwood Ave.
Louisville, Ky.

219. Grant, Gilmore
Audubon Country Club
3265 Robin Road
Louisville 13, Ky.

220. Haywood, Freeman
Box 2022
River Road C. C.
Louisville, Ky.

221. Kirchdorfer, Joe
922 Baxter Ave.
Louisville 4, Ky.

222. McDermott, Joseph
1933 Brownsboro Rd.
Louisville, Ky.

223. Phillips, Raymond
Louisville Country Club
Louisville 6, Ky.

224. Stevenson, Robert H.
River Road C. C.
2117 Village Drive
Louisville, Ky.

THOSE ATTENDING FROM MICHIGAN

225. Anderson, Benk
1585 Apple Lane R. #3
Pontiac, Mich.

226. Bertoni, Andrew A.
Meadowbrook C. C.
Northville, Mich.

227. Bishop, Leo
630 North Union
Tecumseh, Mich.

228. Cornwell, Ward
1358 Anita
Groose Point, Mich.

229. Elphick, F. C.
8165 McKay Court
Utica, Mich.

230. Fauteck, Bob
503 Brown
Birmingham, Mich.

231. Forton, Stephen
220 Country Club Dr.
Grosse Point, Mich.

232. Godwin, H. H.
22366 Grand River
Detroit 19, Mich.

233. Goodrich, Ford
246 East Eddington
Flint 3, Michigan

234. Gridley, Owen
Chikaming C. C.
Lakeside, Mich.

235. Heiermann, John
315 N. Portage
Buchanan, Mich.

236. Hill, Stanley R.
42406 Huron River Dr.
Belleville, Mich.

237. Hurst, Robert G.
1252 S. State
Ann Arbor, Mich.

238. Klomparens, Wm. Dr.
Research Pathologist
Upjohn Company
Kalamazoo, Mich.

239. Leitch, George E.
14377 St. Mary's
Detroit, Mich.

240. Maloney, H. J.
2922 Duchess Drive
Kalamazoo, Mich.

241. Milne, William W.
7560 Oakley Park Rd.
R. R. #2
Walled Lake, Mich.

242. Nye, Morton E.
1904 W. Mt. Hope Ave.
Lansing, Mich.

243. Peck, Harold
Battle Creek C. C.
Battle Creek, Mich.

244. Peck, Leslie
2858 Lake Lansing Rd.
East Lansing, Mich.

245. Peck, Roy
1609 Wites Rd.
Kalamazoo, Mich.

246. Pohlman, Spencer C.
38th Street
Woodstock Golf Club
Indianapolis, Ind.

247. Prieskorn, Harold C.
4535 Brighton Road
Brighton, Mich.

248. Prieskorn, Robert
721 Venoy Rd.
R. R. #5
Wayne, Mich.

249. Ruess, Edward
Gateway Golf Course
Western Mich. College
Kalamazoo, Mich.

250. Savage, Philip J. Jr.
817 Symes St.
Royal Oak, Mich.

251. Slack, Wm.
University of Michigan
Athletic Grounds Supt.
Ann Arbor, Mich.

252. Snyder, Mark
Box A
Ypsilanti, Mich.

253. Stryd, Abraham
825 Lake Street
Kalamazoo, Mich.

254. Swank Jr.
Upjohn Co.
Kalamazoo, Mich.

255. Taylor, Herbert
17340 Kentfield
Detroit, Mich.

256. Teuber, Robert
756 Elizabeth St.
Flint 4, Mich.

257. Thomas, Gerald E.
7322 Portage
Kalamazoo, Mich.

258. Watknis, Wesley
Marywood Country Club
R.F.D. #3
Battle Creek, Mich.

259. Wolfrom, Clarence
11341 Chicago Rd.
Warren, Mich.

260. Wylie, Samuel H.
6561 Warren Rd.
Ann Arbor, Mich.

THOSE ATTENDING FROM MISSOURI

261. Bauman, Leo S.
720 Olive Street
St. Louis 1, Mo.

262. Cosby, Charles E.
3600 N. Second
St. Louis, Mo.

263. Griesenauer, gregory J.
3938 Potomac St.
St. Louis 44, Mo.

264. Guyer, Ralph
631 S. Berry Rd.
Webster Groves 19, Mo.

265. Hayes, Thomas V.
8224 Washington
St. Louis, Mo.

266. Holmes, James L.
Mallinchrodt
St. Louis, Mo.

267. Lammert, Joseph F.
7650 Lammert Lane
Normandy 21, Mo.

268. Lambert, L. E.
7241 Paseo
Kansas City, Mo.

269. Linkogel Albert Jr.
Link's Nursery, Inc.
Route 3, Conway Road
Creve Coeur, Mo.

270. Linkogel, Albert
Route 3, Conway Road
Creve Coeur, Mo.

271. Longheinrich, Alfred
Rt. 23
Affton 23, Mo.

272. Lyle, Samuel
101 Robert Avenue
Ferguson 21, Mo.

273. Maschmidt, Fred W.
Normandie Golf Course
St. Louis 14, Mo.

274. Meisel, Lawrence J.
48 Frontenac
Clayton, Mo.

275. Michael, Avon L.
5032 Murdoch
St. Louis, Mo.

276. Ott, Wm F.
R. #1 Box 249
Manchester, Mo.

277. Parsons, M. M. Sr.
Algonquin Golf Club
Webster Grove, Mo.

278. Parsons, M. M. Jr.
Algonquin Golf Club
Webster Grove, Mo.

279. Plein, Clarence
1139 Hilltop Dr.
St. Louis 14, Mo.

280. Ragan, Walter
703 Nirk Ave.
Kirkwood, Mo.

281. Schmatzmeyer, August H.
417 Shirley
Ferguson 21, Mo.

282. Sehrt, Ralph W.
Manchester
Missouri

THOSE ATTENDING FROM OHIO

283 Baker, Stuart A.
P.O. Box 55
Dayton View Station
Dayton, Ohio

284. Benvie, George R. Sr.
5168 Paddock Road
Cincinnati 37, Ohio

285. Bishop, Dale E.
R. R. #2
North Canton, Ohio

286. Bishop, Lester L.
Edgewood Golf Club
R. R. #2
North Canton, Ohio

287. Bloch, Alfred
6936 Miami Road
Cincinnati 27, Ohio

288. Boone, Howard
Box 455 Cameron Rd.
R. R. #2
Cincinnati, Ohio

289. Boyd, Mavor S.
16 Green Valley Dr.
Dayton 3, Ohio

290. Boyd, Taylor
Box 21, Station M
Cincinnati 27, Ohio

291. Cohee, B. K.
5605 Montgomery Rd.
Cincinnati, Ohio

292. Dettling, T. J.
43 E. Market St.
Akron, Ohio

293. Dryfoos, Sidney L.
3108 Mayfield Road
Cleveland 18, Ohio

294. Dunlap, Frank
902 Caledonia
Cleveland 12, Ohio

295. Dunn, Robert J.
101 Oregon Ave.
Warren, Ohio

296. Fannin, John
21117 Kinsman Rd.
Cleveland, Ohio

297. Fink, Ollie E.
1379 North High St.
Columbus, Ohio

298. Graves, Stan
22625 Detroit Rd.
Rocky River, Ohio

299. Gruber, Calvin
R. R. #1 Demper Rd.
Sharonville, Ohio

300. Hart, Jack
727 David Road
Dayton, Ohio

301. Hazlett, Leonard L.
28200 Kinsman Rd.
Cleveland 22, Ohio

302. Hocker, Orville L.
1824 Coventry Road
Dayton 10, Ohio

303. Huber, Lawrence
1985 Zollings Road
Columbus 12, Ohio

304. Jones, Robert H.
103 W. State
Athens, Ohio

305. Lentz, Joe
740 W. 6th Street
Marysville, Ohio

306. Lindenschmidt, Robert L.
1513 Dana Ave.
Cincinnati, Ohio

307. Likes, Don
3659 Brotherton Rd.
Cincinnati 9, Ohio

308. List, Marcus E.
70495 Convent Blvd.
Sylvania, Ohio

309. Lyons, William E.
1843 Glenmount
Akron 19, Ohio

310. McCoy, John S.
2501 Bedford Ave.
Cincinnati 8, Ohio

311. McElroy, Nathan E.
2202 Perry
Lima, Ohio

312. McLaren, Malcolm
1518 Warrensville Center Rd.
Cleveland 21, Ohio

313. Mendenhall, Marion
Kenwood Country Club
Sta. M. Madisonville P.O.
Cincinnati 27, Ohio

314. Packer, Edward J.
34 A Compton Rd.
N. C. Hill
Cincinnati, Ohio

315. Plent, Richard A.
4830 Lee Road
Cleveland, Ohio

316. Plent, Richard A. Jr.
5041 Lee Rd.
Maple Heights, Ohio

317. Poole, Tom
Jacobsen-Mower Co.
Cleveland, Ohio

318. Reynolds, A. J.
Miami Valley Golf Club
Dayton, Ohio

319. Reynolds, Dick
3300 Wheibanther
Dayton, Ohio

320. Rinaldi, Anthony
1623 Sunview Road
Cleveland 24, Ohio

321. Rinaldi, Ludwig R.
1623 Sunview Road
Cleveland 24, Ohio

322. Runyan, C. R.
4709 Winton Rd.
Cincinnati 32, Ohio

323. Sedmak, Stephen E.
860 Pierce Ave.
Columbus, Ohio

324. Schornack, Allen
128 W. Melrose Ave.
Findlay, Ohio

325. Shock, Earl
2560 Berkley Dr.
Dayton 9, Ohio

326. Smith, Colin
19512 Kings Highway
Warrensville Height, Ohio

327. Sylvester, E. J.
Box 133, R. R. #2
Piqua, Ohio

328. Toole, Arnold E.
104 W. Colling
Oxford, Ohio

329. Trapp, Lou E.
222 Corona Ave.
Dayton, Ohio

330. Walker, Curtis A.
5212 Lee Road
Maple Heights, Ohio

331. Walling, Robert E.
16119 Oakhill Rd.
East Cleveland 12, Ohio

332. Willcox Ward W.
827 N. Main St. Box 437
Piqua, Ohio

333. Wolfe, Larry
Rosemont Country Club
R. R. #7
Akron, Ohio

334. Wright, Alph
1586 Covered Bridge Rd.
Cincinnati, Ohio

335. Yesberger, Earl F.
5840 Canterbury Rd.
North Olmsted, Ohio

336. Young, O. W.
1130 Stroop Road
Dayton, Ohio

THOSE ATTENDING FROM WISCONSIN

337. Becker, Richard
Walworth
Wisconsin

338. Berg E. E.
3210 S. Wollmer Rd.
West Allis 14, Wis.

339. Bruden, C. O.
Bur Oaks Golf Course
21 E. Gorham Madison
Wisconsin

364. Kaufman, James
Toro Mfg. Corp.
1463 Ashland Avenue
St. Paul, Minnesota

365. Keen, Ray A.
R.R. #5
Manhattan, Kansas

366. Kolb, John L.
Toro Mfg. Corp.
Minneapolis, Minn.

367. Johnson, Norman
6173 Mercer Circle
Jacksonville, Florida

368. Mendenhall, Chester
8039 West 80th
Overland Park, Kansas

369. Nelson, Roy W.
2621 Jersey Avenue
St. Louis Park

370. Pickett, W. F.
Department of Horticulture
Kansas State College
Kansas

371. Ruthven, W. H. C.
Box 118
Alliston, Ont., Canada

372. Updegreff, W. E.
1022 N. Roosevelt
Wichita, Kansas

373. Zimmerman, W. E.
American Cyanamid Co.
150 Overlook Terrace
Bloomfield, New Jersey

374. Woehrle, Theodore
Kankakee Valley C.C.
R.R. #3
St. Anne, Illinois

375. James Cooper
1586 Covered Bridge Road
Cincinnati, Ohio

376. Lewis, Owen
Cary Hall
Purdue University
Lafayette, Indiana

377. Reed, H. J., Dean
School of Agriculture
Purdue University
Lafayette, Ind.

GRASS LEAVES AT WORK

Dr. S. N. Postlethwait
Purdue University

Grass leaves perform many functions but their most important work unquestionably is that of trapping light energy from the sun and converting it into a chemical form. This energy, in a chemical compound, can be stored, transferred to other compounds or altered variously to suit the needs of the grass plant. If the grass plant is used for food, this energy is made available to the consuming organism. Only a few kinds of bacteria have been able to store energy by making organic compounds from simpler substances and man is still at a loss to duplicate the process. Since the existence of all living organisms depends upon a source of energy for all of life's activities, such as growth, reproduction and differentiation, this ability of green plants to combine carbon dioxide and water in the presence of light into an energy-containing organic compound is incontrovertibly the most important process on earth. This process is called photosynthesis (photo, light; synthesis, putting together).

Photosynthesis is a complex, many-step process with many intermediates being produced; however, for convenience of discussion, a simple sugar (glucose) and oxygen are generally considered the end products. It has been estimated that all the world's plants produce about 270 billion tons of sugar each year. In terms of trapped energy this would be about 100 times greater than the total energy which would be released by burning all the coal mined on earth during the year.

What do plants do with all of this energy? This is only the beginning of the synthetic processes which occur in green plants. The compounds which make-up the structure of plants have their beginnings from some of the intermediate compounds or sugar produced in the photosynthetic process. Proteins, fats, oils, gums, waxes, cellulose, chlorophyll, vitamins and hormones--to name only a few--result from a further modification of sugar or a photosynthetic intermediate. Many of these energy-containing compounds are preserved within the plant for its future use in initiating new growth, building new tissue, or combating unfavorable conditions. Some are stored in the seeds or fruit to assist the next generation until it is able to trap energy for itself.

The synthesizing of the more complex compounds also requires a measure of energy. This energy is provided by the respiration of the photosynthetic products. Oxygen too, is a significant by-product of photosynthesis. Aerobic respiration, which releases energy to plants and animals, involves the use of oxygen. Therefore, if grass leaves were of no other value than for photosynthesis alone, they still would be indispensable.

Two raw materials which are abundant in the plant's environment play a vital role in photosynthesis. These are carbon dioxide and water. The air is composed only of approximately .03% carbon dioxide, yet the supply, will not be depleted because of the amount replaced by the respiration of all plants and animals. When the concentration of carbon dioxide within the leaf is lowered by the combining of carbon dioxide into sugar, more carbon dioxide diffuses into the leaf from the surrounding air. Water absorbed from the soil moves through the root and stem to the mesophyll cells of the leaf. Only a small percentage of the total water moving through the plant is used for photosynthesis.

A Belgian philosopher in the sixteenth century planted a willow shoot weighing 5 pounds in a tub of soil weighing 200 pounds. After growing it for 5 years, he found the willow weighed 164 pounds yet his soil only weighed 2 ounces less. The reason, of course, is that water and carbon dioxide were the raw materials from which most of the plant constituents were made.

We must not minimize, however, the important role played by many other elements in the growth processes. Nitrogen is an important part of proteins, iron aids in chlorophyll production, phosphorus is involved in energy transfer, potassium is necessary for sugar translocation, and many others. Many complex processes occur in plants all interdependent on each other.

As one examines the structure of the leaf, it becomes obvious that its design is remarkably favorable to the work of trapping the sun's energy. The long, flattened grass blade intercepts a maximum of sun's rays with a small volume of protoplasm, thus making efficient use of the living tissue. Reduction in the are of the plant exposed to light reduces the plant's capacity to produce food and the large chain of other compounds synthesized with the plant. This is important to remember when grass is clipped short.

A microscopic examination of the leaf reveals many intricate specializations which enhance its efficiency in the photosynthetic process. The innermost tissues, called the mesophyll, and vascular bundles, are sandwiched between an upper and a lower epidermis. The epidermis is overlaid by a waxy coating called cuticles and is perforated by pores called stomates. These stomates are flanked by two cells called guard cells. Changes in tugor pressure can bring about a movement of the guard cells in such a way as to open and close these pores. The cuticle makes the epidermis pracically impervious to gases, therefore, most exchanges of carbon dioxide and oxygen occurs through the stomates. Water loss, though apparently not profitable to the plant, also occurs through the stomates.

The mesophyll is composed of a group of loosely associated cells containing chloroplasts. It is in this tissue that the photosynthesis reactions occur. The chloroplasts are small chlorophyll containing bodies which are floating in the cytoplasm of the cell. The pigment, chlorophyll, is green in color and is composed of carbon, hydrogen, oxygen, nitrogen and magnesium. A plant deficient in nitrogen or magnesium, therefore will lack green color. Iron is a catalyst or aid for chlorophyll production. Consequently a deficiency in iron will cause a plant to be lacking in green color. There is no food production in non-green leaves.

Large intercellular spaces in the mesophyll provide an extensive area for gas exchange within the leaf. It has been estimated that the internal surface exposed may be as much as 7 to 30 times as much as the total epidermal surface. This large amount of area is necessary for a rapid rate of photosynthesis. However, it also results in much water loss. The vascular bundles ramify the mesophyll and provide a pathway for water supply and a pathway for carrying food to storage areas such as in the roots, stems, fruits and seeds. Specialized cells enable the mesophyll to perform its task efficiently.

Other functions of the leaf are so dwarfed by photosynthesis that a mere mention of some of them will suffice here. Transpiration cannot be ignored even though its significance is questioned. Many consider it a necessary evil. Most of the leaf specializations which aid in photosynthesis tend to increase transpiration. The stomatal closing, the cuticle, and the motor cells of the upper epidermis which make the leaf curl, all tend to reduce water loss. Food storage--though pretty much of a temporary nature--is an important work, especially to those who are concerned with the use of grass as feed. Leaves also serve as receptors for stimuli which affect flowering. Under the influence of appropriate photoperiod and temperature, leaves apparently produce a "flowering hormone" which will cause vegetative meristems to alter their course of development and produce flowers. Other leaf functions could be noted, but this includes most of the more important ones.

Grass leaves may be very small individuals but on them depend the vigor and rooting of turf areas. Many experiments have shown that a depletion of the leaf surface is quickly reflected in a reduction in root growth and root absorption. Also, many diseases may kill older leaves, such as leafspot of bluegrass, then the new leaves if cut short give little carbohydrate production. Leaves at work can be understood to mean the entire plant at work for it all depends on leaves.

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SEED SUPPLY AND PRICES

Gager T. Vaughan, Secretary
Vaughan Seed Company

The seed supply and price picture today is more topsy-turvy than it has been in many a year. So many of the grasses that we are accustomed to using in large quantities in our turf programs in the northern part of the country are in short supply in comparison with the consumption of these grasses in the past few years.

May I cite a few figures to show the situation at present. These are compiled from government estimates on production from 1953 crops and trade figures on carry-over seed on June 30, 1953. The first column shows the amount consumed from June 30, 1953 to June 30, 1953, and the second shows the amount available for consumption between June 30, 1953 to June 30, 1954. In the latter there is an allowance figured on the amount of seed that probably will be imported:

	Total Usage Year Ending June 30, 1953 (million lbs.)	Totalavailable for year ending June 30, 1954 (million lbs.)
Kentucky Blue Grass	23.5	11.5
Chewings Fescue	3.6	6.5
Creeping Red Fescue	4.6	11.2
Red Top	8.8	4.2
Bentgrass	2.1	3.5
Poa trivialis	2.8	3.5
Perennial Rye Grass	16.0	21.6
	61.4	62.0

At first glance at the above figures, one would assume that the total supply available of the above grasses would be ample, but the above figures do not take into consideration the amount of seed normally carried by the trade on June 30 for the early fall trade - seed that must be carried over as many of the above items are not harvested soon enough to be available for the grass business in August and September. Last year the figures carried by the trade were the lowest in many years and yet this distributed amongst hundreds of dealers throughout the country amounted to about 12 million pounds of the above seeds, so theoretically we have a shortage of close to 12 million pounds of the above grasses if the demand were equal to last year.

I have not used common ryegrass in the above tabulation because we don't know exactly how much of this seed is used in the north for lawn purposes and it would tend to confuse the picture. Roughly there was a reduction of 30% in the supplies this year, but because of the drought in the south, a great deal lesswas used this past fall and so I would estimate the amount available for lawn usage as about the same as last year.

Potentially the demand looks greater than last year. The amount of home building has shown no appreciable decrease and there was a severe drought in a wide area of the country where the above grasses are primarily used, so that a great many lawns are in very bad shape.

To make matters a little worse, because of this drough, production outlook at the moment is not bright, for Kentucky bluegrass and redtop unless we get lots of rain in these areas this spring to bring back these fields - the outlook on the other grasses, however, is satisfactory.

In regard to the price situation, this being a free economy, the law of supply and demand has taken over and for instance bluegrass, where the supply is a little less than half used last year, the price is slightly more than double.

On redtop, although the supply is only half of last year, the price has not doubled. As it is not as basic a grass as bluegrass, substitutes can more easily be found, but the price has increased about 75%.

On the fescues - while there has been a very large increase in the available supplies and theoretically the prices should have come way down from last year - there has only been about a 10% to 20% drop. The reason is fescues are being substituted for bluegrass and redtop in many cases.

Poa trivialis, while more available than last year, has actually increased in price for the same reason as there are many using it as a substitute for bluegrass, although its use in a sunny lawn as a substitute for bluegrass is questioned.

On the bentgrasses, prices are about similar to last year although there is some increase in supply, but here again more is being used to take the place of bluegrass and redtop. Prices on bent are very similar to redtop today, which is a very unusual situation.

Ryegrass prices are slightly higher than last year, but it is still relatively a very cheap grass.

You might well ask the question, "If there is a 12 million pound shortage of grasses what will we do for lawn seed in April and May?" I believe that the prices situation will take care of this problem. That is, there has been such a large increase in price that it will curtail the use of lawn seed and it will be used more sparingly. Generally people plant much more seed than is needed and when the price gets high enough they become much more careful in sowing the seed, so I believe if you can pay the price you will be able to take care of your requirements.

The squeeze on being able to buy seed, if it occurs, will most probably occur in June, July and early August just prior to new crop coming onthe market.

In regard to some of the new grasses like Penn State Fescue, Illahee Fescue and F-74 Fescue, there seems to be ample production of these items at the present price level.

In regard to Merion bluegrass - limited supplies are available for the first time for spring plantings this year. I believe we are over the hill as far as production on this item is concerned and gradually the price will recede. It has been a terrific job to get growers on the West Coast to grow Merion until now. But now that a few growers have gotten good results-they are all climbing on the band wagon. Production this past year was around 400,000 pounds and with luck we may have 800,000 pounds or more this year. Up until now every increase in production was met by an increase in demand. By next year we may be able to reduce prices somewhat in order to increase the volume and match this increase in production.

The potential use of Merion is hard to estimate, but it would surprise me very much if this country isn't producing 5 million or more pounds by 1960 and this figure is probably on the conservative side. Besides that now selections of grasses can be expected to be produced by research activities which will present an ever changing market in turf grasses in the future.

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"HOCUS-POCUS" IN GRASS BREEDING

Glen W. Burton
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The layman may see nothing more than "hocus-pocus"in the achievements of the plant breeder. Sometimes the changes are almost as striking as those performed by the magician. Back of these changes, however, are scientific knowledge and planning. Days, and often years, of tedious work have gone into the development of most of the improved varieties of plants used today. The story of the development of Tiflawn and Tiffine turf bermuda grasses will illustrate how the grass breeder applies his "hocus-pocus" in the interest of better turf.

To get the complete story back of Tiflawn, one must go back to 1929 when J. L. Stephens, walking through a cotton field on the Experiment Station property, notices an unusually tall-growing bermuda grass plant that had escaped the cultivator. It looked so good that he brought it into the grass nursery, increased it, and named it Tift bermuda. In 1937 Tift bermuda became one of four parent plants used in a hybridization program designed to develop a superior pasture bermuda. Some 5,000 seedling plants (the product of the hybridization effort) were spaced 5 feet apart in each direction in the field in 1938. They were kept separate during 1938 and each developed a good sod. One of those hybrid plants that had Tift bermuda as the female parent was later to become the Costal bermuda that has proven its worth for hay and pasture purposes. Another plant that had Tift bermuda as its female parent was a dwarf that failed to produce any heads in 1938. Again in 1939, this plant carrying the number 12, produced no heads and made a very attractive sod with no mowing. The possibility that this plant might make a lawn that would require no mowing was at once suggested and several Tifton lawns were planted to it. The next two years proved that number 12 was not aggressive enough to be a good lawngrass. It was heavily diseased during wet periods and a three-year old sod that had not been mowed died out badly.

In the summer of 1952, a plot of number 12 that was surrounded by disease-resistant hay-type bermudas produced a few seedheads. All of the heads were harvested and the seeds from them gave rise to 100 plants that were planted 8 feet apart each way in the spring of 1943. A number of plants of number 12 were also included in this planting as checks. A study of these plants soon revealed that many of them were hybrids and the hybrids were more disease resistant and more vigorous than number 12. By the fall of 1943, there were well sodded 7-foot square blocks of each plant. The extra duties of war work caused this and a number of other plantings to be set aside with no attention.

When Dr. Fred Grau urged that a Turf research program be started at Tifton, a test to evaluate different selections of bermuda grass was one of the first things agreed upon. That was in the summer of 1946. A request sent out to golf clubs in the south for superior plugs of sod from greens brought in a number of plants. Some of the by-products of the pasture bermuda breeding program, including number 12, were added. The 1943 planting of number 12 hybrids that had been forgotten for 3 years was also examined. Most of these plants had died out almost 100 percent. The lack of fertilizer and care had taken its toll. Twelve good plants were finally found and several of them were still making a remarkably good sod. These were added to the others and all were set out in the turf gardens in the spring of 1947. One of these twelve carried the number 57 and became what is now known as Tiflawn Bermuda.

During the next three years more than 100 bermuda grasses, including 57, were compared under golf green and fairway management. Ratings on such characters as disease resistance, density, weed resistance, rate of recovery after the transition period, playing quality and aggressiveness were recorded on 40 different occasions. When all of these ratings were added together, number 57 had the best score of any bermuda in the test and was released under the name Tifton 57. Later when a shorter name was required for agronomic registration, it was named "Tiflawn".

Reports from the hundreds of people across the South indicate that it is tops among the bermudas for lawns, parks, football fields, tees and fairways.

In an effort to develop a finer, softer bermudagrass for putting green use, Tiflawn was hybridized with a very fine-leafed, disease-susceptible bermuda from South Africa. This procedure involved the hybridization of two different species with different chromosome numbers. Although more difficult to make than previous hybrids, 89 were finally produced. All of these were triploids and were completely sterile. The best of them, combining many of the desirable characteristics of both parents, was released under the name "Tiffine". It approaches its Tiflawn parent in aggressiveness, disease resistance, and tolerance of ryegrass overseeding. It is softer and much finer than most other bermudas, including Tiflawn, and, consequently, is superior for putting green use.

Both Tiflawn and Tiffine must be propagated vegetatively. The rapid increase and wide use of both of these bermudas indicate that this method of propagation imposes no great handicap upon them. Both grasses have survived as far north as the Ohio River. It is doubtful, however, if they can be successfully grown much farther North. By hybridizing our best turf bermudas with a strain that has survived the winters at St. Paul, Minnesota, it should be possible to increase materially the cold resistance of good turf bermudas.

Call it "hocus-pocus" if you will. To me, it is the grass breeder's method of solving turf problems and rendering service to his fellow man.

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TECHNIQUES AND TURF QUALITY

Fred V. Grau, Agronomist
West Point Products Corporation
West Point, Penna.

There seems to be no reasonable doubt, but that we are in the machine age in turfgrass production. The business of developing techniques and turf quality involves the use of new products and new techniques. Each new machine requires the development of special techniques to operate that machine satisfactorily on highly specialized turfgrass areas. The most important factor in the development and use of new products and the development of new techniques is the man in management, who is the superintendent. He's in a particularly strategic position because everyone who uses the golf course, looks to him for virtual perfection.

This brings us to the question of "What is Turf Quality". In my book the degree of quality to which we aspire and to which we can attain is perfection. It is just as simple as that. We will not have reached our goal if we stop trying short of perfection. Once having achieved that enviable goal, it will require even more careful techniques to maintain perfection in the face of all the difficulties which beset the superintendent and the grasses with which he works.

Turf quality, to a superintendent, will mean one thing. He may consider quality turf one which is dependable and trouble-free and easy to maintain. Turf quality to the player, may mean quite a different thing. The player may place particular emphasis upon density, firmness, resilience and close mowing. Playing quality then, is the thing that attracts the player. Turf quality, to a spectator, may mean primarily green color. In addition, smooth uniformity is attractive whether the turf be green or a golden-brown. Thus the different values, each will have a different approach. The superintendents attitude is the most important. Because to a large degree he can provide the qualities which both the players and the spectators enjoy. It is not a simple thing to achieve all of the various goals for the different ones who enjoy the turf.

The techniques of producing high turf quality revolve primarily in keeping all of the growth factors in balance, at a high level, and eliminating or reducing to a minimum those things which tend to destroy quality. We cannot say that high summer temperatures destroy turf quality, because while they may do this to one particular grass, they would be most favorable to another type of grass which enjoys heat. We cannot say that heavy wear will destroy the quality in turf, whereas it may do this with a weak unadapted grass, but it may actually improve a strong vigorously growing grass, which would tend to become undesirable unless it were used heavily and frequently. Again, there is no simple way of achieving turf quality, but all factors must be considered and kept in balance.

Mowing as a technique in developing turf quality is a most important factor. Grass must be mowed in order to produce high quality turf as we know it. In general, other things being equal, the more frequently a turfgrass area is mowed, the higher will be the turf quality. At the same time, more frequent mowing produces more compaction and therefore the turfgrass areas must be aerified more frequently. High turf quality demands skillful, generous fertilization. This produces more growth and possibly encourages more disease in certain types of grasses, requiring the use of chemicals, insecticides, and many other things. It is becoming adequately realized that as turf becomes denser, which is a quality we all admire, it is more difficult for the clippings to disappear, because they do not work down into the turf, as they did when the turf was open. This creates a special problem and introduces the necessity for new products and new techniques.

The devices for measuring turf quality are oddly lacking. True, the science of turfgrass research is quite new compared to other agricultural pursuits. The measurement of an abstract quality is difficult indeed. For instance, we might ask the question, "how high will a football player bounce when he is thrown on the turf?" This implies springiness or resilience, as one of the foremost qualities of athletic field turf. Another measurement of quality is, how successfully can a golfer hold a well played shot on a dry putting green. We know that on some dry putting greens the ball will bounce 30' into the air and disappear into the bushes beyond. However, on a putting green composed of superior grasses, frequently aerified to produce a resilient root cushion, a golfer can stop a well played shot on this kind of a green, even when it is dry. This would imply better turf quality in the latter instance.

Another measurement of quality is the occurence of disease and the presence of weeds. Superior turfgrass, properly managed to produce higher quality turf virtually weed free. Insect injury is minimized with superior grasses, adequately fertilized, and well managed in all other ways. One might measure quality by the length of time it takes for scars to heal, such as on a one shot hole on a golf course. Here we need grasses that heal rapidly and that are tough and deep rooted, otherwise we cannot achieve high turf quality.

The devices for producing turf quality are as varied as the methods in which one might measure quality. We have had many types of hand implements, rakes, brushes, combs on mowers, spikers, tubular tine machines, drilling machines, coring machines and aerifying machines. Each machine has served a useful purpose and each performs a useful function. Most recently, in addition to all these other devices, which have been designed to help us produce turf of excellent quality, we have had the new principle of vertical mowing added. We have had excellent improvements in irrigating devices, irrigation systems, mowers, tractors and other mechanical devices aimed to do the job more effectively and more efficiently. When all is said and done, all of these devices mean nothing, unless the man and the men in management, are fully acquainted with the proper use of each device. They must know frequency of use and use in relation to the conditions existing at the site.

The Kodachrome slides which followed included these features:

Turf Quality in Montreal, for example, is influenced tremendously by summer temperatures. A large part of the year the temperatures are so low that there is no plant growth and indeed the ground is covered with snow so that regardless of turf quality, the turf would serve little useful purpose. In South Africa, the emphasis is on grasses that are resistant to heat and drought and able to survive the extreme conditions. In Miami where temperatures are favorable and rainfall is frequent, the emphasis is on fertilization to maintain turf quality and more recently, improved grasses. In Kansas City and St. Louis, where crabgrass is such a problem, here the emphasis is on any device that will help to eradicate this bane of the superintendent's existence. In Salt Lake City, and Thunderbird, California, water is essential to producing turf quality. But, too frequently water is used in excess and in an effort to replace other factors in producing turf quality.

Slides which were shown included terrific disease on the greens at Columbia Country Club. Disease was encouraged by a heavy mat which now can be prevented by the frequent use of vertical mowing devices.

Buckhorn is a thing of the past when 2,4-D is used. At Merion Golf Club in the early days, they used to grind tobacco stems in tandom hammer mills. Today that is a thing of the past with Chlordane, Aldrin, Dieldrin, and other modern insecticides. The clover fairways that we used to see no longer are with us when 2-4-5 T is used, and when adapted grasses are introduced and properly managed. The old brush used at the Elk Country Club, Ridgeway, Pennsylvania, is an example of one of the devices attempting to produce turf quality.

In Oklahoma City, we see putting greens that are feverishly being patched and repaired for championship play. Then the next one is of a C-7 bent nursery plugged heavily, setting the plugs into putting greens for introducing this new superior grass into the greens without interrupting play, improving quality, the meanwhile. There is a picture of zoysia plugs being removed. Then four pictures of plug repair on putting greens, showing how a scar can be removed and a new plug from the improved sod nursery inserted in its place. More pictures of C-1 C-9 combination turf plugs being set into greens without interruption of play and without inconvenience to the players.

Turf Quality at Los Angeles Country Club showed a beautiful putting green with Merion bluegrass in a broad band around the putting green, and tall fescue on the slopes of the green for rough areas. Then there is a picture of Joe Valentine and Merion bluegrass. Merion bluegrass has meant better turf quality for many tees over a large part of the country. The roots of Merion bluegrass were shown at Davis, California, and then U-3 bermudagrass with six foot deep roots at Davis. Here again we are introducing a quality in turfgrass, the like of which we have seldom seen before. Merion bluegrass at Michie Stadium in New York, showed the quality of Merion. Beaver Field, Purdue University, Stanford University, Iowa State, all of them proving that the superior turfgrasses make it easier to produce superior turf quality. In addition the use of modern aerifying devices, sensible watering and adequate fertilization are needed to improve turf quality. Then there was a picture of Merion seed-hay-mulch being used to establish a superior turf. Musser with his bluegrass and his point quadrat. Then three slides of crown vetch showing how this remarkable legume can produce higher quality cover on many slopes where it is difficult to grow any other kind of plant. Several slides then of Merion compared with common bluegrass. A most striking demonstration of superior turf quality with a superior turfgrass.

Then the thickness of cutting sod one half inch and better than two inches. Then the ability of new improved fescues to resist clover. The greater tolerance to drought and heat of Kentucky 31 fescue at Penn State. Tall fescue in the roughs at Southern Hills and at Oklahoma City.

The effect of dull mowers and fertilizer burn as affecting turf quality. Tree roots in Montana. The use of saw dust as an organic soil ammendment in Tifton. And then the negative affect on turf quality by the practice of flooding fairways in the southwest. The effect of caddy carts on turf quality and the need for more study on this phase, which gradually seems to be gaining ground, especially with the golfers.

The need for adequate turf nurseries wherever improved grasses are being introduced.

The high quality of bermuda fairways such as we find in Southern Hills and Memphis Country Club, and other places. Honeycomb soil and then a couple of pictures of bad tees--over-watered, heavily compacted, badly in need of aerifying. Then the effect of aerifying on athletic fields and helping to produce higher turf quality. In the Rose bowl, at Berkeley Stadium, showing the compact zone in the soil, and how it defeats the very things we want to do, such as seeding and fertilizing and watering to produce excellent turf-quality.

There followed several pictures of lawns in Washington including the author's lawn, between 1947and 1951.

And how new devices such as Milarsenite, which is no longer being made, has greatly effected turf quality on fairways and other turfgrass areas. Then how hand weeding of goosegrass and crabgrass on putting greens completely destroys turf quality, whereas modern devices like vertical mowing equipment and chemicals can remove these pests without interfering with the putting quality. Finally, since many people associate green color with turf quality, we see a gradual increase in the use of vegetable dyes, in order to provide green color on such excellent turfgrasses as bermuda and zoysiz, which normally become golden brown during the winter, which is their dormant season.

Then finally, a picture of a bent putting green of championship quality which denotes perfection in every detail. This is the thing for which we are striving, not only on the putting green, but on home lawns, athletic fields, parks, and cemeteries, and every other turfgrass area everywhere. Finally, turf quality can be ever more appreciated when the surroundings are more beautiful, such as the use of flowers and shrubs to complete the picture, which a turf of high quality gives us.

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CASE HISTORIES OF TURF IMPROVEMENT PROGRAMS

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Present day turf maintenance is a complex task in some respects. The growth of grass depends upon several factors, any one of which can retard or prevent satisfactory turf performance. The following are the most important factors:

1. Grasses used must be suited to regional climate and local weather.

2. Grasses need light--some more so than others.

3. A favorable range of air temperatures.

4. A good soil environment.

5. Favorable soil reaction.

6. An ample supply of soil nutrients.

7. Protection from injury--mechanical, insects, and diseases.

8. A sound maintenance program.

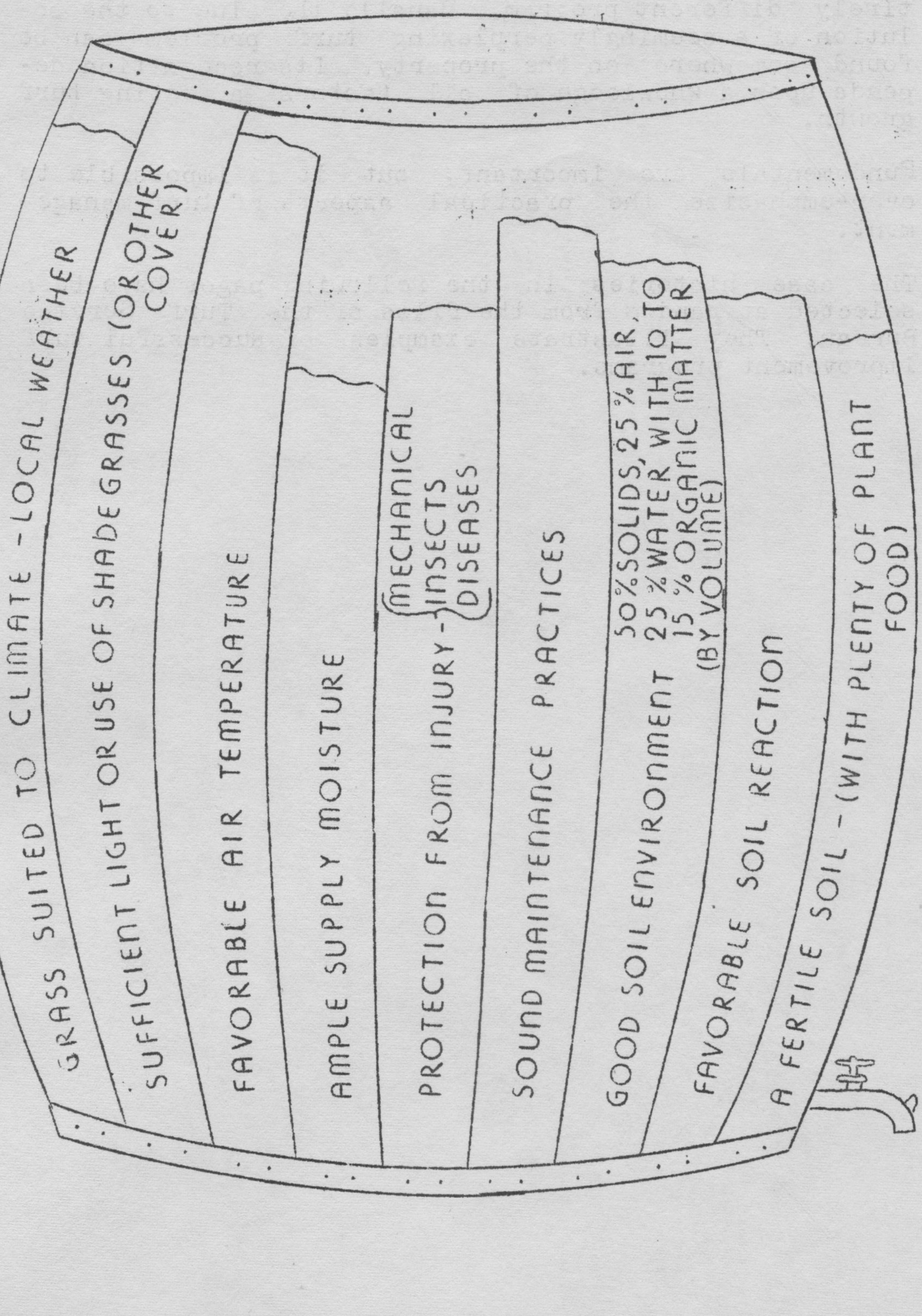
The capacity of a barrel to hold water is often used to depict the effect of various growth factors on the behavior of plants. The amount of water in the barrel is governed by the length of the shortest stave. When the short stave is lengthened the next shortest determines the capacity of the barrel. This is shown in Figure 1.

Poor growth results when one or more factors are unfavorable. Eliminating one may result in noticeable improvement, but best results are obtained only when all factors are favorable. Plant growth acts in a similar manner. Eliminating one unfavorable factor puts the next in line if several are involved.

Each year much time and money are wasted in vain attempts to improve turf. For example, it is folly to expect improvement from reseeding in cases where soil impoverishment is the cause of poor turf. Clubs blindly adopt methods employed at nearby courses. Success elsewhere does not prove its universal value. Differences in type of grass, soil, etc., may call for an entirely different program. Usually the clue to the solution of a seemingly perplexing turf problem can be found somewhere on the property. Its recognition depends upon a knowledge of all factors affecting turf growth.

Fundamentals are important, but it is impossible to over-emphasize the practical aspects of turf management.

The case histories in the following pages have been selected at random from the files of the Turf Service Bureau. They illustrate examples of successful turf improvement programs.


GRASS SUITED TO CLIMATE - LOCAL WEATHER
SUFFICIENT LIGHT OR USE OF SHADE GRASSES (OR OTHER COVER)
FAVORABLE AIR TEMPERATURE
AMPLE SUPPLY MOISTURE
PROTECTION FROM INJURY - MECHANICAL
INSECTS
DISEASES
SOUND MAINTENANCE PRACTICES
GOOD SOIL ENVIRONMENT
50% SOLIDS, 25% AIR,
25% WATER WITH 10 TO
15% ORGANIC MATTER
(BY VOLUME)
FAVORABLE SOIL REACTION
A FERTILE SOIL - (WITH PLENTY OF PLANT FOOD)

CASE HISTORY 1

GOLF CLUB IN CONNECTICUT

THE PROBLEM: Fairways were badly infested with clover. Coverage was reported as being almost solid.

TURF & SOIL SURVEY: The soil was a light-colored loam unquestionably low in nitrogen. There was no grass except isolated patches of native creeping bent. No bluegrass in evidence, despite the fact that the original seed mixture was a mixture of Kentucky bluegrass and red top. That was standard Green Section recommendation at that time. Drainage was satisfactory.

QUICK SOIL TESTS: All samples were strongly acid - PH 5.5 or lower. Phosphorus and potash were high.

DIAGNOSIS: Abundant growth of clover at that acidity seemed unbelievable. Evidently the native wild white clover could withstand considerable acidity provided phosphorus and potash supplies were abundant. The Kentucky bluegrass disappeared in two years, probably due to the excessive soil acidity.

RECOMMENDATIONS: The club was confronted with two alternatives, either lime enough to make soil a favorable medium for bluegrass or turn to the bentgrasses, which are the native grasses in that section.

They elected to encourage the bent, because they thought lime would make the clover even worse.

Consequently, generous fertilization was advised along with a little reseeding with bent in the places where there was little or native bent.

The use of herbicides was not mentioned because nothing was known about them at the time.

RESULTS: Marked improvement occurred during the first uear. As the bent spread the amount of clover diminished. Within a couple of years there was a dense cover of grass with little or no clover.

CASE HISTORY 2

GOLF CLUB IN ILLINOIS

THE PROBLEM: Players complained bitterly about the fairway "lies", especially on the portion of the course where the soil was a sticky black clay loam. They urged wholesale top-dressing with sand as the obvious solution because they had no trouble on the portion of the course where the soil was a light sandy loam.

The superintendent and some of the club officials questioned the correctness of their solution.

TURF & SOIL SURVEY: An "on the spot" inspection disclosed these facts:

The existing turf was uniform but thin and showed evidence of nitrogen hunger. Samples were collected for phosphorus, potash, and pH tests.

Dandelion and plantain were the principal weeds. The amount of clover was nominal. (2,4-D was not available at that time.)

Worm casts were present on some areas. The condition was not serious and should disappear with increased turf density.

Both surface and underdrainage were satisfactory.

QUICK SOIL TESTS: All samples were barely acid and high in calcium and magnesium. Available phosphorus and potash were abundant so increased turf density would follow the use of nitrogen fertilizer in adequate amounts.

DIAGNOSIS: Close inspection showed that golf balls rested directly upon the slick heavy soil because of grass sparsity. When the fairways were dry and hard the impact of the club head with the soil created a terrific jar, almost sufficient to jolt the club out of the player's hands.

By holding the ball well above the soil, a thick sole of turf would provide good clean lies.

Fertilization to develop a dense turf rather than the use of sand appeared to be the logical and best answer. On established turf sand does not mix with heavy soil. It forms an objectionable layer which is bound to cause trouble in bad weather. The cost of enough sand to cover 30 to 40 acres is prohibitive.

An irrigation system to provide needed moisture during dry periods would make walking more pleasant and help eliminate bad lies.

RECOMMENDATIONS: Because existing grass was of the right type and because it was uniform but thin, reseeding was not suggested or recommended.

Generous fertilization spring and fall with the main emphasis on nitrogen was urged. Approximately 100 pounds actual nitrogen and 50 pounds phosphoric acid per acre were used both times. It was suggested that rates be reduced by one-third to one-half after a dense turf was developed.

Supplementary watering was advised during dry periods. The needed water could be provided at small cost.

RESULTS: The program was followed substantially as outlined. All player objections to unsatisfactory brassie lies subsided after a good thick sole of turf was created on the turf.

Weeds diminished automatically as the turf density improved.

CASE HISTORY 3

GOLF CLUB IN QUEBEC PROVINCE, CANADA

THE PROBLEM: Clover and iron weed, commonly called knotweed in the States, were bad. There was little or no grass despite yearly seeding with chewings fescue.

Turf on the greens was bad due to various causes. Algae was prevalent each summer.

TURF & SOIL SURVEY:

Fairways: Fairway surfaces were very uneven, with no grass in the ponded areas, due to winterkilling of the fescue.

Side-hill seepage existed on almost every fairway. Out-cropping rock made tiling impossible.

No fescue could be found. Patches of native creeping bent was the only grass. Clover and ironweed were absent from these patches.

Lime had been applied and 5-12-12 fertilizer was used at 500 pounds per acre each spring for three years

Greens: The soil was extremely heavy and compact on many of the greens. Contours were bad for surface drainage. Seepage was bad where greens were located on sidehill slopes.

Almost every green was surrounded by heavy undergrowth and many trees.

QUICK SOIL TESTS: None made.

DIAGNOSIS:

Fairways: Since the only grass of consequence was the patches of creeping bent, encouragement of it by planting stolons and use of seaside for reseeding seemed like the best solution to clover and ironweed control.

Greens: Improved air drainage must be the first step. Then better soil drainage becomes the next step, followed by better fertilizer practice, careful watering, and control of snow mold.

A change in the fertilizer program seemed advisable, and steps to control snow mold were essential.

RECOMMENDATIONS:

Fairways: In the low pocketed areas planting of native bent stolons was suggested. Native bents were abundant on the property. It was suggested that the soil be loosened with a farm disc. After that stolons were to be scattered over the disced area and cut into the soil by cross-discing. Light rolling to press the stolons into the soil was to follow.

Greens: Removal of underbrush and sapling trees around each green was urged.

The need for tile drainage in some of the greens and the importance of stopping seepage from saturating greens on sidehill slopes was pointed out. In connection with seepage, the importance of backfilling the trench to the very top with gravel, placement of the trench between the green and sidehill in a direction to cut the line of water flow, as well as making the trench sufficiently deep to intercept all seepage flow was pointed out.

A fertilizer plan was suggested along with snow mold control.

Water management was covered thoroughly during the several visits to the course.

RESULTS: By following the program substantially as outlined, creeping bent took possession of the fairways and provided good playing turf. Clover and ironweed vanished as vexing problems.

The biggest change was in the turf on the greens. Within two years the club gained a reputation of having as good greens as any in Canada. They have been as good as any on this continent because the superintendent in charge has learned the secret of their care, and is no longer bothered with a dozen different bosses.

CASE HISTORY 4

GOLF CLUB IN NORTHEASTERN PART OF COUNTRY

PROBLEM: Every year since play started greens maintenance had been troublesome. Grass became thin every summer, and in bad seasons actual loss was not uncommon.

TURF & SOIL CONDITIONS: Clover was present and bad because the vegetative bent was too sparse to choke it out. Many of the greens were surrounded with dense tree growth.

The surface soil and subsoil were extremely heavy. There was a sand layer near the surface. It was put there at the suggestion of a supposed expert.

QUICK SOIL TESTS: Not available at that time.

DIAGNOSIS: Poor physical soil condition, the sand layer, inadequate drainage, poor air circulation, and improper use of fertilizer and water were indicated as the primary cause for poor turf. Tendency was to use too much readily available nitrogen without regard to seasonal variations and other conditions. Overwatering was regular practice, so greens would hold a ball.

RECOMMENDATIONS: (1) Improve drainage by installing tile, spacing lines 10 to 15 feet apart, especially on greens located in sheltered spots. To stop seepage, use tile lines between green and slope and backfill entire trench with pea gravel.

(2) Remove undergrowth and saplings along a line in the direction of the prevailing wind to insure a sweep of air across the green.

(3) Modify fertilizer practice to do major feeding in spring and fall. Greens in shade need less nitrogen than those out in the open. Avoid weak grass at all times. Abandon the former practice of applying 10-5-2 at the same rate on all greens and at regular intervals of three weeks because of its inflexibility.

(4) For sensible feeding use 8 to 10 pounds superphosphate and 3 to 4 pounds muriate of potash per 1,000 square feet in spring and fall. At the same time apply Milorganite at 30 pounds per 1,000 on greens out in the open and at 20 pounds on shaded greens. During the summer months apply ammonium sulphate as needed at 1 to 2 pounds per 1,000 square feet. Aim to adjust rates and frequency to keep the grass sturdy.

(5) Water in morning instead of at night, and do not overwater.

(6) Never use pure sand top-dressing. Instead-use a medium sandy loam (about one part soil, two parts sand, and one part peat).

(7) Build away from the sand layer with this kind of soil.

(8) Watch greens closely during hot weather. If grass takes on a gray-bluish cast and footprints, it is a sign of wilting. To prevent loss of grass sprinkle lightly by hand and at once.

(9) Should localized dry spots develop, fork deeply by hand and drench the area several times with water.

(10) Before first snowfall, but late in fall, apply calomel--corrosive mixture for snow mold prevention at 3 to 4 ounces per 1,000 square feet. Treat adjacent banks and slopes as well as the putting green proper.

<u>RESULTS</u>: Program started in fall of 1935. Greens came through winter unscathed and were good all through 1936 and ever since.

CASE HISTORY 6

GOLF CLUB IN ONTARIO PROVINCE, CANADA

PROBLEM: Greens, tees, and fairways were bad, the result of extreme economy on the part of club officials.

Greens contained clover and were infested with crabgrass during the summer. There was a considerable amount of *Poa annua*.

The tees had little or no grass. There was some *Poa annua* but it did not persist.

The fairways contained much chickweed, considerable clover, and crabgrass in the summer.

TURF & SOIL SURVEY:

Greens: There was nothing basically wrong that could not be corrected. Although *Poa annua* was present, there was a lot of bent on all of them. Clover was not too bad. Crabgrass in July and August was very bad and made for bad putting.

Tees: Tees were rather small and badly shaped with abrupt banks. They were suffering in part from neglect.

Fairways: Fairway soil was a bit sandy, but there was an adequate water system. Grass was uniform but thin in most fairways. In some places *Poa* and clover were sufficient to justify more than fertilization only.

There was evidence of grub damage. A rather severe infestation was discovered later, sufficient to justify treatment.

QUICK SOIL TESTS: Samples from all the greens were tested. Soil reaction was in the range of pH 7.3 to 7.4 with ample amounts of calcium and magnesium. Phosphorus was ample. 400 to 600 pounds per acre, but potash was a bit low,from 250 to 325 pounds per acre.

No samples were submitted from fairways and tees.

DIAGNOSIS:

Greens: The problem was essentially one of controlling crabgrass and modifying the fertilizer program to provide considerably more nitrogen and step-up potash rates. This, it was believed, would grow enough grass to control clover.

Tees: Although some needed to be made larger, the first problem was one of introducing grass, something able to withstand close mowing.

Fairways: The problem was one of eliminating chickweed, curbing crabgrass, and obtaining a good, dense cover of turf.

RECOMMENDATIONS:

Greens: Essentially the suggestion embodied the use of lead arsenate at 7 to 10 pounds per 1,000 square feet in late spring to be followed with weekly applications of PMAS at rates recommended by the manufacturer. This combination should control crabgrass.

In order to supply plenty of potash, spring and fall applications of muriate of potash - 60 per cent grade - was suggested at 4 to 5 pounds per 1,000 square feet each time. Phosphate rates used before were adequate, but nitrogen rates of 1½ to 2 pounds actual nitrogen per month were suggested.

Tees: It was suggested that Toronto bent be tried on one tee. Merion bluegrass was to be tried on one also. It was suggested that reseeding mixtures contain a goodly proportion of bent grass seed.

Fairways: Spraying with arsenic acid or sodium arsenite was suggested on the fairways for chickweed control at a rate of 1 to 2 pounds per acre. Spraying to be done in early spring and late fall.

Generous fertilization was advocated to improve turf density and renovation with reseeding seemed justified on one fairway where Poa annua predominated.

RESULTS:

Greens: The improvement in 1953 was most remarked. In August there was no crabgrass, whereas the year before it was bad because the suggested program was not followed. Clover was gone and turf was vastly better.

Tees: The Merion bluegrass tee made rapid growth and provided good playing turf during the first year of use.

The C-15 tee was not up to par, due to improper care. By fall it showed improvement. The answer will be told in 1954.

Fairways: Spraying eliminated most of the chickweed and fertilization improved the turf. In another year fairways will be acceptable for play.

Renovation and reseeding was not tried. The plan is to start in 1954.

CASE HISTORY 7

COUNTRY CLUB IN NEW YORK STATE

PROBLEM: The first pressing problem was severe leaf spot infostation on the greens. In mid-May the grass in large spots and over the entire green in several instances turned brown in a matter of several hours.

TURF & SOIL SURVEY: Leaf spot was extremely active on the day the visit was made. In thirty years we have seen nothing like it.

There was an extreme surface thatch on all the greens. It was several inches thick. The lower portion was peat-like in character, not from the use of peat as such, but from the partial decay of accumulated stems and leaves. A goodly portion of the grass was Virginia bent, which is especially susceptible to leaf spot.

QUICK SOIL TESTS: All of the samples were strongly acid, in the range of pH 5.3 to 5.7. Calcium content was reasonably good, but available magnesium was extremely low.

Potash was low, approximately 250 to 300 pounds per acre. The phosphorus content was ample, 500 to 800 pounds per acre.

DIAGNOSIS: While leaf spot was the immediate cause of turf loss, the disease was secondary to other things. The grass appeared to be in a weakened condition.

There were no roots, due to the extreme surface thatch. The subsequent soil tests showed that past practice with respect to the use of lime and fertilizer had not been sound. Greens got no lime. They received a little mixed fertilizer of low potash content in the spring and after that ammonium sulphate until fall. Then another application of mixed fertilizer.

RECOMMENDATIONS: It was suggested that PMAS be used on half of one green and Acti-dione on half of another. This was done to see if the leaf spot was the primary or secondary cause of damage.

Aerifying with any one of the good machines now available was suggested to encourage deeper root development. The use of dolomitic limestone immediately afterward seemed best because part should move down into the Aerifier holes. One with not less than 20 to 30 per cent of magnesium was suggested, in order to eliminate any possibility of a soil deficiency in magnesium. Then it was suggested that the Verti-Cut be used immediately and periodically thereafter to remove the thatch gradually.

It was pointed out that more potash should be applied and that the type of nitrogen be changed for 1953 at least. The suggestion for potash was to apply 1/2 to 1 pound per 1,000 square feet of 60 per cent grade muriate of potash per month, after an initial spring application of 5 pounds per 1,000 square feet.

RESULTS: The fungicides did not do anything startling, but the program of aerifying, removing thatch along with dolomite and a different fertilizer program enabled the club to have good turf all season.

The chairman made this remark in a letter written in September: "Incidentally, our greens are absolutely the best anyone ever remembers them".

CASE HISTORY 8

COUNTRY CLUB IN STATE OF CALIFORNIA

PROBLEM: Severe crabgrass infestation in bermudagrass fairways.

TURF & SOIL SURVEY: There was bermuda on all the fairways. However, lippia was bad in winter. It disappeared in May when weather started to become warm. Crabgrass soon appeared in the bare and thin areas which had been occupied by the lippia.

QUICK SOIL TESTS: The soils were about neutral in reaction and well supplied with phosphorus and potassium.

DIAGNOSIS: The problem seemed simple. It was one of checking the lippia in the spring and the crabgrass in the summer with sodium arsenite and then fertilize liberally during the summer to make bermuda produce a solid, tight turf.

All fairways could be watered.

RECOMMENDATIONS: Routine spraying with sodium arsenite throughout the season was suggested along with generous nitrogen fertilization. The actual amount of nitrogen to be not less than 125 to 175 pounds per acre during the season.

RESULTS: The suggestions were tried first on two one-acre plots. The results justified spraying and fertilizing the entire course. As a result, crabgrass is no longer a problem on the fairways.

CASE HISTORY 9

CLUB IN WESTERN MICHIGAN

PROBLEM: Greens behaved badly each summer and also in winter. Summer loss of grass caused player complaints. Wind burn damage in late winter retarded the start of growth in spring.

TURF & SOIL CONDITIONS: The turf consisted of Washington bent, which is a satisfactory grass for the region. Roots were shallow, due to the thick surface mat on all the greens. The soil was satisfactory.

QUICK SOIL TESTS: The samples were very slight to neutral in reaction and were well supplied with calcium and magnesium. Available phosphorus was high, but potash was low.

RECOMMENDATIONS: It was suggested that greens be aerified cautiously three or four times during the first year.

Cross-raking followed by close cutting was suggested to eliminate the surface mat.

A change in the fertilizer program to provide more potash was advocated.

RESULTS: The greens showed marked improvement the first season. No grass was lost. The second year they were even better, and by the third year they were eminently satisfactory.

By introducing air, decomposition of the partially decayed material was accelerated. That, with mechanical removal of top growth resulted in firmer greens, deeper root growth, and less daytime wilting.

CASE HISTORY 10

CEMETERY IN STATE OF MICHIGAN

PROBLEM: The absence of grass and presence of moss in the shaded parts of the cemetery brought complaints from lot owners. Because of the moss the superintendent thought lime was needed.

TURF & SOIL SURVEY: The soil was a sandy loam. Moss was bad because of persistent over-watering. There was a musty soil odor everywhere, which is evidence of over watering. Seeding was with Kentucky bluegrass. None was in evidence in the shade.

A brief search uncovered several patches of Poa trivialis. The superintendent said he and the lot owners would be happy with cover of that kind.

QUICK SOIL TESTS: The soil was almost neutral in reaction, indicating that lime was not needed. Levels of phosphorus were low.

DIAGNOSIS: Moss was present because of impoverished soil, use of the wrong kind of grass, and overly moist soil conditions.

RECOMMENDATIONS: Over-seeding with straight poa trivialis seed was suggested, after using phosphate generously and some nitrogen.

RESULTS: Even though the moss was not raked out, the Poa trivialis soon crowded it out and provided a cover which met with lot owner approval.

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FERTILIZER FACTS AND FANCIES

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What are facts and what are fancies? Webster tells us that a fact is anything actually existent; any statement strictly true. Among the many definitions for fancy these were found; an opinion or notion formed without much reflection, or that which pleases or entertains the taste. Certainly it is difficult to define what is a fact in this world of advancing technology.

Today we will be talking about the process of taking carbon dioxide out of the air and combining it with the water and the minerals of the soil to produce the carbohydrates, protein, fibers, fats, and waxes that make up the grass, the grain and the clover. This is that marvelous process of photosynthesis and plant growth which still lacks much of being completely understood. However we do know that certain elements are essential for this process to occur. The amounts required vary widely for each of the elements. Carbon, Hydrogen and Oxygen are the building blocks of the carbohydrates and are needed in large quantities. The major mineral elements carried in fertilizers are nitrogen, phosphorus and potassium. Calcium, magnesium, and sulfur are often called the secondary elements. The third group are made of minor or trace elements including iron, boron, copper, zinc, manganese and molybdenum. In our discussion of facts and fancies we will concern ourselves primarily with nitrogen, phosphate and potash. This does not mean that some of the secondary and minor elements are not important but they are usually available in adequate quantities.

How much nitrogen does it take to grow a ton of dried grass? Grass varies from 1 to 4% nitrogen; that is, 20 to 80 pounds of nitrogen per ton. It is a fact that we cannot produce grass containing no nitrogen. Nitrogen is a component of protein in live plants and animals. Therefore, to think of producing large quantities of grass with just a teaspoonful of fertilizer dissolved in water and sprinkled on the lawn is one of the fertilizer fancies. Approximately 50% of the nitrogen applied on grass sod may be absorbed by the plant roots and used in growth.

The Phosphorus in dried grass varies from 0.2 to 0.5% as P_2O_5. This is from 4 to 10 pounds of phosphate per ton. To produce grass without phosphorus is again impossible, since phosphorus is one of the essential elements for growth. We also know that when we apply phosphatic fertilizer the very maximum efficiency we can expect is about 30% recovered in the fertilized crops. More often the figure is about 15% recovered. These values are exact since radioactive phosphorous makes possible exact determinations of how much of the phosphate applied gets into the plant. Therefore, it is also a fancy to believe that a few drops of solution spread into sprinkling water, spread over a lawn is going to produce outstanding results in increased growth of grass.

The same situation holds true for potash. Potash concentrations in leaves vary from 1 to 3 percent or about 20 to 60 pounds of potash per ton of dry material. Potash efficiency or uptake from applied fertilizer figures near 50% recovered. In summary it takes about 500 lbs. of a 16-4-12 fertilizer to produce a ton of dry grass when allowance is made for the efficiency of uptakes of various nutrients. To expect more returns from this quantity of fertilizer is a fancy; in other words believing what we like to believe rather than believing the facts of fertilizer utilization by turf.

Commercial fertilizers are used to supplement the nutrient supply in the soil available to our grasses. Under the fertilizer laws of the various states it is necessary that these fertilizers be guaranteed with regard to their content, of nitrogen, available phosphate and potash on a weight basis. Let it be reemphasized this is on a weight basis, irrespective of whether the product is a gas, solid, or liquid. Also this guarantee is only for the contents of the container. It does not guarantee the product you might get from mixing the contents with water for some other solid. Even though a package may indicate that the "contents of this box" makes 100 gallons of complete fertilizer and directly underneath this statement is listed the analyses 7-8-9, this analysis applies to the contents of the container and not the diluted product.

What is the value of the plant food within the fertilizer? Where can we search out a representative price of these plant foods? In Indiana the fertilizer tag sales and inspection of all fertilizer shows that there were over 1 million tons sold in the state in

1952 for all purposes of which perhaps 5% went to turf use. From this total million ton sale price we find that a pound of nitrogen is worth approximately 15 cents, a pound of P_2O_5 is worth approximately 10¢, a pound of K_2O is worth approximately 5¢. For example a tone of 10-10-10 would figure:

2,000 lbs. x 10%	=	200 Lbs. N x 15¢ =	$30.00
2,000 lbs. x 10%	=	200 Lbs. P_2O_5 x 10¢ =	20.00
2,000 lbs. x 10%	=	200 Lbs. K_2O x 5¢ =	10.00
For a mimimum cost per ton			$60.00

What is the comparative value of a ton of pelleted ammonium nitrate, 33% N? (2,000 x 33% = 660 x 15¢ = $69.30).

We in turf work know the value of nitrogen in producing good growth and vigor. Nitrogen costs the most of any element. Further, organic formulations, or those carrying as much as ¼ to ½ of the total nitrogen in organic forms have considerable convenience which increase their value and range of usefulness. When it comes to special colors, name mixes special turf formulations etc. the convenience of these may be a considerable proportion of the selling price.

The liquid or soluble fertilizers are being offered from many sources. Why not? Is there anything fancier than spraying a little through the water hose to get bountiful growth. Isn't the problem of foliar burn largely eliminated? How nice it is to have no clogging, easy solubility, uniform distribution, easy measurement for light applications and many other potential advantages. All of these are real conveniences to a particular user. Therefore he is willing to pay several times as much for soluble or solution fertilizers.

What about feeding plants through their leaves? Much emphasis has been placed on this method of fertilizing out crops. We know that for several of the minor elements this is a much more efficient way of fertilizing our crops than attempting to feed the plants these minor elements through the soil. The fixing capacity of some soil for certain minor elements is quite high. Why is it effective? Because these minor elements are required only in trace quantities within the plant. The situation with regard to nitrogen, phosphate and potash is quite different. As has been pointed out these are required in large quantities--a hundred times more than the trace elements. Limited amounts of major elements can be absorbed through the leaves but it is difficult to get enough through the leaves to have a lasting effect upon the plants. If you are interested in reapplying fertilizer every week, foliar application might be useful to uou. Under grass where you have a mass of actively absorbing roots near the surface,there seems to be little advantage in attempting to feed the plants through the leaves.

You may be interested in some of the liquid forms of nitrogen carriers. Let me caution you about these.The first product in nitrogen fixation is anhydrous ammonia under pressure. This can be used directly; however, its use on turf is practically nil. This ammonia can be placed in water and you have ammonia-water solution. It has no pressure and varies in concentration from 1 to 25% nitrogen,all as free ammonia. In other words, if you remove the bottle cap, all the ammonia will escape to the air just like in household ammonia. Any liquid fertilizer containing free ammonia is not adapted for broadcast use on turf grasses. The nose test is almost 100% perfect. If you can smell ammonia the solution contains free ammonia.

Ammonia can be converted to nitric acid which is combined with ammonia to make ammonium-nitrate. Ammonium nitrate solutions have limited applications because of their relatively low analysis and high salting out temperature.

Ammonia can be made into urea which has comparatively low water solubility. The combination of ammonium nitrate and urea in water makes a solution which has a lot of possibilities for turf use. This solution analyses 32% nitrogen, one half as ammonium nitrate and one half as urea. Its salting out temperature is fairly high--32^{o}--and it has very little burning effect. All salt solutions, including solution 32 are corrosive on iron, brass and steel so one must keep sprayer nozzles and screens washed clean of solution after using these or use stainless steel or aluminum fittings. These solutions can be injected into irrigation systems with very little trouble.

Many formulations of complete liquid or soluble fertilizers are on the market. Here is an example of a guaranteed analysis:

Nitrogen -- 20%

Ammonia nitrogen -- 4.8% from ammonium phosphates
Nitric nitrogen -- 6.0% from potassium nitrate
Organic nitrogen -- 9.2% from urea

Available phosphoric acid -- 20%

As P_2O_5 derived from ammonium phosphates.

Water soluble potash -- 20%

As K_2O derived from potassium nitrate

This mixture uses three water soluble chemicals for this 1-1-1 ration of nutrients. Many other chemicals or combinations can be made from refined water soluble materials. The phosphorus, which may be least needed on irrigated turf, is the most expensive component.

Liquid fertilizers have a basic fertilizer value as a source of nutrients to plants comparable to other forms. Beyond this you may have convenience which is the measure of their value to you.

A station circular No. 396, April 1953, Inspection of Commercial Fertilizers, gives extensive data on all fertilizers sold in Indiana. Write to Experiment Station Mailing Room, Purdue University, Lafayette Indiana.

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CRABGRASS CONTROL IN TURF

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Rutgers University

Crabgrass is a very troublesome turf weed in New Jersey as it is in the Midwest. While repeated prevention of seed set is one solution it is very difficult to achieve. Crabgrass is very aggressive and persistent under our conditions of warm humid weather and high rainfall. Nevertheless, crabgrass can be controlled very satisfactorily.

Some of the factors contributing to crabgrass infestations are failure to fertilize enough to maintain a dense, vigorous turf, cutting Kentucky bluegrass and red fescue too short, removal of clippings, serious disease injury, over-fertilizing in hot weather, frequent watering, and seeding lawns late in the spring. Of this group inadequate fertilization, close-mowing, and improper watering are the most frequent offenders. Fortunately, these factors can be regulated by man.

A few scattered crabgrass plants in the lawn or turf area can develop into a heavy infestation in 3 to 8 weeks, if they are watered and fertilized in hot weather. Whenever a crabgrass threat appears, it is usually desirable to keep the turf hungry, dry and cut high. If this can be done, the crabgrass growth should be minimized; then fall recovery of the desired grasses can be encouraged by fertilizing and watering in the fall.

There are a number of crabgrass control techniques that every turf grower might use if the need arises. A sound maintenance program that provides a dense healthy turf is the first step in controlling crabgrass. Generous fertilization of the turfgrass at the correct season encourages development of a grass cover, which will shade-out crabgrass. This is a very important treatment for lawns that are on poor soils.

In our area, high mowing of Kentucky bluegrass and red fescue turf will greatly reduce crabgrass in one to two seasons. Cutting at a 2 or 3 inches height encourages a dense turf cover that destroys the crabgrass seedlings by shading. While this technique cannot be used on some areas, it is still the easiest solution for many crabgrass infested areas.

The use of mechanical equipment for raking up and removal of the crabgrass seedheads has been used to some extent for a period of uears. With the advent of better machines; this technique will be used more frequently. This procedure needs some consideration with regard to season of treatment and the type of turf that will tolerate treatment.

Chemical control of crabgrass is here to stay. Chemicals are not a cure-all that eliminate the need to consider other crabgrass control techniques, but many have found them valuable tools for various crabgrass problems. In our experience, we have found the phenulmercuric acetate preparations most selective, but quite dependent upon careful and repeated application. We prefer this chemical for bentgrass turf areas. Potassium cyanate is a non-poisonous material that has given its best performance later in the season when the crabgrass plants are more mature. We prefer that it be used on Kentucky bluegrass type of turf rather than on bentgrass. The best results with either potassium cyanate or phenylmercuric acetate have obtained when they are used under cool-moist conditions. Accurate rates and uniform application are very important.

The keystone to success in crabgrass control is persistence. It does little good to start a sound program if it is not carried to completion over the required period of time. A small amount of faithful hand weeding early in the season each year is very practical when isolated plants appear over the area. If crabgrass is controlled by this or other means, it can be done only through persistence and a sound program.

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ATHLETIC FIELD RESEEDING

Fred V. Grau, Agronomist
West Point Products Corporation
West Point, Penna.

The first problem on athletic fields, and by far the most serious, is that of compaction. The problem here is to relieve the compaction, to attempt to create a more favorable physical soil structure, so that seed or sprigs can be planted with a greater chance of success. It is obvious from actual photographs and from the data obtained in research studies at the Penn State University, that the most serious zone of compaction is in the upper inch. When seeds are sown on top of compacted soil such as this, with only a light spiking, the seeds can germinate, but the roots fail to be able to get through the compacted zone and the seedling plants die and offer no cushion for the players who use the field.

In some of my work with athletic fields, where an Aerifier or some other cultivating or aerating device, is that the seeds have a much better opportunity to germinate and to send their roots down into the somewhat more mellow soil below. The holes left by the machine catch fertilizer and water, and concentrate them in the holes where the seed obtains the maxium benefit from these growth factors. Many practical demonstrations have proven the value of the Aerifier in reseeding athletic fields, and some of the pictures show these. At Beltsville on raw subsoil, which bakes hard in the mid-summer sun, the only successful establishment of seed was in the Aerifier holes. The same thing was true at the Occidental College in Los Angèles. After the field was seeded in the Aerifier holes, the field was used for band practice and for other activities, then a windstorm swept the field, then a flood washed everything off the surface, and lo and behold, within ten days,the field was green with millions of green shaving brushes where the seed was coming up only in the Aerifier holes. A later picture showed that the grass had spread and covered, to provide a perfectly uniform, satisfactory, playing turf.

Following the National Celebrities Golf Tournament at The Woodmont Club in Bethesda, Maryland, there had been enough rain and thousands of people milling around the club house, that the turf was completely destroyed and the soil compacted to a degree that was almost unbelievable. By using the Aerifier several times, heavily weighted, to break through the compact surface layer, and reseeding, an excellent stand of grass was obtained. Samples of the grass growing in the Aerifier holes was shown at the West Point openhouse in December. We could go on naming many other examples, such as the Philadelphia Municipal Stadium, the Purdue playing field, and others. We firmly believe that the principle of seeding in cavities left by the Aerifier is one of the soundest discoveries of recent years. It is producing results where only failure had been obtained before.

Choose the Right Grass

In reseeding an athletic field, it will be of little avail to correct the soil condition, to fertilize, to relieve the compaction, unless an adapted grass is chosen. Too often grass is purchased on a price basis rather than on a performance basis. There are very few grasses that are adapted to heavy use on athletic fields. Among the cool-season grasses, there are only two that have any real value. One is Merion bluegrass and the other is Kentucky 31 fescue. Among the warm-season grasses, there is only one, and that is bermuda grass. Naturally we are talking about the improved strains of these grasses, that is why we mention Merion bluegrass instead of common Kentucky blue. We use Kentucky 31 fescue, because of its superior characteristics of relatively fine blades, disease resistance, drought tolerance, and other factors. Among the bermudas, we would like to see only the improved types used, such as Tiflawn, (Tifton 57) U-3 bermudagrass and T-47 from Texas. These three bermudas, probably represent the cream of the crop when it comes to athletic fields. They are vigorous, they are disease resistant, they are unbelievably tough and tolerant and rapid healing.

If Merion bluegrass is used, it should be used by itself. A planting rate of one pound to the thousand is generally agreed upon as a satisfactory rate. Merion bluegrass requires frequent heavy feeding with nitrogen, balanced, of course, with phosphates and potash in the spring and fall. Merion bluegrass thrives under a program of frequent aerifying, at least once a month. Merion bluegrass requires very little supplemental irrigation. When it does receive irrigation, the fields should be aerified so that the water will soak into the ground. Then a deep soaking should be applied rather than a superficial sprinkling.

Kentucky 31 is relatively inexpensive and it needs to be seeded heavily. Most authorities agree upon a seeding rate of approximately 200 pounds to the acre. It is important also to get Kentucky 31 fescue seed deeply into the ground. We have noted in every case where the Aerifier has been used in connection with seeding, that success virtually is assured. Kentucky 31 fescue can be seeded either spring, summer or fall. It seems to make very little difference.

The bermudas must be planted in the spring or early summer, and they must be planted by sprigs, by plugs, or by sodding. There is no seed available of any of the improved athletic field bermudas.

Fertilization

Any good grass needs to be fertilized adequately and often, in order to make it perform at its best. Evidence is strong to favor aerifying each time fertilizer is used. This we believe is a well established principle. Work at Penn State shows that fertilizer ingredients quickly reach to six inch depth in the root zone where the Aerifier has been used.

The water subject has been well covered, but here again watering in connection with aerifying is sound recommended practice. Water should be used only frequently enough to keep the grass from wilting and drying. Water should never be used as a substitute for good management and good turf. The improper use of water can only bring weeds.

The practice of aerifying an athletic field frequently is one of the best ways to encourage deep heavy root systems, which provide a springy, resilient cushion on which the players can fall with a minimum of injury.

Many authorities firmly believe that seeding the heavily worn center of a gridiron largely is a waste of time. There is a growing feeling that the adapted grasses should be grown in a sod nursery, and transferred to the center of the field as solid sod in order to gain the maximum advantage from the improved grasses. This makes sense because it is almost too much to ask a tiny seed to produce a plant sturdy enough to withstand the tearing action of thousands of cleats in a short space of time as a few months, beset by heat, drought, insects and diseases. When it comes to sodding, there is quite a misconception as to how sod should be cut. Too often sod is cut very thick and then not only does it fail to heal on the athletic field, so that it is torn out easily by the actions of cleated shoes, but the nursery from which it was taken fails to recover. Sod should be cut thin for best results, because a thin cut sod--1/2 to 3/4 of an inch will knit to the soil very quickly, and within a short time cannot be torn from its place. In addition, the nursery from which the thin sod was taken, renews its growth and forms another usable sod in the shortest space of time.

Repairs to athletic fields can easily be made by means of a 4" turfgrass plugger. The plugs of superior grasses must be taken from a sod nursery. This sod nursery might be in another location, or it might be established in the end zones and on the side lines of the field. Actually this makes a lot of sense, because there is only a minimum of wear in the end zones and on the sides of the field, and turfgrass plugs can be removed from these areas and transferred to the center of the field to heal injuries immediately, that otherwise would take weeks and months to heal if the same areas were seeded.

It is important in refilling the holes where the sod plugs were removed to use weed-free soil. In this case it is important to have good soil that has been treated with Cyanamid, at the rate of 13 pounds to a cubic yard, and allowed to stand for several weeks before it is used. Not only will this soil be weed-free but it will be abundantly filled with nitrogen to stimulate the growth of the grass so that the adapted grasses will quickly heal over the injuries.

Above all, it will do little good to use machines for relieving compaction and improving the structure of the soil, to use excellent planting material of adapted grasses, and to fertilize generously, unless the field is given intelligent, sympathetic management. The man and the men in management represent the coach, the field superintendent and the workman. Without the man and the men in management there is little need to go to all the trouble of planting and fertilizing because it will be of no avail unless the field is managed properly. Information is available today from the dealers and manufacturers who maintain staffs of trained agronomists, of competent agronomists, to answer the questions and to help solve the problems of this nearly forgotten field of turfgrass.

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THE VEGETATIVE GRASS POTENTIAL

W. H. Daniel, Turf Specialist, Dept. of Agronomy
Purdue University, Lafayette, Indiana

Traditionally grass seed has been considered the start of all turf areas. Only on the better putting greens have bent stolons been used in the midwest. In the vegetative grasses I include in the selections of creeping bentgrasses, bermudas and zoysias which are now or later will be proven of superior turf value through research and observation.

Let us take Pennlu creeping bentgrass (originally labeled 10 (37) 4 by Professor H.B. Musser and now called "Pennlu" as an example. Every research plot reported shows it superior to other selections, particularly in brown patch resistance. The states of Pennsylvania, Ohio and Indiana are considering certification of this material as is now done with Tiffine and Tiflawn Bermudas in Georgia and Alabama. Through certification you who purchase Pennlu can be sure of identity and the results of research can be augmented and maintained because of known source materials. And further, the consumer and producer can be mutually informed and encouraged to utilize the quality material. The same may apply to Bermuda and Zoysia. Of course, it will take some time to get this certification going in these states.

How about Bermudas? You can purchase certified or uncertified Tiffine and Tiflawn from several southern nurseries. These sprig (vegetative) propagated grasses have known superior characteristics which are very valuable in turf. The U-3 bermuda is already in extensive use in several midwest turf areas. U-3 does have a definite winter survival history in several areas, such as St. Louis, Terre Haute and Purdue University. We can hope for increased fairway utilization of bermuda. There is a need for methods to incorporate these and Al Linkogel's talk in this year's Proceedings of the Conference shows their good results.

We know that bermuda survives winter in the underground rhizomes. Further, the soil must begin to warm up in the spring before the dormant buds along the rhizomes begin to develop new shoots which emerge above ground. All this takes time so that bermuda is very slow to emerge and develop a ground cover in the spring.

In contrast winter just interrupts the growth of zoysia. The leaf tips are browned during the winter, but in spring the growth begins at the previous growth points. This basic difference and the fact that zoysia is mostly a surface mat, thus responding to warm days and not requiring large soil temperature changes, means it may begin growth as much as one month earlier in the spring than would bermuda. Therefore, zoysia may be much more adapted for lawn, fairway and park use insofar as its longer period of growth more nearly covers the period of spring use.

Zoysia is a comparatively slow grower. Surface stolons of creeping bent may easily grow 1/2" per day, bermuda may grow 1", while zoysia grows only 1/4" per day. However, this is a disadvantage only until the turf cover is formed. Then the slower growth rate is most valuable in reduced maintenance costs.

Each of these grasses put the sod nurseryman into the same type of production as is the landscape nurseryman with shrubs. They produce and sell to the homeowner a prescribed plant and may install it. If and when the homeowner needs another they again purchase replacements. For an example of zoysia utilization let us take Terre Haute, Indiana. The city is built on the old Wabash River flood plain, much of which is very sandy. Bluegrass has a difficult time. Zoysia should work very well particularly as a lawn grass on sunny south and west lawn areas. Who will produce the thousands of plugs, sprigs or sod pieces needed? Would this not fit in with other landscape activities? How many homes are there in the city? How many orders of plugs could be anticipated? The homeowner market is most promising in those areas where zoysia is adapted.

Someone must produce the material if the demand is to be increased and met. The Vegetative Grass Potential can move fast for the educational processes on any subject are easier to develop today.

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WHO PLAYS GOLF TODAY?

Herb Graffis, Editor
Golfdom

It's curious that in a game that is fundamentally based on each player keeping his own score, so few have considered the very important point of who is actually playing golf today.

Popular estimates of the number of golfers in the U. S. vary widely, due to inability to define a golfer with the same precision hunters and fishermen can be defined by purchase of licenses. Our own basis of defining a golfer is for determining the market for golf course construction, playing equipment and maintenance equipment.

We consider for market statistical purposes a golfer as one who plays 10 or more rounds a year. There are about 3,330,000 ten rounders in the United States. Besides there are approximately 1,000,000 who play fewer than 10 games a year, a total of 4.3 million.

In 28 years of research we have attempted to determine the average number of rounds played annually by a "golfer". At metropolitan district private clubs in the northern area this figure is approximately 30 rounds per male member.

There are approximately 63,000,000 rounds of golf played per year on the 5,056 courses in the U. S., a average of 12,000 for every course in the country.

There are 2,079 18-hole courses of which 1,237 are private clubs courses; and 2,977 9-hole courses, of which 1,733 are private clubs. The others are public owned and privately-owned pay-as-you-play courses. In a typical year about 63 per cent of all rounds played are on the non-private club courses. Thus 63,000,000 x 63% divided by 2,086 equals approximately 20,000 rounds as an average for every fee course in the country.

During our 28 years the figures on play and on number of golfers have checked closely with sales of clubs and balls. The latest fiscal year report of the Golf Club Manufacturers' Assn. was 3,372,601 clubs. Golf ball sales in a recent year were about 2,100,000 dozen.

Actually the figures show golf ball total sales as one of the few items that has been sharply reduced during the past 25 years. In the '30s the ball sales were about one ball per round played. Now, due to great improvements in ball construction, less rough, fewer water holes from which balls can't be recovered quickly and turf that holds the ball up better, ball use is longer.

The popular trend of the game may be shown by these figures. There are 108 courses owned by colleges and universities now; 94 courses at U. S. military installations and about 90 courses owned by corporations for their employees. These courses indicate the broad popular base of the game and the considerable activity in developing new golfers. Ladies play has advanced very rapidly. Also industrial leagues, civic support and greater leisure for workers all contribute to the variation in golf attractions.

Junior programs in high schools, at private and public courses are extensive and effective and already have created tremendous pressure for an increase in golf facilities. In 1953 and 1954 more than 100 new courses will have become available to ease the serious shortage of courses. About 250 additional courses are in the development stages.

Taxation and residential development demands are forcing some shifts in golf course locations with an undermined number of courses probably due for new locations within the next ten years. However golf is not alone in feeling this pressure; and with the increased demand for golf facilities as well as the recognition of the value of golf as a balance for an intensely mechanized American way of living and as a healthy social activity we do not believe the necessity for new golf locations to be alarming.

Our opinion is that the trend will be for more courses and they'll be factors in development of new residential neighborhoods. Already relocation of industries has spot-lighted golf courses as strong attractions in getting employees to move to new locations.

The national average is one golf course to 31,052 people of all ages and colors. Illinois has a golf course for each 28, 196; Indiana, one for 24,661; Ohio, one for 28,727; and Kentucky, one for 41,738. These figures plainly indicate vast, sound opportunity for more golf courses. There is solid growth now, rather than the boom of the '20s. Prior to the stock market collapse in 1929 there were a few more than 6,000 courses in the United States.

Another indication of the substantial interest in golf is the activity at golf ranges. There are about 1100 of these that represent considerable investments on which good profits are being made. There are approximately 500 more ranges that are doing well during their seasons, as rather casual enterprises.

You as turf superintendents have every right to be proud of the job being done in golf course maintenance. Increased use should be expected by a wide range of players.

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POA ANNUA AND ARSENIC TOXICITY

W. H. Daniel, Turf Specialist
Purdue University

Many of you will recall the 1952 National Golf Course Superintendents Association Conference at Columbus, Ohio. One of the sectional programs at that time was a panel discussion of "Poa annua - Friend or Foe". At that time Dr. De France, Engle and others commented that they believed the most permanent solution to the Poa annua infestation problem would be to apply chemicals which would inhibit the development of the young seedlings as they germinate.

One of the old standbys in turf management, which you are very familiar with, is lead arsenate. Its use has been greatly reduced in turf because chlordane has been very successful as an insecticide on turf pests. However, many of you will recall that in the past you felt there was less Poa annua, crabgrass, chickweed, etc., and you wondered if it was not the arsenate, supplied through the lead arsenate, which was inhibiting the seedlings.

In 1951, under the sponsorship of a grant from the Indiana Golf and the Indianapolis District Golf Association, we began to study on the effect of arsenic on Poa annua. The first plots were established on an unfertilized, unirrigated fairway in the sahde of oak trees at the Lafayette Country Club. At that time we applied 15 chemicals, many of which completely killed the grasses. One of those applied was lead arsenate at a rate of 30 pounds per thousand square feet spread over the surface in topdressing. Three months after that application we noticed that the Poa annua was considerably reduced in the lead area and that its root system and height of growth was much less. During the following spring we again observed a definite reduction in the Poa annua on the lead treated plots so that we felt this was a very practical way of selectively controlling Poa annua in that it was not completely killed, but that it would be reduced in vigor so that other grasses, namely bentgrass, bluegrass, fescue, would have the advantage in their development.

Meanwhile we had been working in the greenhouse, using flats of soil in which 2" - 4" plugs of bentgrass were placed and Poa annua seeded. Over this area then was sprayed some seedling affecting chemicals - the first

Chloro-IPC was at a range from 0 to 1 gallon per acre. We had a severe stunting of the bentgrass plugs at rates above 1/4 gal. and complete inhibition of *Poa annua* at all rates of Chloro-IPC used. This looked most promising. However, as yet I do not recommend it to you for control since there are many problems with its correct use.

Another material which was used was called Dinitro. This is currently being used on pre-emergence weed control in soy beans, cotton, corn and other crops. Again, it kills the seedling as it emerges as the young root takes up excess quantities of thismaterial. Meanwhile, the oily soy bean, the cotton and the deep planted corn seed escape damage in the seedling stage.

On turf the bentgrass plugs placed in the flats had a rather high tolerance for the Dinitro, while the *Poa annua* seedlings were killed by the lightest rate which was used. Again, this chemical Dinitro presents several problems in its correct use and is not recommended to you as a standard practice at this time.

The problem indicated with the Dinitros and Chloro-IPC is that the management required and the conditions necessary to get perfect results are very exacting. For example, in 1953 much of the cotton acreage received a light rain (total 1/4") after planting. This rain coming at the wrong time caused the Dinitro to move into the seed zone and kill their cotton material. Just a small rain greatly complicated the management procedure.

Let us now turn to the use of lead arsenate on the practice green at the Lafayette Country Club. This material was applied in November 1952 at rates up to 30 lbs. per 1,000 sq. ft. During the following spring no results were observed. Also, at that time plots were established on the 10,000 sq. ft. experimental putting green on the Purdue University Campus, and there again the results secured were questionable.

In order to follow this up, in the fall of 1953 we applied another series of applications to the practice green of the Lafayette Country Club so that we have a multiple checkerboard with rates ranging from 0 to 80 lbs. of lead arsenate per 1,000 sq. ft. At this time we have not been able to observe results. We are very hopeful for results during the coming spring season.

Our old friend, arsenates, either in the sodium or lead form, offers a much safer means of utilization of seedling inhibition, so we tried in the greenhouse to set up a very elaborate program to determine the feasibility of using lead arsenate to secure a weakening of the Poa annua. In one of our experiments we used flats in which a weedy ordinary topsoil was placed. Some of the soil had 20 lbs. of arsenic per acre inch of soil per 1,000 sq. ft. of area.

In the first slide you notice the difference in the vigor of the grass in the various flats. In the second slide there is shown 3 rates of application, 20,40, 60, all of which limit the growth of the Poa annua. Since this was an unfertilized soil and a literary review of bio-chemistry shows that phosphorus and arsenic inter-act, we applied to the north half of each flat superphosphate at the rate of 1 ton per acre so that the half of each flat has phosphorus added after the arsenic reduced the vigor of the grass.

It was very interesting to see the inter-action of arsenic and phosphorus for we found the arsenic reduces growth, while the phosphorus will overcome the arsenic effect and produce new growth. Then it appears that if we wish to have a ground cover and we wish that to be bentgrass, bluegrass or ryegrass that we must hope for a difference in species tolerance to arsenic.

Before going on I should point out that one phase of management, that where we applied the arsenic treated soil as the top inch we had excellent seedling inhibition of Poa annua and broad lead weeds. When the broad leaf weeds developed tap roots into non-arsenic soil, below they immediately became very vigorous. To the contrary, when arsenic treated soil was placed below non-treated soil, the seedlings were well established before the roots reached the arsenic layer, and there was never any restriction due to the arsenic in the lower layer. Does not this imply that the inclusion of the arsenic material would be necessary in the topdressing applied to a putting green, or that if the topdressing material were treated with arsenics during the coming years that the new seedlings would be weakened before their roots reached the non-arsenic treated area?

Now, to consider the arsenic effect on different species of desired grasses, we planted an experiment utilizing 500 small pots. Here on the blackboard this can be illustrated by showing the rate of arsenates from 0 to 80 lbs. per 1,000 sq. ft. A 100 lb. pile of soil would be treated at a rate equivalent to 20 lbs. per 1,000 sq. ft., then that 100 lbs. is divided so there are only 20 lbs. in each pile, each of which receives an increasing amount of phosphorus. Then the 20 lbs. is divided so that we had 5 grasses and 4 replicates of each. That gave us ryegrass, bentgrass bluegrass, bent stolons and Poa annua planted on each phosphorus--arsenic combination. Then we divided the grasses so that we had two replicates in a hot greenhouse, 80° to 85° which would represent summer temperatures, and two in a cool greenhouse, 60° temperature, which would represent spring and fall conditions. The following 8 slides show the results of those inhibited by the arsenic. On these 4 at high temperatures you will notice that the Poa annua is the only one inhibited and that only at low phosphorus availability.

In the cold greenhouse there is a much greater inhibition due to the arsenic. This shows up most on the Poa annua and least on the bentgrass. This would indicate that the most accurate use of arsenicals would allow a difference in specie response so that one could maintain a bentgrass or bluegrass area with the Poa annua gradually weakened so that it would not compete with the desired grasses. Also, in this experiment there is an obvious response from the Poa annua to phosphorus applications, more so than is true with bentgrass, ryegrass, or bluegrass which reduction may conclude that Poa annua is favored by high phosphorus availability, while bentgrass can tolerate a much lower phosphorus availability.

How can this unfinished research apply to your situation? In the first place, we should review the general fertilizing practice of today in contrast to that of years ago. Earlier one used much of the organic fertilizers, and would not annually apply repeat applications of the common high phosphorus containing fertilizers of today. Today there has been a great increase in the use of high phosphorus carrying materials such as 5-10-5 in order to get growth response from nitrogen. Meanwhile the accumulation of phosphorus in putting green soils exceeds that of the renowned potato growers of Maine. Dr. O. J. Noer, in reporting on soil testing for over a quarter of a century in 1953 at the Midwest Regional Turf Conference, pointed out it was an exception to find a golf green anywhere in the country which did not show high or excess phosphorus availability. We find it true in the soil testing program at Purdue University.

Your problem then is, can you expect to get an arsenic inhibition when you already have in the older established greens a phosphorus excess?

In earlier days you used light repeated applications of lead as an insecticide, but you did not have the excess phosphorus in the soil and may have gotten a response to the arsenic. Today, with a very high phosphorus content present, one would expect from the research we have seen so far to anticipate that there will be a need for a very heavy application of arsenic carrying material before there will be this weakening of the Poa annua on the established turf areas.

On the arsenicals, particularly sodium arsenite has been repeatedly by some of you attending this Conference as a foliar application to burn the seed heads and reduce the leaf surface. This is of necessity, a carefully conducted program in order to get the selected burn desired. It may be that one can explain from the results secured in the greenhouse by soil applications why this spray program has particular merit as a means of inhibiting the Poa annua without overcoming the phosphorus availability in the soil.

As pointed out, this thing is most complicated because it is biochemical in which temperature is more important than the relative application of arsenics, that the rate of phosphorus application is more powerful than the rate of arsenics, it is affected by day length, temperature, phosphorus level; in fact, it is certainly a complicated procedure. However, it does offer to me a most plausible means of allowing the superintendents to be relieved of the potential and perennial threat of seedling infestation into our turf areas.

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REPLANTING GOLF GREENS

Joe McDermott
Supt. Municipal Golf Course
Louisville, Kentucky

One of the five municipal golf courses, Shawnee, lies close to the Ohio River. Some years we had as many as three or four floods. This would cause more work, such as cleaning up the mud and debris on the course. Then in midsummer our biggest problem was silver crabgrass. To keep the greens playable, we hand weeded and even used the Goodall and Sensation Rotary power lawn mower. We set them as low as possible because a power green mower wouldn't keep the silver crabgrass down.

The above statements will give you an idea what a job it was trying to maintain the course. Mr. Morgan, the Director or Parks, City of Louisville, the President of Shawnee and I inspected every green and found much work to be done on the old greens to even make them playable. A decision was next reached to rebuild them. The sum of $18,000 was appropriated for the work, which was let out for contract. The few bids made were much higher than the amount of money appropriated. So by September 29, 1952, I was assigned the job. I felt it too late in the year to start rebuilding, because of uncertain weather conditions. We had good weather and on November 9, 1952, within six weeks, the last green was planted.

The first operation called for cutting the old sod and silver crabgrass 2" thick from the surface of the Green, then using a tractor with grader to push the sod off the area.

Lime was then applied at the rate of 15 pounds per 1,000 sq. ft. with a Master spreader.

Fifteen yards of coarse sand was spread evenly over the surface. We had several tons of leaf mold available, but before spreading ran it through the Royer Shredder to pulverize it. Then we mixed 3 tons of peat moss and 2 tons of leaf mold and spread evenly over the area on the green. A disk was used to mix the above into the soil to a depth of 8 inches. This operation was repeated several times and at different angles. Then a Gil Pulverizer was used to do the rough grading.

A complete fertilizer was applied at 80 pounds per 1,000 such as 5-10-5. Milorganite fertilizer was applied at 120 pounds per 1,000. We used an 8 foot Ezee-Flow Spreader and tractor to apply the fertilizer.

Twenty-five pounds of arsenate of lead per thousand square feet of green, was applied with a Master spreader. This was used as a hopeful prevention against Poa, grubs and crabgrass. After this was done the pulverizer was used to work theabove into the soil 2 to 3 inches in depth and to do the finish grading.

We marked the green off to get exactly 10 bushels of stolons per 1,000 sq. ft. I picked five of my best men to do the broadcasting of the stolons. After some of the stolons were in place, two men started rolling, then a crew of men began top dressing. After the stolons were rolled and topdressed they were rolled again. I had a man ready with the hose to start watering as soon as possible, and with a very fine spray. Watering was repeated to keep the surface moist until new roots were established.

We have been pleased with the putting green this past year. The rebuilding has been done with very little loss of play and increased play later more than made up the early spring loss.

This past season I put into effect a system of using two hole cups on each green, which I feel benefit the greens by avoiding compaction and wear around the single cup.

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PLANTING STOLONS ON LARGE AREAS

A. A. Linkogel, Turf Research
Committee of St. Louis, Missouri

First of all I would like to touch upon our research turf program in the St. Louis area. We have a turf garden of about 1 acre, composed of small plots of bermudas, zoysias and mixtures of cool and warm season grasses. Also we are conducting fungicide and weed control tests. Now that the U-3 strain of bermuda has proven itself in our area, the question came up, "How can we introduce it into our fairways with minimum golf interference?"

We have in our district, Mr. Leo Bauman, who has been a greens chairman for 25 years and knows our turf problems. We always depend upon him to secure funds and he has never failed to raise what was needed. He proposed a research program to the members of the St. Louis District Golf Association and got pledges for a 3 year program.

The Mississippi Valley Golf Superintendents Association was to lay out a program for a large scale planting of U-3 bermuda into fairways. They formed a committee of two golf course superintendents, Dr. Bill Daniel, myself and Mr. Bauman as Chairman. The committee hired a student, who happens to be my son, to do the work and checking.

We tried several methods of planting U-3 into fairways. The first experiment was on No. 1. Fairway at Westwood Country Club. This club was good enough to offer us any part of their fairways or grounds for experimental work. The grass on this fairway composed of bluegrass, bent and Poa annua. The work was started in July 7 just as the Poa annua had gone out.

First a West Point Grasslan Aerifier with 1½ inch spoons was used once. Then a F-G Aerifier with 1 inch spoons was used once. Following this a manure spreader was used to spread the stolons after they had been cut and chopped at the nursery. This spreader did a very fine job of spreading the stolons. It can be adjusted to spread from 60 to 150 bushels per acre. After spreading the stolons an alfalfa seed drill disks pressed the stolons into the ground. Then after rolling the ground smooth again it was fertilized and watered. This work was done on July 7 and on Sept. 1 there was from 80% to 85% coverage of U-3.

We cut the U-3 sod out of the nursery with a power sod cutter, then hauled it to the cutter. With a converted silo cutter, we can grind up about 700 bu. per day.

On No. 10 fairway at Westwood we tried a different method. We took a 20 ft. strip through the center of the fairway from tee to green. This was disked up with a chain link drag. After the stolons were spread it was disked lightly with the tandem disk then rolled, fertilized and watered. On September 1 the coverage here was about 90%.

We think the strip method is the best of the two, because if the player's ball would land in this planted strip, they could lift their ball to either side and drop on the old fairway. This coming year we can take another strip on either side of the fairway with the same convenience for the players.

On another fairway we planted ½ of it the same as No. 10 fairway. The players didn't like this too well because while keeping the stolons watered, it got pretty muddy at times. On the approach to a green, part of it was sodded solid and part of it strip sodded. We left a strip of bluegrass between the green and bermuda sod, in order to keep the bermuda out of the bent green. Many tees have been partly planted to bermuda.

This slide is a picture of a tee which you can see that the left side is covered with straw for two reasons; one, is to keep off the play over the winter months. It seems that the bruising of the grass over the winter does more harm than the cold. The other reason is to hold surface moisture, as drying of the the grass stolons may be a factor on some winter kill.

This club has most of their tees ½ bermuda for summer play, and the other half in bluegrass and bent which is for winter play. They mulched their tees in December after several killing frosts, the bermuda under the straw is brown but will green up next spring with a couple of weeks of warm weather. Another club in the district mulched their bermuda tees the first part of November, before a frost, and just this past week I looked at them; they are green, just the tips of the bermuda leaves are brown. One mowing and they would be 100% green in color, of course, we had a mild winter.

The first U-3 bermuda tee was planted in the St. Louis area in 1947. It is still in perfect shape. This tee was stripped of the sod two different times this past summer. This fall it was back in perfect shape.

The strip disking and replanting was by far the most acceptable by the golfer and it tended to sell them on the program for the contrast was so easy to observe in the fairway.

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MANAGEMENT, WEATHER, AND DISEASE

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Turf diseases develop as a result of a combination of factors. The weather, soil conditions, drainage, fertilization, watering, and other factors may contribute to any given disease attack. Likewise, when a turf area remains free of disease, a number of factors may contribute.

More research is needed to determine the conditions that favor turf diseases, but some of the factors can be given. Very acid soil conditions favor most of the turf diseases. Tender succulent grass, which has received an excess of water and nitrogen fertilizer, is more susceptible to most all diseases. It is especially favorable for large brownpatch and snow mold; and it has been known to increase the incidence of copperspot. While serious cases of dollarspot often occur on succulent turf, severe attacks are more common on turf that is grown on a low level of nitrogen. While high humidity contributes to the softeness of the grass, it also may aid growth of the fungi.

Optimum temperatures for the individual diseases vary considerably. Those who have experience with turf diseases soon associate certain diseases with cool or hot weather. The optimum temperatures have been given us:

Disease	Centigrade	Fahrenheit
Large brownpatch	25 - 30° C	77-86° F.
Pythium	34°	93°
Copperspot	28 - 30°	81-86°
Dollarspot	20 - 30°	68-86°
Pink Patch	18 - 22°	65-73°
Pink snowmold	20 - 21°	68-70°
Typhula snowmold	8 - 15°	46-54°

Since various disease factors are inter-related to the extent that it is difficult to isolate each factor and determine its exact responsibility for a given disease attack, it is easier to appreciate why an idea or practice works one time and not the next. If we understood all the important turf diseases factors,the information we have to date would have clearer meaning and disease control would be easier.

Often we overlook the effect of management factors on disease. Selection of the grass, age of the turf, fertilization, application of lime. Also, moisture, relations of rain and water application may have a bearing on a disease situation. Temperature, which is so critical for disease, is influenced by heat of the sun, site, exposure of the site, watering practices, heat from nearby objects, nearness to water and other factors.

Soils differ in their warming and cooling properties. A wet sandy soil conducts heat more readily and helps maintain a more uniform temperature than a wet organic soil. The difference in cover greatly affects the temperature at the ground surface. A deeper, more complete grass cover reduces the amount of radiation that reaches the soil. Air movement has a great influence on humidity as well as temperature at the turf level. Both high humidity and high temperature can develop near the surface of the turf if there is not enough air movement.

Disease is controlled by maintaining environmental conditions that are unfavorable for the organism. Better results will be obtained if more of the major factors are properly managed. Use the minimum amount of water that will keep the grass healthy. Applying water in the early morning rather than in the evening has been found to keep turf more free of disease. Take all practical steps to obtain good soil and air drainage as these help avoid excessive moisture in the turf and soil surface.

Feed the turf to keep it healthy, but avoid overstimulation. Large quantities of inorganic fertilizer in a single application in hot weather, or an accumulation of undecomposed organic fertilizer can lead to soft turf. Lime the soil only when needed to maintain a pH above 6.0. Use disease resistant grasses if their other qualities are satisfactory. When these requirements have been met, disease control will be easy, but the assistance of a good fungicide program will still be needed. Use the correct fungicide before disease strikes, as a protection program. Actually less effort will be required than to repair disease damaged turf.

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PRACTICAL MICROSCOPIC DISEASE OBSERVATIONS

Robert Williams
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There was once a time in the medical profession when most all ailments of a human being were treated with cure-alls. Today doctors are equipped with a knowledge of specific ailments and specific treatments. The knowledge of the plant kingdom is going through this very same transition today. We golf course superintendents are charged with the maintenance of healthy turfgrass. Therefore, it is our individual duty to keep abreast of the findings of research as pertains to our work.

Plant pathologists are continually isolating more and more specific grass disease organisms and finding specific treatments for their control. The time has come when it is no longer practical to apply a one shot cure all fungicide. We must first determine from symptoms and microscopic examination of the grass plant, which disease organism is responsible for the ailment and then apply the specific fungicide and treatment as recommended from research findings.

At first mention of a golf course superintendent employing the use of a microscope in turf disease diagnosis, one gets the impression that it would be too technical and would require a great deal of study. This is not true; it is just another milestone that we are passing in the history of better turf maintenance.

Two years ago I became interested in the use of microscopes as applied to turf maintenance. At that time I started out with a wide-field, binocular stereomicroscope with a power rating of 20 to 60 magnification.

This instrument can be taken right out on the green or other turf area and be employed to study the grass plant and its reactions to various treatments and use. Through this process I have come to know the grass plant much more intimately. I now look upon a golf green as an area inhabited with individual plants rather than merely a piece of turf. I have seen the damage to a bentgrass blade from a mower and how it "bleeds" and dies back after cutting. I can better understand now why many times a green that is cut in the afternoon of a hot day will wilt and show mower marks. I have seen comparatively large grains of sand lying on a fresh green grassblade and the damage that is done through abrasion when stepped on or when a power mower is given a quick spin on the turf. All of these things merely give me the basis for a greater respect for the individual plant and for the turf in general.

After working out on the turf with the stereomicroscope I realized that this was only scratching the surface of the potential. I soon contacted one of the doctors at our club and he found a used high powered microscope for me at a cost of some $30.00. Now I could go up to 100 to 400 magnifications which is as much as is practical in our work and thereby study and become acquainted with the disease organisms. After a short briefing by a plant pathologist in the preparation of a slide, I was ready to continue my study. My next step was to identify one disease and distinguish it from another. To accomplish this I obtained sample slides showing each specific organism and I came to know them by memory. Today at our turf conferences we are being given additional training along these lines which all adds up to making the golf course superintendents more professional.

We cannot and should not expect to become plant pathologists; but if we can learn to differentiate between disease and physical damage as well as between Curvularia and Helminthosporium organisms, then we have progressed measurably.

From my experience I certainly advocate that every golf course superintendent should obtain a microscope and become more familiar with the plants with which he is working.

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