INDEX TO VOL. XII, RESEARCH BULLETINS
Nos. 146-156

A
Acetylmethylcarbinol, relation to butter cultures........................................... 321
Age, at first egg, compared with the date of hatch........................................... 253
Agricultural Economics Section, bulletin from.................................................... 361
Agricultural Engineering Section, bulletin from................................................ 185
"An Economic Analysis of Farm Mortgages in Story County, Iowa, 1854-1931," by William G. Murray................................................................. 361
Appendix ................................................................................................................. 412
Bibliography ............................................................................................................. 423
Introduction ............................................................................................................. 365
Miscellaneous factors ............................................................................................... 396
Duration of loans ..................................................................................................... 401
Interest rates ............................................................................................................ 395
Term of loans ........................................................................................................... 399
Mortgage situation, 1910-31.................................................................................. 401
Conclusion ............................................................................................................... 410
Debt by townships and individual farms................................................................. 407
Defaults, 1921-31 .................................................................................................... 405
Indexes of the situation ......................................................................................... 401
Short time debt changes.......................................................................................... 375
Foreclosures ............................................................................................................ 379
Influence of changes in prices of farm products..................................................... 380
Purpose of mortgage loans..................................................................................... 377
Sequence of prosperity and depression.................................................................. 383
Sources of funds........................................................................................................ 385
Assignments ............................................................................................................ 389
Lenders ................................................................................................................... 385
Location of lenders ................................................................................................. 393
Summary ................................................................................................................... 363
Trend of farm mortgage debt................................................................................... 368
Period of price deflation .......................................................................................... 374
Period of price inflation ........................................................................................... 373
Period of steady rise in land values........................................................................ 371
Settlement period .................................................................................................... 370
Animal Husbandry Section, bulletin from............................................................. 185, 245, 261, 297

B
Bacterial activities in soils, effects of various kinds and amounts of lime on .......... 64
Brown, P. E., co-author of "Method for Determining Carbon Dioxide Production in Soils" ................................................................. 25
"Some Chemical and Bacteriological Effects of Various Kinds and Amounts of Lime on Certain Southern Iowa Soils. Part I. Laboratory and Greenhouse Experiments" .............................................................. 57
Butter cultures, relationship of acetylmethylcarbinol and diacetyl to................. 321
Studies on the development of from mixtures of organisms.............................. 1

C
Calcium carbonate, effects of various amounts of chemically pure carbonate on Grundy silt loam, Shelby loam and Tama silt loam....................................................... 68
Cannon, C. Y., co-author of "Length and Floor Construction of Dairy Stalls" .......................... 185
"Normal Growth in Dairy Cattle" .................................................. 297
Carbon dioxide, methods for determining production of in soils.................. 25
Evolution of from soils.......................................................... 35
Manometric method for testing rate of production in soils by measuring the oxygen consumption...... 45
Percentage of in soil air.......................................................... 30
Citrullus vulgaris, relative wilt resistant varieties of.................. 158
Concrete, for dairy stalls.................................................. 201
Cork brick, for dairy stalls.................................................. 201
Crops yields and composition, effects of various amounts of lime on........ 66

Dairy cattle, normal growth in........................................ 297
Growth in live weight.................................................. 305
Skeletal growth.......................................................... 311
Dairy stalls, construction of........................................ 185
Flooring materials.................................................. 193
Concrete.......................................................... 201
Cork brick.......................................................... 201
Mastic floor.......................................................... 204
Measuring the wear on.................................................. 196
Rubber paving block.................................................. 206
Wood block.......................................................... 207
Length of.......................................................... 186
Dairy Industry Section, bulletin from........................................ 1, 321
Debt, changes in short time.................................................. 375
Diacetyl, relationship of to butter cultures........................................ 321

Egg production, factors affecting.................................................. 245
Entomology Section, bulletin from........................................ 209
Espe, D. L., co-author of "Normal Growth in Dairy Cattle".................. 297

Factors Influencing Egg Production, III. The Association of the Date of Hatch with Date of First Egg, Sexual Maturity and Egg Production in S. C. White Leghorns," by C. W. Knox.................................................. 245
Experimental, (date of hatch compared with the).................................................. 252
Age at first egg in days.................................................. 253
Date of first egg.................................................. 252
Spring egg production.................................................. 256
Total annual egg production.................................................. 257
Winter egg production.................................................. 255
Literature cited.................................................. 260
Materials and methods.................................................. 251
Summary.................................................. 248
Farm Crops and Soils Section, bulletin from........................................ 25, 57
Farmer, R. S., co-author of "Studies on the Development of Butter Cultures from Mixtures of Organisms".................................................. 1
"The Relationship of Acetylmethylcarbinol and Diacetyl to Butter Cultures".................................................. 321
Farm mortgages, an economic study of in Story County, Iowa.................................................. 361
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm mortgage debt, trend in</td>
<td>368</td>
</tr>
<tr>
<td>First egg, date of compared with date of hatch</td>
<td>252</td>
</tr>
<tr>
<td>Floor, construction of in dairy stalls</td>
<td>185</td>
</tr>
<tr>
<td>Flooring materials, dairy stall</td>
<td>193</td>
</tr>
<tr>
<td>Fowl typhoid, selection for resistance to in the chicken with reference to its inheritance</td>
<td>261</td>
</tr>
<tr>
<td>Comparative resistance of males and females</td>
<td>289</td>
</tr>
<tr>
<td>Effect of selection upon resistance</td>
<td>273</td>
</tr>
<tr>
<td>Inbreeding in the selected population in relation to resistance</td>
<td>281</td>
</tr>
<tr>
<td>Mechanisms contributing toward genetic resistance to</td>
<td>261</td>
</tr>
<tr>
<td>On the inheritance of resistance</td>
<td>286</td>
</tr>
<tr>
<td>Results of crossing selected with unselected stock</td>
<td>283</td>
</tr>
<tr>
<td>Variation in the resistance of progeny from different sires</td>
<td>278</td>
</tr>
<tr>
<td>Funds, sources of</td>
<td>385</td>
</tr>
<tr>
<td>Fusarium niveum, pathogenicity and host plants of</td>
<td>129</td>
</tr>
</tbody>
</table>

G
- Genetics Section, bulletin from                                    | 261  |
- Giese, Henry, co-author of “Length and Floor Construction of Dairy Stalls” | 185  |
- Growth, normal dairy cattle                                         | 297  |
- Grundy silt loam, some chemical and bacteriological effects of lime on | 57   |
  - Calcium and magnesium carbonate                                     | 100  |
  - Chemically pure calcium carbonate                                   | 68   |
  - Limestone—different degrees of fineness                             | 94   |
  - Quarry-run limestone                                                | 79   |

H
- Hammer, B. W., co-author of “Studies on the Development of Butter Cultures from Mixtures of Organisms” | 1   |
- “The Relationship of Acetylthiolethanol and Diacetyl to Butter Cultures” | 321  |
- Hansen, E. N., co-author of “Normal Growth in Dairy Cattle”          | 297  |
- Hatch, date of as affecting egg production                           | 245  |
- Honeybee, studies on the changes in nectar concentration produced by the | 209  |
- Hybridization, watermelon                                            | 169  |
- Hydrogen, effects of various kinds and amounts of lime on the exchangeable | 63   |

K
- Knox, C. W., author of “Factors Influencing Egg Production. III. The Association of the Date of Hatch with Date of First Egg, Sexual Maturity and Egg Production in S. C. White Leghorns” | 245  |
- Co-author of “Selection for Resistance to Fowl Typhoid in the Chicken with Reference to Its Inheritance” | 261  |

L
- Lambert, W. V., co-author of “Selection for Resistance to Fowl Typhoid in the Chicken with Reference to Its Inheritance” | 261  |
A study of dairy stall flooring materials
Concrete ............................................... 201
Cork brick ............................................ 201
Mastic floor ........................................... 204
Measuring the wear of .................................. 196
Preparation of curves.................................. 197
Procedure ............................................ 194
Rubber paving block .................................. 206
Wood block ............................................ 207
Length of stall platforms ................................ 187
Analysis of data ......................................... 188
Conclusions regarding stall length ...................... 192
Literature .............................................. 208a
Summary ................................................ 208a

Lime, some chemical and bacteriological effects of various kinds and
amounts of on certain southern Iowa soils ................. 57
Limestone—quarry-run, effects of various amount on Grundy silt loam,
Shelby loam and Tama silt loam .......................... 79

M

Mastic floor, for dairy stalls .................................. 204
Melhus, I. E., co-author of “The Pathogenicity of Fusarium niveum
(EFS.) and the Development of Wilt Resistant Strains of Citrullus
vulgaris (Schrad.)” ....................................... 121
“Methods for Determining Carbon Dioxide Production in Soils,” by
F. B. Smith and P. E. Brown ................................. 25
Discussion and summary .................................. 48
Experimental ............................................... 29
Evolution of carbon dioxide from soils ................. 35
Effect of crop rotation on carbon dioxide production in
soils ......................................................... 44
Effect of treatment on the evolution of carbon dioxide
from soils by the free evolution methods ................. 41
Free evolution of carbon dioxide from the soil .......... 35
Manometric method for determining the rate of carbon dioxide
production in soils by measuring oxygen consumption 45
Percentage of carbon dioxide in soil air .................. 30
Historical .................................................. 27
Determination of the concentration of carbon dioxide in soil
air .......................................................... 27
Determination of the rate of diffusion of carbon dioxide
through soil .............................................. 29
Measurement of the evolution of carbon dioxide from soils 28
Literature cited .............................................. 50
Michaelian, M. B., co-author of “The Relationship of Acetilmethylearbinol and Diacetyl to Butter Cultures” .... 361
Milk, germicidal properties of .............................. 21
Mortgage situation, 1910-31 ................................ 401
Murray, William G., author of “An Economic Analysis of Farm Mort-
gages in Story County, Iowa, 1854-1931” ................. 361

N

Nectar, changes which occur between the flower and the hive .... 209
“Normal Growth in Dairy Cattle,” by D. L. Espe, C. Y. Cannon and
E. N. Hansen .................................................. 297
Growth in live weight ........................................ 305
Influence of gestation and lactation ................ 316
Literature cited ............................................ 319
Methods of procedure .................................. 298
Skeletal growth ............................................. 311
Summary ......................................................... 297

Organisms, butter cultures developed from .......... 1

Park, O. W., author of "Studies on the Changes in Nectar Concentration Produced by the Honeybee, Apis mellifera. Part I. Changes Which Occur Between the Flower and the Hive" 209

"Pathogenicity of Fusarium niveum (EFS.) and the Development of Wilt Resistant Strains of Citrullus vulgaris (Schrad.), the," by D. R. Porter and I. E. Melhus 121

Hybridization .............................................. 169
Artificial crosses of the variety Conqueror on four commercial varieties ........................................ 170
Chance hybrids of the variety Conqueror on commercial varieties ............................................. 173
Crosses of varieties of the citron group on varieties of the watermelon group ........................................ 175
Varieties chosen as stocks .................................. 169

Methods of measuring the relative wilt resistance of varieties, selections and hybrids in the greenhouse ........ 178

Pathogenicity and host relationships of Fusarium niveum ............................................. 129
Cultural characteristics ...................................... 131
Infection ................................................................ 129
Symptoms ................................................................ 130

Relation of soil temperature to seedling rot ............ 138
Greenhouse trials with dust fungicides in the control of seedling rot and seedling wilt .............................. 149
Relation of air temperature to watermelon wilt in two infested fields .............................................. 150

Review of pertinent literature ................................ 127
Studies on the control of watermelon wilt .............. 152
Development of wilt on transplanted watermelons .... 158
Effect of soil treatment on the wilt pathogene ........ 158
Isolation of wilt resistant strains of watermelons by selection within commercial varieties ................. 162
Mass selections made in 1928 ................................ 168
Trials with the variety Kleckley Sweet .................... 162
Trials with the variety Tom Watson ........................ 167
Relative wilt resistance of varieties of Citrullus vulgaris ............................................. 158

Summary .......................................................... 125

Porter, D. R., co-author of "The Pathogenicity of Fusarium niveum (EFS.) and the Development of Wilt Resistant Strains of Citrullus vulgaris (Schrad.)" 121

"Relationship of Acetylmethylcarbinol and Diacetyl to Butter Cultures, the," by M. B. Michaelian, R. S. Farmer and B. W. Hammer 321

Discussion of results ............................................. 354
Part I. Acetylmethylcarbinol and diacetyl in butter cultures 354

5
Part II. Source of acetylmethylcarbinol and diacetyl in butter cultures .................................................................. 355
Part III. Destruction of acetylmethylcarbinol and diacetyl by the butter culture organisms .......................... 356
Part IV. Development of a special butter culture. ................................................................................................. 357

Experimental .......................................................................................................................................................... 328
Part I ....................................................................................................................................................................... 328
Part II ....................................................................................................................................................................... 335
Part III ....................................................................................................................................................................... 345
Part IV ....................................................................................................................................................................... 348

Historical .................................................................................................................................................................. 324
Literature cited ........................................................................................................................................................... 359
Methods ..................................................................................................................................................................... 326
Acetylmethylcarbinol plus diacetyl ........................................................................................................................... 326
Acidity ....................................................................................................................................................................... 328
Diacetyl ....................................................................................................................................................................... 327
General numbers of organisms in butter cultures ................................................................................................... 328
Volatile acid ............................................................................................................................................................... 328

Summary ................................................................................................................................................................... 357
Part I ....................................................................................................................................................................... 357
Part II ....................................................................................................................................................................... 358
Part III ....................................................................................................................................................................... 358
Part IV ....................................................................................................................................................................... 359

Rubber paving block, for dairy stalls ........................................................................................................................ 206

S

"Selection for Resistance to Fowl Typhoid in the Chicken with Reference to Its Inheritance," by W. V. Lambert and C. W. Knox. ...................................................................................................................................................................................... 261
Comparative resistance of males and females ............................................................................................................. 289
Concerning the possible nature of the mechanisms contributing toward genetic resistance to disease .................................................................................................................................................................................................................. 265
Discussion ..................................................................................................................................................................... 290
Effect of selection upon resistance .............................................................................................................................. 273
Experimental technique .................................................................................................................................................. 268
Mortality following the infection of varying numbers of bacteria .................................................................................. 268
Specificity of mortality .................................................................................................................................................. 272
Variation in the control population following the injection of the standard dose .................................................. 271
Virulence of the organism ............................................................................................................................................. 270
Inbreeding in the selected population in regard to resistance ..................................................................................... 281
Literature cited ............................................................................................................................................................. 293
Material and methods .................................................................................................................................................. 267
On the inheritance of resistance .................................................................................................................................. 286
Problem, the ............................................................................................................................................................... 266
Results of crossing selected with unselected stock ...................................................................................................... 283
Summary ..................................................................................................................................................................... 261
Variation in the resistance of progeny from different sires .......................................................................................... 278

Smith, F. B., co-author of "Methods for Determining Carbon Dioxide Production in Soils." .................................................................................................................................................................................................................. 25
Soil, methods for determining carbon dioxide production in ...................................................................................... 25

Experimental .................................................................................................................................................................. 67

Series I. Effects of various amounts of chemically pure cal-
Calcium carbonate on Grundy silt loam, Shelby loam and Tama silt loam ............................................ 68
On hydrogen ion concentration of soils ............................................ 70
On exchangeable hydrogen, exchangeable bases and degree of saturation of soils with bases ................. 74
Series II. Effects of various amounts of quarry-run limestone on Grundy silt loam, Shelby loam and Tama silt loam ....... 79
Series III. Effects of various amounts of quarry-run limestone on Grundy silt loam ............................................ 87
Series IV. Effects of limestone of different degrees of fineness on Grundy silt loam ............................................ 94
Series V. Effects of calcium and magnesium carbonates and limestones on Grundy silt loam ..................... 100
Historical ............................................ 160
Literature cited ............................................ 118
Summary and conclusions ............................................ 113
Spring egg production, compared with date of hatch ............................................ 256
"Studies on the Changes in Nectar Concentration Produced by the Honeybee, Apis mellifera. Part I. Changes which Occur Between the Flower and the Hive," by O. W. Park ............................ 209
Discussion ............................................ 239
Experimental ............................................ 214
Methods ............................................ 215
Capturing and dissecting bees ............................................ 222
Determination of concentration of nectar and other sugar solutions ............................................ 215
Feeds and sirups ............................................ 219
Identification of bees used ............................................ 221
Training bees to feed at the desired location ............................................ 218
Problem, the ............................................ 214
Results ............................................ 223
Field-bees carrying sirup one-half mile ............................................ 225
Review of preliminary experiments ............................................ 223
Literature cited ............................................ 243
Review of literature ............................................ 212
Summary ............................................ 210
"Studies on the Development of Butter Cultures from Mixtures of Organisms," by R. S. Farmer and B. W. Hammer ............................ 1
Conclusions ............................................ 22
Experimental ............................................ 5
Effect of germicidal property of milk on butter cultures ............................................ 21
Influence of carrying butter cultures in dairy plants ............................................ 20
Influence of temperature on butter cultures ............................................ 15
Influence of temperature on the constituent types of organisms in pure cultures ............................................ 17
Influence of various strains of constituent organisms in the development of butter cultures ............................................ 5
Rapid procedures for the selection of organisms satisfactory for the development of butter cultures ............................................ 12
Relationship of organisms in satisfactory mixtures of butter culture organisms ............................................ 11
Stability of butter cultures ............................................ 13
Methods ............................................ 3
Temperature, influence on butter cultures ............................................ 15
Total annual egg yield, comparison with the date of hatch ............................................ 257
Walker, R. H., co-author of "Some Chemical and Bacteriological Effects of Various Kinds and Amounts of Lime on Certain Southern Iowa Soils. Part I. Laboratory and Greenhouse Experiments" 

Watermelon wilt, hybridization to control ........................................... 169
Methods of measuring resistance to ..................................................... 178
Studies on the control of ........................................................................... 152
Winter egg production, comparison with the date of hatch ..................... 255
Wood blocks, for dairy stalls ..................................................................... 207

Young, A. W., co-author of "Some Chemical and Bacteriological Effects of Various Kinds and Amounts of Lime on Certain Southern Iowa Soils. Part I. Laboratory and Greenhouse Experiments" 

57