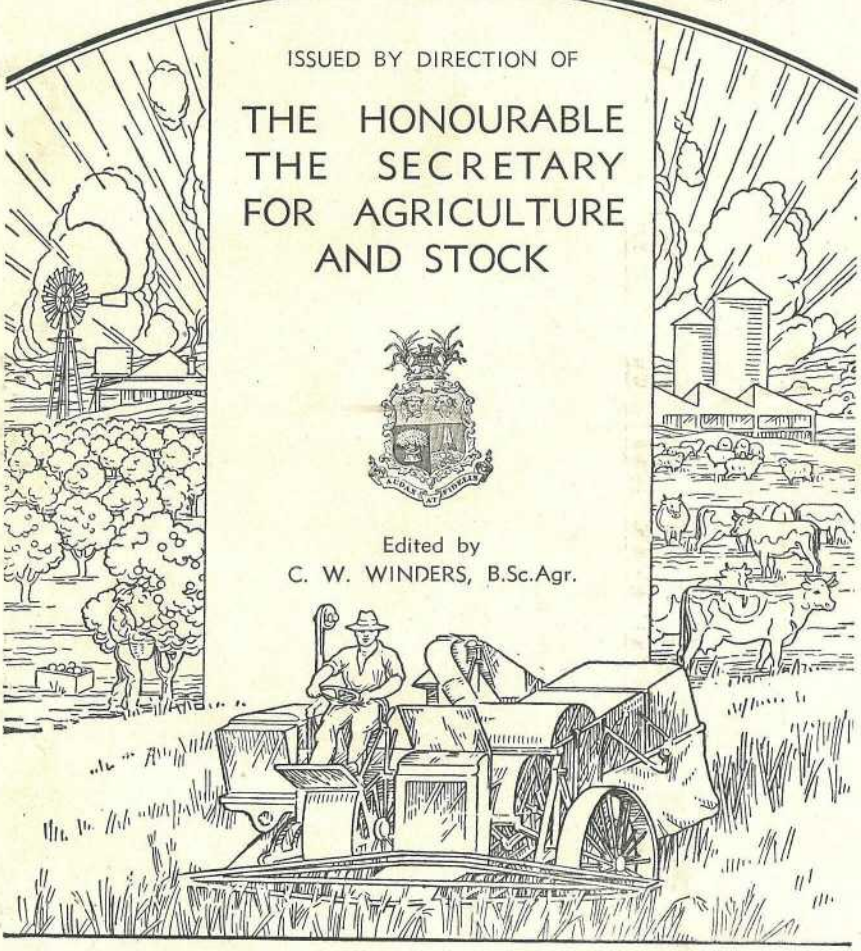
Volume 80

QUEENSLAND AGRICULTURAL JOURNAL

ISSUED BY DIRECTION OF

THE HONOURABLE
THE SECRETARY
FOR AGRICULTURE
AND STOCK

Edited by
C. W. WINDERS, B.Sc.Agr.



JANUARY TO JUNE, 1955

Vol. 80 Parts 1 to 6.

QUEENSLAND AGRICULTURAL JOURNAL

SUBJECT INDEX.

PAGE.

A

Apple—
- Gravenstein 317-318

Avocado Paste 273

B

Banana—
- Aftermath of 1954 Cyclones 258-260
- Dwarf and Semi-Dwarf Varieties 83-87

Beans—
- Pod Quality in French Beans 319-322

Beef Cattle—
- Environment and Breed Improvement 241-245
- Industry of Central Coastal Queensland 351-362
- Industry of Eastern Cape York Peninsula 47-55,116-124

Beekeeping—
- Hints on Hive Making 151-152

Bloat Control by Strip Grazing 296

Botany—
- Broad-leaved Apple 191-193
- Rough-barked Apple 153-155
- Rough-barked Ribbon Gum 276-278
- Rusty Gum 193-196
- Wood's Apple 155-158

Brucellosis-tested Swine Herds 2, 91, 136, 232, 254, 316

C

Cauliflower Varieties 147-150

Celery 212-214

Citrus—
- White Wax Scale 92-94

Copper Deficiency in Plants and Soils 25-26

Cotton Production 197-199

Cowpox 295-296

Custard Apple 17-21

PAGE.

D

Dairying—
- Buildings on the Atherton Tableland ... 173-182
- Bull Testing 217
- Calf Feeding and Management 304-310, 363-372
- Calf Identification Scheme 245
- Cleaning Method 220
- Environment and Breed Improvement 241-245
- Farm Refrigeration 349
- Milking Times and Practices 32-46
- Netherlands 342-348
- Official Australian Pure Bred Dairy Cattle Production Recording Scheme 98-112
- Payment for Cheese-Milk 183-186
- Seasonal Calving 287-294
- Vibriosis 331-336

E

Export Outlook 247-248

F

Fauna Conservation Legislation 323-326

Freight on Fertilizer 245

G

Grass Caterpillar 22-24

H

Honey Flora 153-158, 191-196, 274-278

Horticultural Districts—
- Granite Belt 137-146

I

Inoculation of Legume Seeds 97

L

Land Leveller 311-314

Lantana Poisoning 200-204

Lettuce 205-211

PAGE.

M

Minister's New Year Message 1

O

Orange—
Washington Navel 255-257

P

Pastures—
African Star Grass 115
Centro in the Mackay District 125-128
Guinea Grass 261-269
Irrigated Pasture Management 330
Kapok Bush 341
Molasses Grass 129-135
Renovating Pastures 269, 294
Sowing Summer Pastures on the Darling Downs 79-82
Sown Pastures in the Chinchilla District 204
Pigeon Pea Seed Identification 315

Pigs—
Brucellosis-tested Herds 2, 91, 136, 232, 254, 316
Identification 225-231
Swine Erysipelas 28-31

Poultry—
Egg Quality 95-97
Infectious Laryngo-Tracheitis 297-303
Laying Rate 56-62
Sorghum for Chickens 221-224
Successful Hatching 337-341

R

Rotproofing 26-27

PAGE.

S

Shallot 217
Sheep—
Body Lice 159-169
Effects of Light on Merinos 336
Feeding Ewes on Silage 112
Fluorosis of Merinos 113-115
Mules Operation 233-240
Supplementary Feeding 279-286, 327-330
Weaning Lambs 286
Soil Conservation—
In South-Eastern Darling Downs 63-74
Sorghum Grain Storage 278
Sorghum Midge 251-253
Spinach 214-216
Sweet Potato Growing 3-16

T

Timber Eradication 27
Timber Rake Attachment 270-273
Tomato—
Varietal Trends at Bowen 88-90
Traumatic Pericarditis 171-172
Trees on Roads 169-170

V

Vibriosis 331-336

W

Water Conservation—
Atherton Tableland 75-78
Pondage of Runoff Water by Contour Pasture Furrows 187-190
Storing Rain Water 218-220
Waterproofing 26-27
Water Requirements of Crops 249-250
White Wax Scale on Citrus 92-94

A

PAGE.

Animal Breeding—
Animal Selection Graph 244

B

Bananas—
Cavendish 84
Cyclone Damage 259, 260
Lakatan 86
Mons Mari 85
Beans, French 320, 322
Beef Cattle—
Brahman 117, 119
Branding 122
Beekeeping—
Diagram of Hive 151
Blue Lupin 140
Botany—
Broad-leaved Apple 191-193
Rough-barked Apple 153-155
Rough-barked Ribbon Gum 276-277
Rusty Gum 194, 195
Western Vegetation Types 281
Wood's Apple 156-158

C

Cabbage Crops 76, 146
Cattle Diseases—
Lantana Poisoning 201-203
Cauliflower Varieties 148-150
Celery Crop 214
Cheese—
Edam 345
Gouda 347
Citrus—
Washington Navel Orange 256
White Wax Scale 93-94
Climatology—
Rainfall Zones 283
Cotton Crop 198-199
Custard Apples 18-20

D

Dairying—
Buildings on the Atherton Tableland ... 173-182
Calf Feeding 309, 363-364, 370-371
Calf Feeding Bails 365-367
Debudding Irons 369
Dutch Friesian Cattle 347
Dutch Friesian Sire 343
Equipment 344
Herd Recording 105, 290-292
Research School, Wageningen 346
Dips (Sheep)—
Plunge 167-168
Spray 161, 164-166
Districts—
Granite Belt 138-139
Map of Central District 353
Map of Portion of Eastern Cape York Peninsula 48

E

Entomology—
Grass Caterpillar 22-32
Sorghum Midge 251-253
White Wax Scale 93-94

F

Fauna Districts 326

G

Grapes— PAGE.
Vineyard before Pruning 144
Grass Caterpillar 22-23

L

Land Leveller 311-314
Lettuce—
Bedded Lettuce 209
Bolting in the Crop 207
Green Manuring 208
Single Row Planting 210
Varieties 206
Lucerne 274-275

O

Orange—
Washington Navel 256

P

Pastures—
Centro 125-127
Dairy Pastures in Holland 346
Guinea Grass 262-268
Kikuyu Grass 23
Mitchell Grass 280
Molasses Grass 130-134
Pasture Furrowing Project at Toowoomba 187, 189
Rotational Grazing 368
Summer Pastures on the Darling Downs 80-81
Pear 143
Pigeon Pea 315
Pigs—
Carcases 225-227
Firebrand 228
Tattoo 229-231
Plum 142
Poultry—
Feed Cost Graph 61
Infectious Laryngo-Tracheitis 297-302

S

Sheep—
Dips 161-168
Distribution of Body Lice 15 Years Ago 160
Merino 279-282
Mules Operation 235, 238
Soil Conservation in South-eastern Darling Downs 63-74
Sorghum Midge 251-253
Sweet Potatoes—
Grazing 6-7
Leaves 9-16
Varieties 9-16

T

Timber Rake 270-273
Tomatoes—
Crops 144
Fruit 88-90

V

Vegetation—
Marine Plain Country 50-55

W

Water Conservation—
Atherton Tableland 75-78
Rainwater Tank 218, 219
White Wax Scale on Citrus 93-94

PAGE.

A

ALEXANDER, G. I. (with A. Hutchings)—
The Dairy Calf—Its Feeding and Management 204-310, 363-372
ANDERSSEN, K. B.—
Cotton for Cash 197-199
ARBUCKLE, J.—
The Beef Cattle Industry of Central Coastal Queensland 351-362
ARMSTRONG, W. C.—
The Gravenstein Apple 317-318

B

BAIRD, E. W.—
A Home-made Land Leveller or Smoother 311-314
BARKER, J. S. F.—
The Problem of Environment and Breed Improvement 241-245
BECKMAN, T. J.—
Waterproofing and Rotproofing 26-27
BERRILL, F. W.—
Dwarf and Semi-Dwarf Varieties of Banana 83-87
BLAKE, S. T. (with C. Roff)—
The Honey Flora of South-eastern Queensland 153-158, 191-196, 274-278
BURNS, E. O. (with T. Kudyba)—
The Rate of Lay—Its influence on Poultry Farm Profits 56-62
BURTON, H. W.—
Sorghum Doesn't Harm Chickens 221-224

C

CHAMP, B. R.—
The Grass Caterpillar 22-24
COLEMAN, F. B.—
Identifying Pigeon Pea Seed 315
COPEMAN, N. C.—
The Beef Cattle Industry of Eastern Cape York Peninsula 47-55, 116-124

F

FANNING, R. R.—
Storing Rain Water for Dairy Use 218-220

G

GOODCHILD, N. E.—
Centro in the Mackay Agricultural District 125-128

H

HANNIGAN, M. A.—
Horticultural Districts of Queensland 1. The Granite Belt 137-146
HARVEY, J. M. (with G. R. Moule)—
Fluorosis of Merino Sheep in Queensland. Part 3. The Management of Flocks to Overcome Fluorosis..... 113-115
HASSELL, O. L.—
Sweet Potato Growing in Queensland... 3-16
HUTCHINGS, A. (with G. I. Alexander)—
The Dairy Calf: Its Feeding and Management 304-310, 363-372

PAGE.

K

KELSEY, R. F.—
Pondage of Runoff Water by Contour Pasture Furrows 187-190
KNOTT, S. G.—
Lantana Poisoning of Stock 200-204
KUDYBA, T. (with E. O. Burns)—
The Rate of Lay—Its Influence on Poultry Farm Profits 56-62
KUSKIE, S. J.—
The Washington Navel Orange 255-257

M

MANEFIELD, T.—
White Wax Scale on Citrus..... 92-94
MILLER, S. J.—
Body Lice of Sheep..... 159-169
MILNE, F. N. J. (with C. H. Smith).—
Successful Hatching 337-341
MOBBS, J. A.—
Bananas—Aftermath of the 1954 Cyclones 258-260
MORGAN, C. N.—
Cauliflower Varieties 147-150
MORGAN, C. N. (with S. E. Stephens).—
Lettuce, Celery and Some Other Greens 205-217
MORRIS, T. A.—
Payment for Cheese-Milk According to Quality is Justified 183-186
MOULE, G. R.—
The Case for the Mules Operation..... 233-240
The Supplementary Feeding of Sheep in Queensland.—Part 1. Introductory 279-286
The Supplementary Feeding of Sheep in Queensland.—Part 2. What Does the Sheep Do with the Feed It Eats?..... 327-330
MOULE, G. R. (with J. M. Harvey)—
Fluorosis of Merino Sheep in Queensland. Part 3. The Management of Flocks to Overcome Fluorosis 113-115
MURRAY, A. J. W.—
Dairy Buildings on the Atherton Tableland 173-182

N

NICHOLS, L. E.—
Dairying in the Netherlands..... 342-348

O

OFFICERS OF THE AGRICULTURE BRANCH—
Guinea Grass 261-269
Molasses Grass 129-135
OFFICERS OF THE DIVISION OF DAIRYING—
The Official Australian Pure Bred Dairy Cattle Production Recording Scheme 98-112
OFFICERS OF THE PIG BRANCH—
Identification of Pigs..... 225-231

PAGE.

P

PARKINSON, B.—
Vibriosis of Dairy Cattle..... 331-336

PASSLOW, T.—
The Sorghum Midge 251-253

PEGG, S. E.—
Seasonal Calving for Dairy Cows..... 287-294

PEGG, S. E. (with E. B. Rice)—
A Survey of Milking Times and Practices 32-46

PREST, R. L.—
The Custard Apple..... 17-21

Q

QUEENSLAND FOREST SERVICE—
Trees on Roads..... 169-170

R

RAMSAY, W. R.—
Cowpox 295-296
Traumatic Pericarditis: Inflammation of the Heart Sac Caused by Physical Injury 171-172

RANBY, P.—
Infectious Laryngo-Tracheitis of Poultry 297-303

RICE, E. B. (with S. E. Pegg)—
A Survey of Milking Times and Practices 32-46

ROCHE, W. J.—
A Timber Rake Attachment for a Bulldozer Blade 270-273
Soil Conservation on the Steeper Cultivated Slopes of the South-eastern Darling Downs..... 63-74

ROFF, C.—
Hints on Hive Making..... 151-152
Queensland Fauna Conservation Legislation—"*The Fauna Conservation Act of* 1952" 323-326

PAGE.

ROFF, C. (with S. T. Blake)—
The Honey Flora of South-eastern Queensland ... 153-158, 191-196, 274-278

RUMBALL, P.—
The Egg and You 95-97

S

SIGLEY, G. R.—
Dairy Farm Refrigeration in the Roma District 349-350

SMITH, C. H. (with F. N. J. Milne)—
Successful Hatching..... 337-341

SPRING, H.—
The Outlook for Sterling Convertibility and Its Significance for Queensland's Rural Exports..... 247-248

STEELE, W. G.—
Water Conservation on the Atherton Tableland..... 75-78

STEPHENS, S. E. (with C. N. Morgan)—
Lettuce, Celery and Some Other Greens 205-217

T

TREE, E. F.—
Varietal Trends in the Tomato Crop at Bowen..... 88-90

TRIM, L. G.—
Pod Quality in French Beans 319-322

V

VON STIEGLITZ, C. R.—
Copper Deficiency in Plants and Soils 25-26

W

WELLS, W. G.—
Know the Water Requirements of Your Crops..... 249-250

WILSON, R. G.—
Sowing Summer Pastures on the Darling Downs 79-82

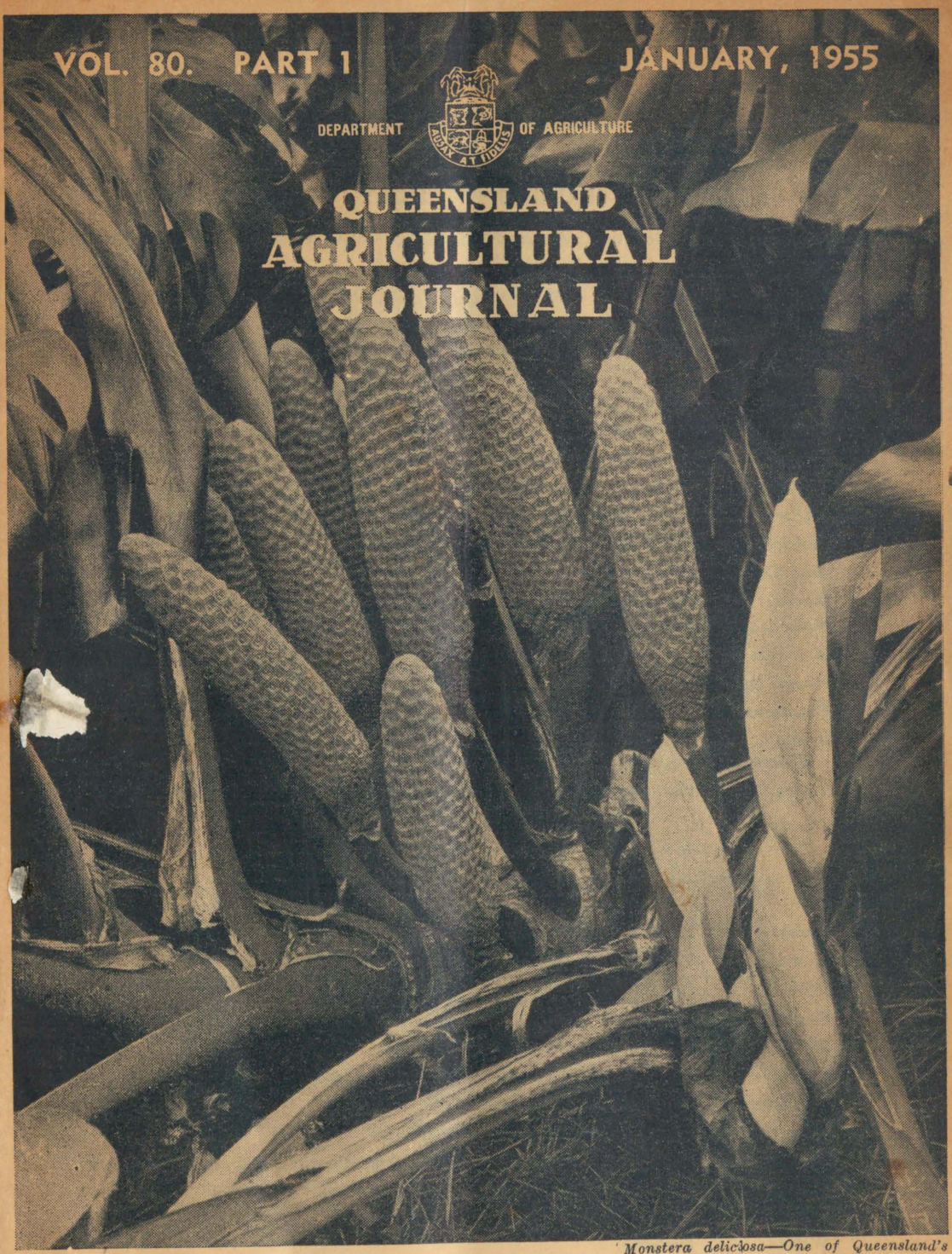
WOOLCOCK, B. A.—
Swine Erysipelas 28-31

A. H. TUCKER, Government Printer, Brisbane.

VOL. 80. PART 1 JANUARY, 1955

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL



Monstera deliciosa—One of Queensland's wide range of fruits.

LEADING FEATURES

Sweet Potato Growing
The Grass Caterpillar
Swine Erysipelas
Poultry: Rate of Lay
The Custard Apple
Copper Deficiency
Waterproofing and Rotproofing
Milking Survey
Cattle Country in Eastern Cape York Peninsula

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

Queensland AGRICULTURAL JOURNAL

Contents

Page

A Message from the Minister 1

Brucellosis-tested Swine Herds 2

Field Crops—
Sweet Potato Growing in Queensland. By O. L. Hassell 3

Fruit Growing—
The Custard Apple. By R. L. Prest and A. A. Ross 17

Entomology—
The Grass Caterpillar. By B. R. Champ 22

Agricultural Chemistry—
Copper Deficiency in Plants and Soils. By C. R. von Stieglitz .. 25
Waterproofing and Rotproofing. By T. J. Beckmann 27

Pig Raising—
Swine Erysipelas. By B. R. Woolcock 28

Dairy Farming—
A Survey of Milking Times and Practices. By E. B. Rice and S. E. Pegg 32

Cattle Husbandry—
The Beef Cattle Industry of Eastern Cape York Peninsula. By N. C. Copeman and W. F. Mawson 47

Poultry Farming—
The Rate of Lay—Its Influence on Poultry Farm Profits. By E. O. Burns and T. Kudyba 56

A MESSAGE FROM THE MINISTER.

<>

As a new year dawns, one would like to be able to give an assurance that a rosy future lies stretched before our primary industries.

Unfortunately, the outlook is veiled by the uncertainty of adequate markets for some of our important products.

The situation is one that leaves no room for vacillation. Forthright action by responsible authorities and producers' organisations is called for if traditional markets are to be held—and held remuneratively—and if new markets are to be obtained.

As a producer, you too have a degree of responsibility that you must accept as an individual. If you are producing a commodity in which quality counts—and what farmer isn't?—you must strive for highest quality.

Those are the tasks that lie ahead of us in 1955. We must tackle them with enthusiasm, energy and skill if we hope to bring a forbidding situation under control. We must be determined to sustain our efforts over a long hard pull.

For my own part, I can assure you that in the spheres in which I am privileged to serve the primary industries I will do my best for them. I know that the officers of the Department of Agriculture and Stock will continue to devote themselves faithfully to their duties.

W. H. Collins

Minister for Agriculture and Stock.

Brucellosis-Tested Swine Herds.

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found. A semi-annual or annual re-test of the herd, as determined by the Director, is required.

TESTED HERDS (As at 31st December, 1954).

Berkshire.

S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
E. Pukallus, "Plainby" Stud, Crow's Nest
G. C. Traves, "Wynwood" Stud, Oakey
E. Tumbridge, "Bidwell" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, "Kennington Stud, Underwood Road, Eight Mile Plains
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, "Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, "Burdell," Goovigen
R. H. Coller, Tallegalla, M.S. 292, Marburg
R. E. Paulsen, "Crest" Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, "Hartley Grange" Stud, 684 Logan road, Greenslopes
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. J. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. C. Fletcher, "Myola" Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon
The Marsden Home for Boys, Kallangur
M. F. Callaghan, Lower Mount Walker, *via* Rosewood
J. B. Lotz, M.S. 794, Kalbar
E. J. Clarke, "Kaloon," Templin, *via* Boonah
K. B. Jones, "Cefn" Stud, Clifton

Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
M. D. Power, "Ballinasloe" Stud, Swan Creek, *via* Warwick
H. L. Larsen, "Oakway," Kingaroy
C. Wharton, "Central Burnett" Stud, Gayndah
Mrs. I. G. Utting, "White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. J. Horton, "Manneum Brae" Stud, Manneum, Kingaroy
Miss G. R. Charity, Coondoo, Kin Kin.
W. J. Blakeney, "Talgai" Stud, Clifton
O. B. Vidler, Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur.

Tamworth.

S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry Road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. A. Herbst, "Hillbanside" Stud, Bahr Scrub *via* Beenleigh
H.M. State Farm, Numinbah
D. B. Alexander, "Debreczen" Stud, Kinleymore *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
D. and P. V. Campbell, "Lawn Hill" Stud, Lamington
H. J. Armstrong, Alhambra," Crownthorpe, Murgon
Q.A.H.S. and College, Lawes
R. H. Coller, Tallegalla, M.S. 292, Marburg

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
D. Kay and P. Hunting, "Kazan" Stud, Goodna
J. M. and B. N. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trout road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
A. Curd, "Kilrock" Stud, Box 35, Jandowae
W. R. Dean, "Trelawn," Tandur, *via* Gympie
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
J. E. Heath, "Springlea" Stud, Murgon
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank
A. J. Stewart "Springbrook," Pie Creek Rd., Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur.

British Large Black.

H. W. Naumann, "Parkdale" Stud, Kalbar

Sweet Potato Growing in Queensland.

By O. L. HASSELL, Senior Adviser in Agriculture.

The sweet potato is extensively grown in many countries, including Mexico, Central and South America, the United States of America, South Africa, India, China, Japan, South Sea Islands, New Zealand and Australia.

In Queensland, sweet potatoes are grown as a minor crop in almost every coastal district from the southern border to Cooktown. In the southern portion of the State they are grown on numerous small areas for sale or for local consumption as a culinary vegetable, and for hand-feeding to pigs. In the central district their value as a stock food is more widely recognised, and, for this purpose, larger areas are grown for grazing.

There is scope for considerably increased production of this crop in the State, both for human consumption and as a bulk feed for pigs and cattle. Most of the varieties described in this article are excellent for human consumption, being free of strings or fibres, such as spoiled the texture of many of the older varieties.

According to statistical returns, the area planted commercially to sweet potatoes in Queensland during the year 1952-53 was 642 acres, from which the yield of roots was 2,099 tons.

SOILS.

The most suitable soils for the production of sweet potatoes are the sandy loams and the sandy clay loams. Surprisingly good results have been obtained with this crop on poor sandy soils with the aid of a little fertilizer, so long as the water requirements of the crop have been met either from rainfall or from irrigation. Heavy clay soils should always be avoided, no matter how fertile they may be.

Soils on which sweet potatoes are known to produce well in Queensland are the poorer sandy loams of the coastal and sub-coastal areas of southern Queensland, the red clay loams, red loams and brown loams of the softwood scrubs of Central Queensland, and the red volcanic soils of the Atherton Tableland.

On the lighter soils this crop may even become a pest of subsequent cultivation. Portions of roots and vines will remain alive in the soil from season to season; these commence to grow where conditions are suitable, and frequently overrun succeeding crops. To avoid this trouble, a smother crop such as cowpea should follow the sweet potato crop.

Rich alluvial soils will very often produce a disappointing crop of sweet potatoes. A heavy cover of vine growth is made with a light crop of roots. The same results may be produced when a fertilizer which is too rich in nitrogen has been used.

PREPARATION OF THE SOIL.

Usually two ploughings are necessary to have the soil in a suitable condition for planting. The first ploughing is done during the winter or early spring, and sufficiently early to allow the soil to settle and become compact before planting. The first ploughing

should be deep (up to 9 in.), and the second ploughing considerably shallower. On light sandy soils, if the second ploughing is made too deep there is a tendency for the fleshy roots to become excessively long and thin.

PROPAGATION.

As compared with the English potato, the sweet potato is a cheap crop to grow, as it is propagated from cuttings, which can be produced in a few weeks at suitable periods of the year. Roots for the purpose of providing cuttings should be planted as soon as all danger of frost is over. A careful selection of such roots is worth while. The selection should be confined to plants which are high-producing and free from disease. The roots themselves should be smooth, well shaped, of market quality, and of a type characteristic of the variety to be propagated.

Before planting, all roots should be inspected for evidence of the sweet potato weevil. Any infested roots should be discarded, and only sound material used for planting. The selected roots should be planted in a nursery plot of well-drained fertile soil, where irrigation can be supplied if required.

If the roots are well "shot" when planted, a good supply of runners can usually be obtained in six weeks. Sometimes as many as 50 cuttings and over can be obtained from a single large root. If planting material is required for a considerable area, however, a nursery plot area of 800-1,000 sq. ft. will be required to supply the necessary cuttings for every acre of ultimate crop.

It is not necessary in Queensland to propagate sweet potatoes in a cold frame or hot-bed unless, for commercial reasons, a very early crop is required.

Sweet potatoes may be propagated by planting roots directly in the field. This method of planting is not generally recommended, however, as the period of growth is longer, and it is seldom possible to secure sufficient small roots to carry out this method of planting.

PLANTING MATERIAL.

The Department of Agriculture and Stock can usually advise interested persons of a source of supply of limited quantities of named varieties. Once in possession of a small stock of a new variety, a farmer can then maintain the variety and increase it according to his requirements.

PLANTING OUT.

Prior to planting out the sweet potato crop in the field, the surface soil should be well prepared to ensure its freedom from weeds.

The time required for the maturity of the sweet potato normally ranges from four to five months. Planting should be completed in time to avoid any risk of the crop being damaged by frost. In southern Queensland coastal areas, this requires that planting should be completed by the end of January. In coastal areas of central Queensland the planting period may be extended till the end of February, while in far northern coastal districts planting may be carried out at practically any time of the year. In inland districts the planting-out period will be considerably restricted because of the frost hazard.

Planting material consists of cuttings, each about 15 in. long, from the nursery plot. A suitable distance for planting on most soils is 3 ft. apart in the row, and 4 ft. between the rows. With this rate of planting, 3,630 cuttings per acre would be required.

Where the roots are to be harvested by hand, the most suitable method of planting is on ridges. Using this method, the cuttings may be dibbled in along the crown of a ridge or hill which has previously been thrown up by the cultivating implements. Alternatively, the cuttings may be placed the correct distance apart along the top of the ridge and pressed into the soft moist soil with a blunt board, the pressure being applied to the middle of each cutting. This job may be done quite satisfactorily using a short piece of board nailed to an old spade handle. The latter method is quicker than dibbling or planting with a spade.

Where large areas are to be planted out, the quickest method of planting is by ploughing in the cuttings when the ground is receiving its final ploughing. When this method is adopted, the plants are placed the required distance apart in every third or fourth furrow, the necessary covering being given by the plough as it turns the succeeding furrow.

A method of large-scale planting which has been practised successfully by a grower in the central district is to employ three or four men, a tractor, and a three-furrow disc plough. One of the men is fully employed preparing the cuttings, one man drives the tractor, and a man sitting on the plough drops the plants along the plough furrow. Upwards of eight acres per day have been planted in this manner.

CULTIVATION.

The only cultivation necessary is to check weed growth until the vines commence to run. In well-prepared land it is seldom that more than one inter-row cultivation will be required.

RATOONING.

A common practice where sweet potatoes are grown for grazing pigs is to have a plant crop and one or more ratoon crops on the same land. Experience is required in determining when a paddock has been sufficiently grazed to allow of satisfactory ratooning. If a paddock is overgrazed, insufficient roots will be left in the ground to start the following crop, and a light crop will result.

In preparation for the ratoon crop, the field is well harrowed down at the end of the winter (after grazing has been completed), and is then allowed to remain undisturbed until there is sufficient soil moisture to induce new growth. When the ratoon crop is mature the field is again grazed. On well-prepared and fertilized land a second ratoon is possible.

MANURING AND FERTILIZING.

Stable manure improves the yield of both the vine and the roots, but adversely affects the quality of the roots. Therefore, if the crop is intended for commercial purposes, the use of stable manure is not recommended. If intended for grazing by cattle or pigs, liberal dressings of farmyard manure may be applied to the land and ploughed in prior to planting. Any land intended for sweet potato production may be improved by ploughing in a green manure crop before planting.

Most sweet potato soils will benefit from an application of a commercial fertilizer. As a general recommendation for most fertile soils it is suggested that a 4:12:4 mixture should be applied at the rate of 4-5 cwt. per acre. On the poorer sandy soils, it is recommended that a 6:14:10 mixture be applied at the rate of 5-6 cwt. per acre. In the Redland Bay area instances of boron deficiency have been recorded. Where this deficiency is known to exist, it is recommended that 15 lb. of borax per acre be applied to the land before planting, provided no borax has been used for two years previously.

HARVESTING.

To ascertain whether the crop is ripe and fit to dig, a typical root should be cut in two and the cut surface examined. If ripe, the cut surface will dry clear, according to the normal colour of the flesh; if unripe, it will dry a dark or greenish colour. With most varieties of sweet potatoes it is not possible to use the plough when harvesting for market, because of the risk of damaging a large percentage of the roots.

Harvesting for market is normally carried out using a long-pronged fork. Care should be exercised when digging, because sweet potatoes bruise very easily. The roots should be carefully graded, and marketed in a clean, attractive condition. Where the roots are required solely for stock feeding purposes, they may then be ploughed out, preferably with a mouldboard plough.

The roots will normally continue to increase in size in the ground until the first killing frost is experienced.

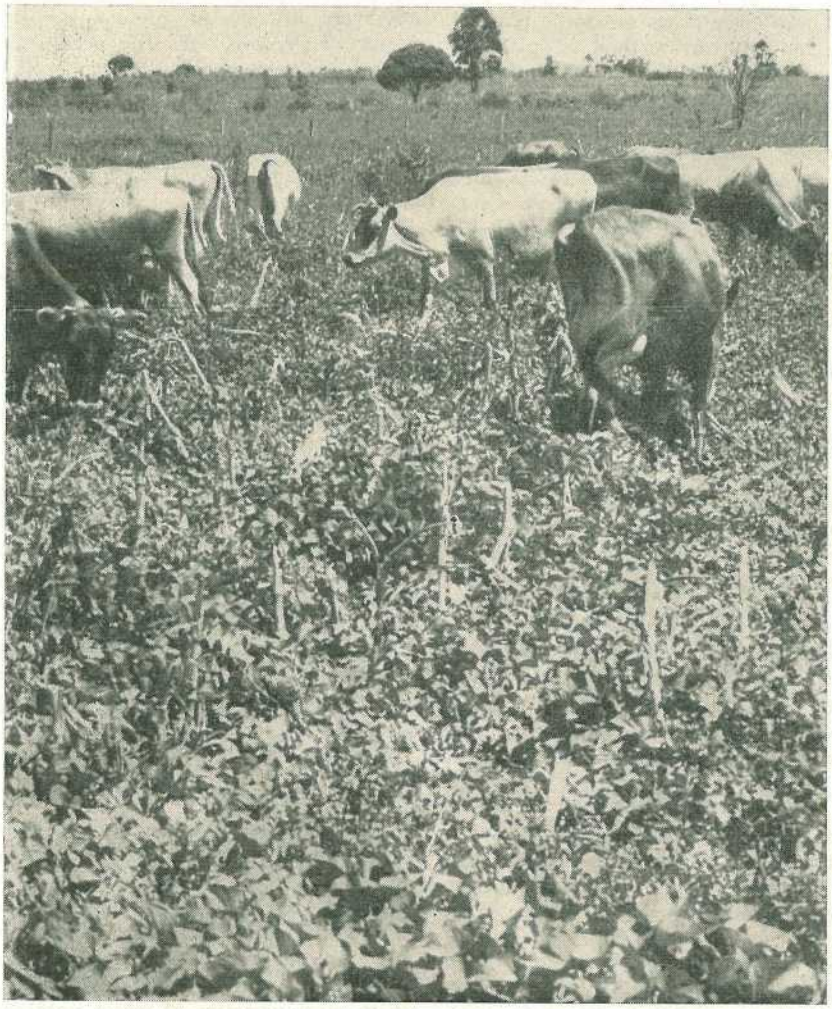


Plate 1.

Sweet Potato Vines being Grazed by Dairy Cows in Central Queensland. This is an early grazing of the spring growth. The stalks in the picture are old maize stalks from a preceding crop.

Such frosts will kill the vines and check any further growth of the crop. Provided frosts are not too severe, the crop may be left in the ground for a considerable period, and harvested as required. The frosted vines should be removed from the field, however, as they may otherwise help to start decay in the underground crop.

If the roots are to be harvested before the vines are dead, it will also be found advisable to cut and remove the vines before digging commences.

GRAZING BY PIGS.

Where the sweet potato crop is to be used for grazing by pigs, the paddocks should be subdivided into conveniently sized areas and the pigs allowed to do their own harvesting. If the subdivisions are too large, a good deal of waste may occur. A suitable fence for holding pigs on sweet potatoes may be made with four barbed wires. The first wire is placed six inches from the ground, the second nine inches above that, the third wire nine inches from the second, and the

top wire 18 inches above the third wire. If the field is not overcrowded, and sufficient roots are present under the vines, the pigs rarely attempt to force their way through such a fence. An electric fence may also be used.

If put on to graze the crop before frosts occur, the pigs will eat the potato tops and other green material in the field as well as digging for the roots. The number of pigs that a field of sweet potatoes can carry will largely depend, of course, on the weight of roots available in the soil. A fair average yield of sweet potatoes would be 6-8 tons per acre, but heavy yields of up to 15 tons per acre are not uncommon. With average yields a safe grazing rate would be three to four pigs per acre. This type of grazing requires a supplement of grain together with a protein meal or skim-milk. This supplementary feed is best supplied in covered troughs within the field.

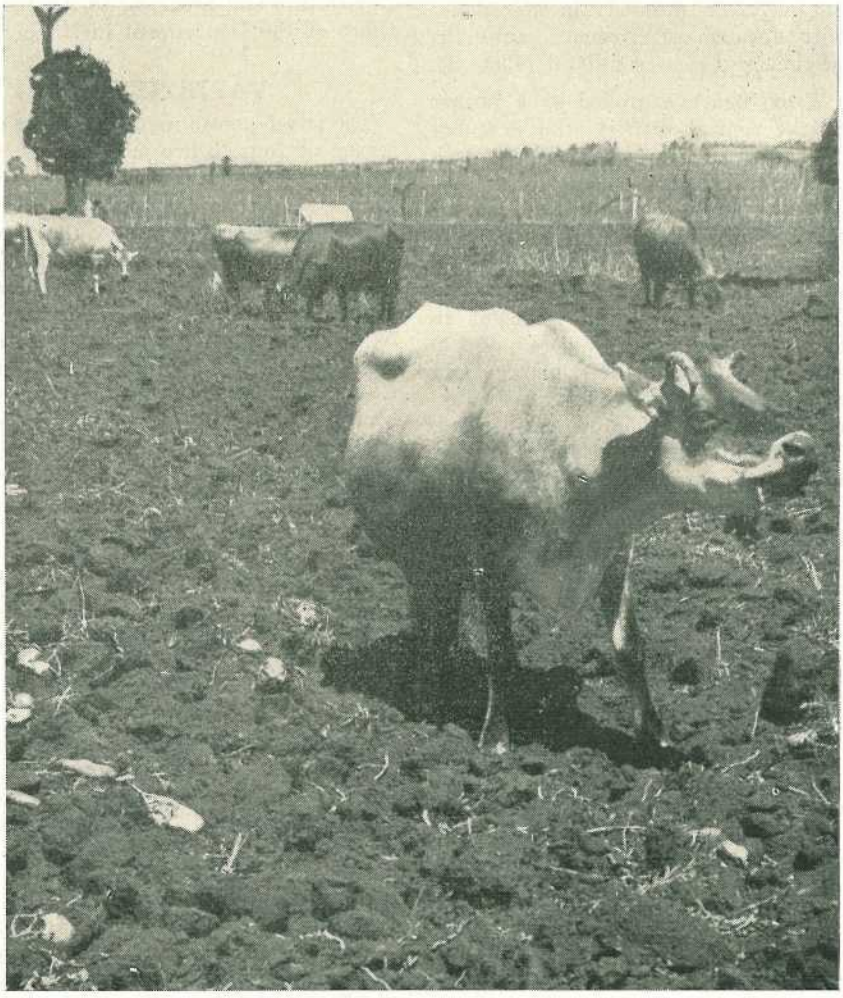


Plate 2.

Winter Grazing of Cows on Sweet Potato Roots which Have Been Recently Exposed by Ploughing.

GRAZING BY CATTLE.

Sweet potatoes are also used effectively for grazing by dairy stock, particularly in central Queensland. The general procedure is to graze the vines lightly during the middle of the season, and to follow with a final grazing just before crop maturity or the anticipated period of early frosts (Plate 1). When there is no further above-ground forage, several rounds of the paddock are then ploughed to bring the tubers to the surface, and the cows allowed access to this ploughed area. This ploughing out of the roots proceeds in accordance with feeding requirements until the whole area has been utilised (Plate 2).

From figures supplied by a farmer in the central district who now has 40 acres under crop, the life of each area sown is approximately three years before replanting is desirable. In order to maintain continuity of feeding on this farm, 10 acres have been planted each year during the past four years. These areas have been sufficient to maintain an average herd of 30 milkers during both summer and winter periods with good production returns. In the 1951 drought period, 25-30 cows were grazed on an area of 12 acres for some months, holding their condition and production. This farmer considers that one acre of sweet potatoes would maintain one milker during its lactation period.

PESTS.

The main pest of the sweet potato is the sweet potato weevil. Though the beetles attack the leaves, stems and roots, the main source of loss is damage to roots by the larvae, which are stout white legless grubs about one-third of an inch long. Roots may be rendered valueless by the burrowing of these larvae.

As the pest is carried over from one season to another in roots and vines, it is advisable to clean up an infested crop after harvesting. This is done by collecting all infested material and destroying it, as well as eliminating volunteer plants. Sensible crop rotation and clean farming methods should assist considerably in keeping this pest in check.

Planting material should always be carefully examined for signs of infestation and only sound roots should be used. It is also a good idea to have the propagation bed well removed from the paddock to be planted.

Should any further advice be required upon the control of this pest, application should be made to the nearest office of the Department of Agriculture and Stock, or to the Head Office of the Department in Brisbane.

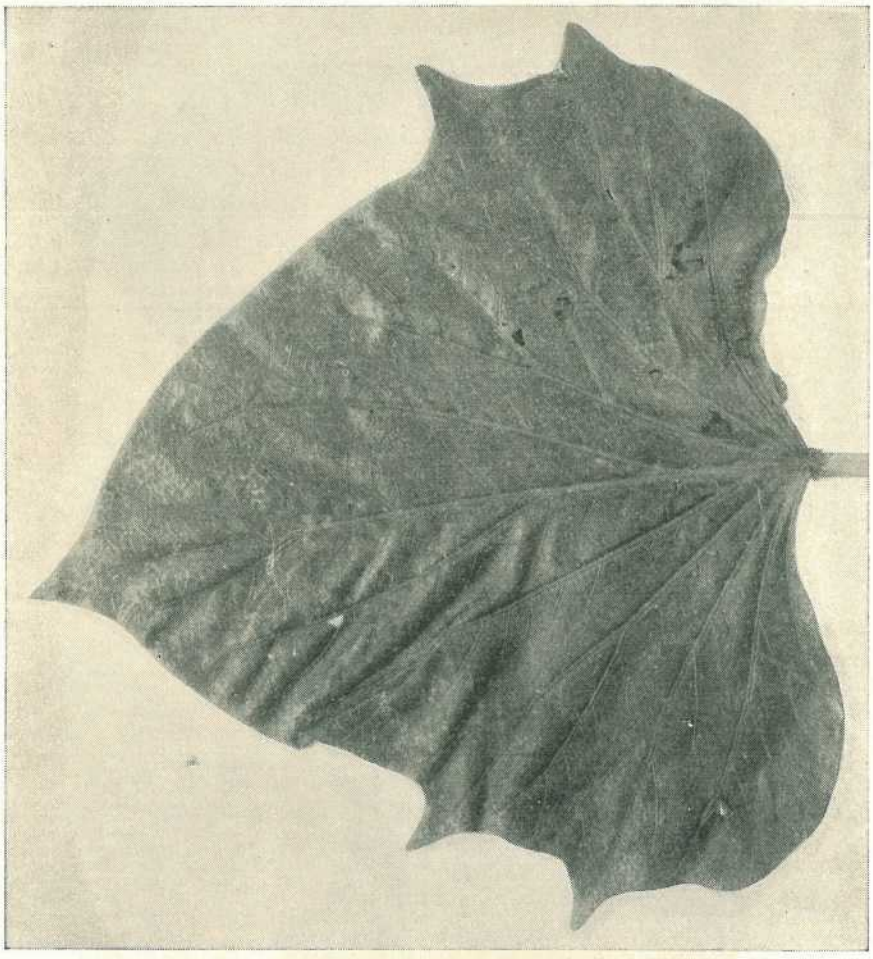
VARIETIES.

The sweet potato requires a growing season of four to five months, and, in accordance with their maturing habits, varieties can be classed as early, midseason, or late. Varieties that have been grown for many years in the coastal districts of Queensland, and which can be recommended for planting for both pig feed and culinary purposes, are White Maltese and Porto Rico. Both are midseason types and heavy yielders. These varieties, together with a number of others which have been tried in more recent years, are described below.

Porto Rico.

Several strains of Porto Rico have been grown in Queensland, including an early introduction (here referred to as the "local strain"), Porto Rico (Unit 7) and Porto Rico (Bunch).

The first two are similar. The leaf is of variable shape and size but for the most part is large with distinct shoulders (Plate 3). The veins are green in Porto Rico (Unit 7) and purple in Porto Rico (local), with a purple spot at the base of the leaf in both strains. The stem is purple, and an abundance of vine and leaf is produced, especially with Porto Rico (local). The roots are medium to large in size, well shaped, with a bronzy pink skin; the flesh is yellow, with



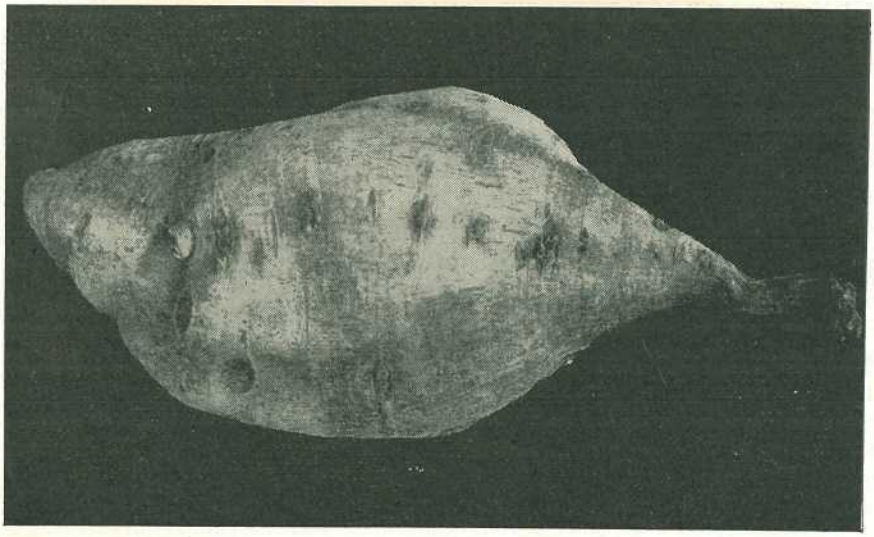


Plate 3.
Porto Rico (Local). Root 8 inches long.

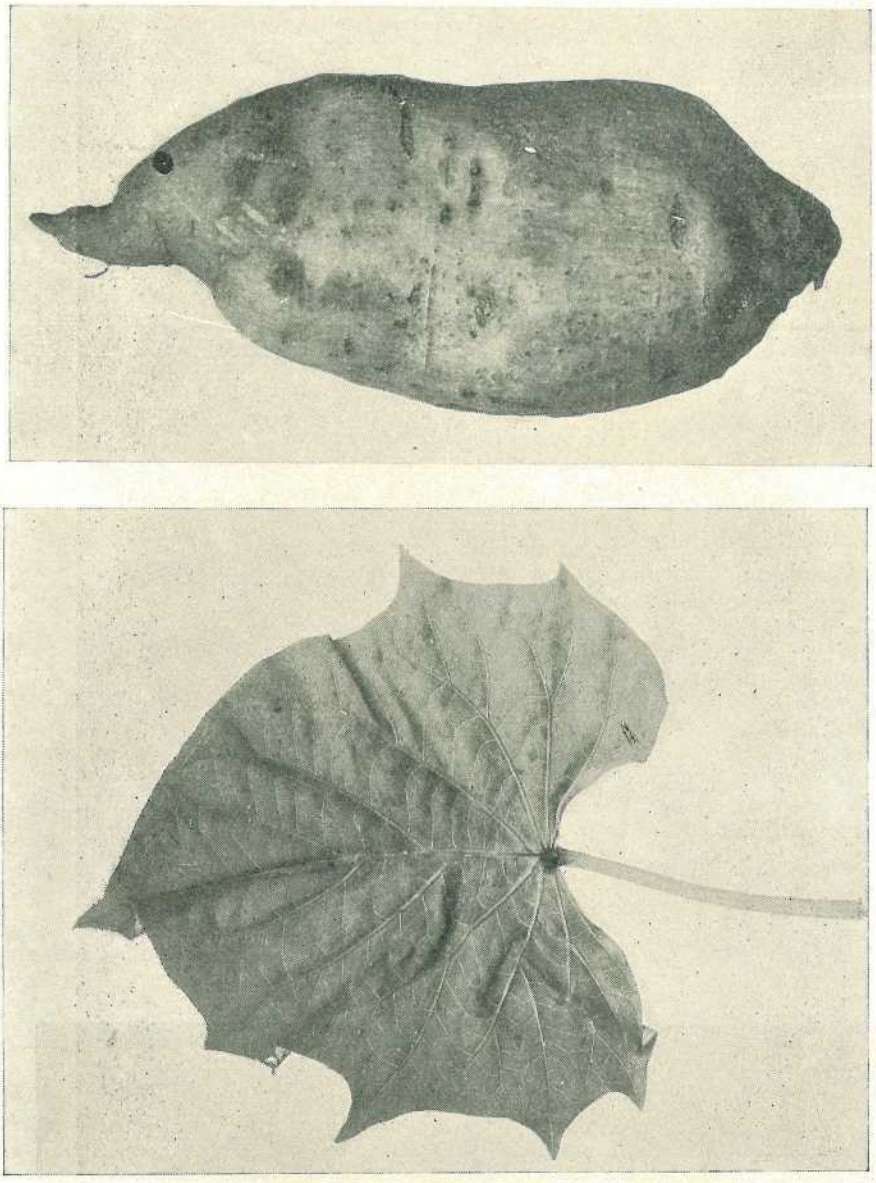


Plate 4.

Porto Rico (Bunch). Root 6 inches long.

dry texture and good flavour. Both strains are midseason and are highly recommended for both culinary and grazing purposes.

In Porto Rico (Bunch) the leaf is large and has distinct shoulders, green veins, and a purple spot at the base. (Plate 4.) The stem is purple, the growth is characteristically bunched, and there are no runners. The roots are elongated and have a light pink skin; the flesh is yellow, with only fair texture and flavour; maturity is late. This variety has not shown great promise for farm conditions because its yield is below average, but it would be useful in home gardens where a bunched growth and an absence of runners are desirable.

White Maltese.

In the White Maltese variety (Plate 5) the leaves are small and heart-shaped, with the main vein purple and lateral veins green; a purple spot occurs at the base of the leaf. The stems are green and thin but the variety rambles extensively. The roots have a rough white skin and may grow to a great size under good conditions; the flesh is white, with soft texture and a sweet flavour. This mid-season variety is a heavy yielder and has been popular in Queensland for many years, especially for feeding to pigs.

Abundance.

Abundance (Plate 6) is a good variety for both culinary and grazing purposes, and is recommended especi-

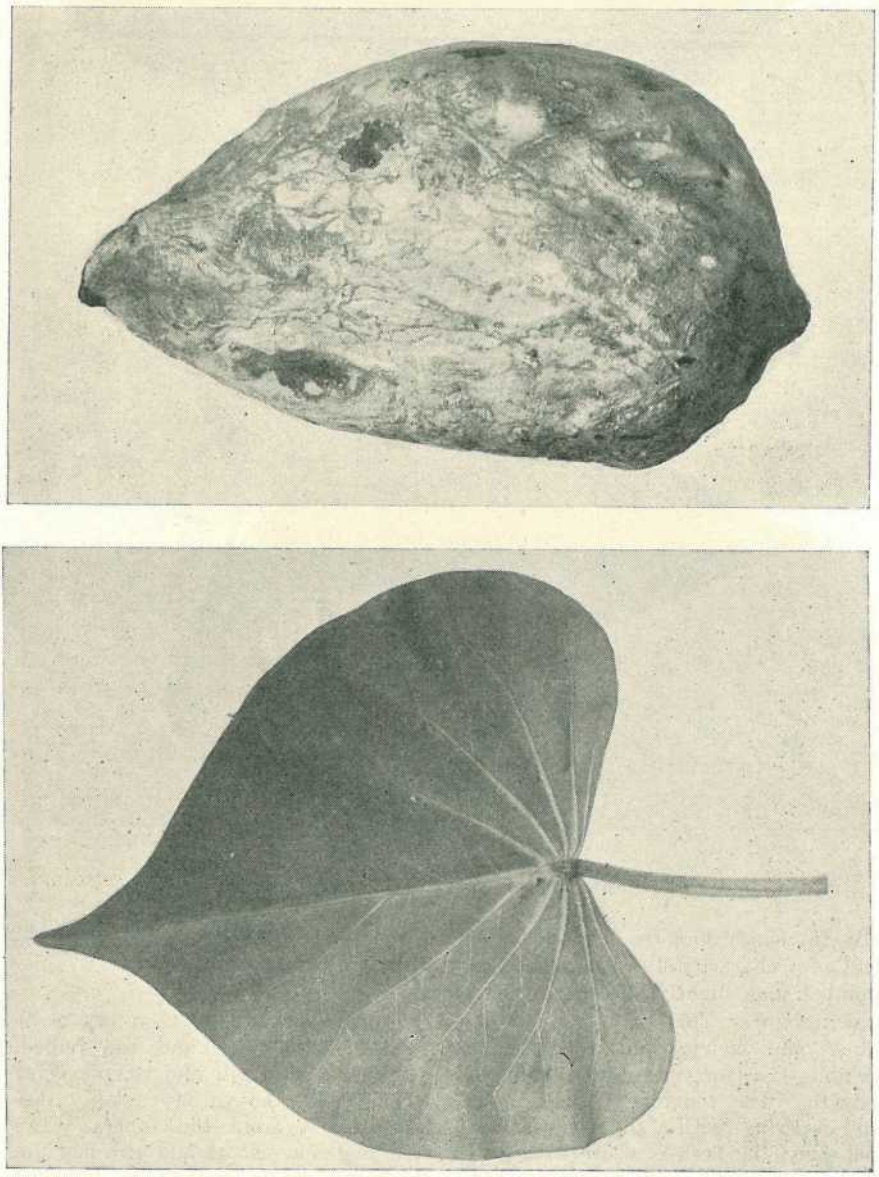


Plate 5.

White Maltese. Root 5½ inches long.

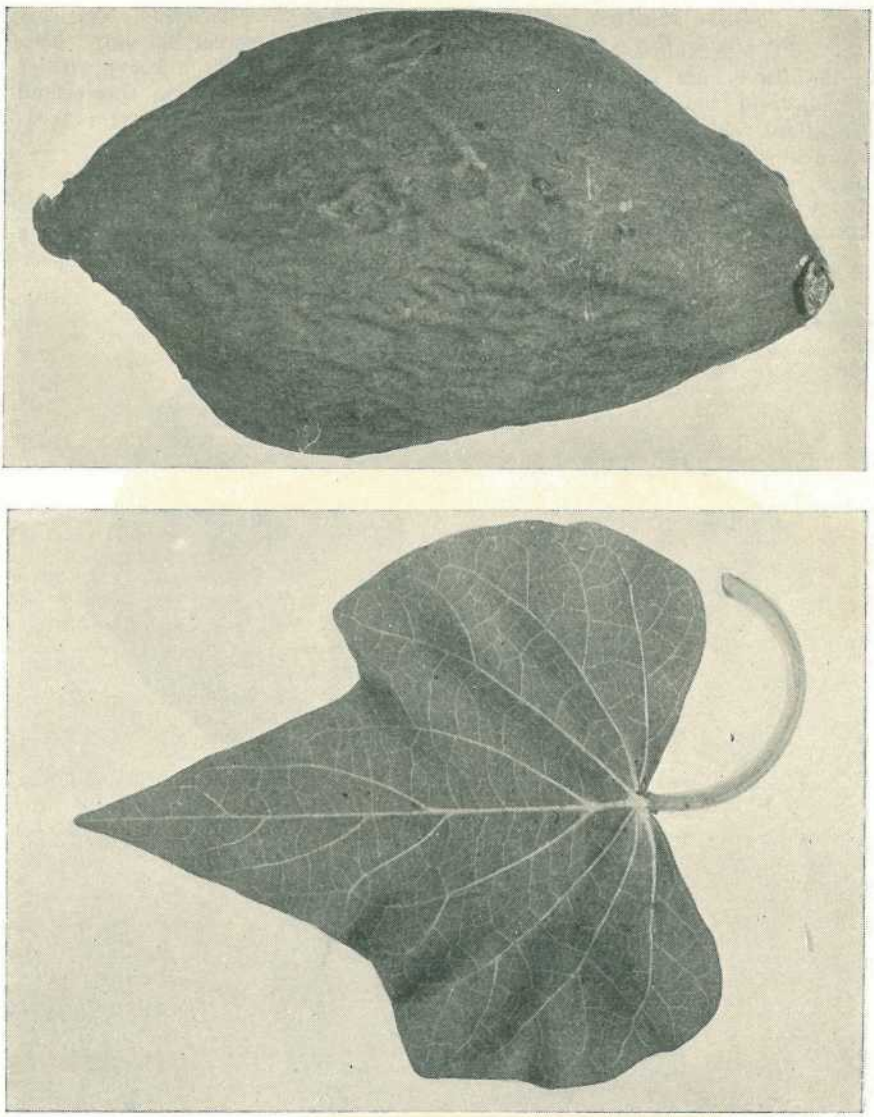


Plate 6.
Abundance. Root 7 inches long.

ally for sandy and coastal lands. The leaf is characteristic, being small, pointed and slightly shouldered, with green veins. The stems are green, thick and hairy, and the variety exhibits a strong rambling habit of growth. The roots are usually long and tapering, with a slightly wrinkled red skin; the flesh is white with grey flecks, stringless and floury in texture, and with a very good mild flavour. The variety is a mid-season type which yields heavily on light soils.

Brooks' Gem.

The leaf of Brooks' Gem (Plate 7) is of medium size and fan-shaped, with a distinct frill and purple veins which make the variety readily distinguishable from the others. The stem is green, smooth and of a medium thickness, while growth is bunched and of a non-rambling habit. The roots are long and tapering, with a

rough white skin; the flesh is white, with a floury texture and very sweet flavour. This is an excellent table variety and most suitable for digging, as the crop is carried under the vine in the row in which it is planted.

Louisiana No. 9.

Louisiana No. 9 (Plate 8) is a newer variety than the preceding. The leaf is medium to large in size, tending to a rounded outline, with green veins and a purple spot at the base. The stem is of medium thickness, and is green tinged with purple; growth habit tends to be bunchy and runners are not produced freely. The roots are medium sized, with a smooth, light pink skin; the flesh is yellow with a dry texture and an attractive flavour

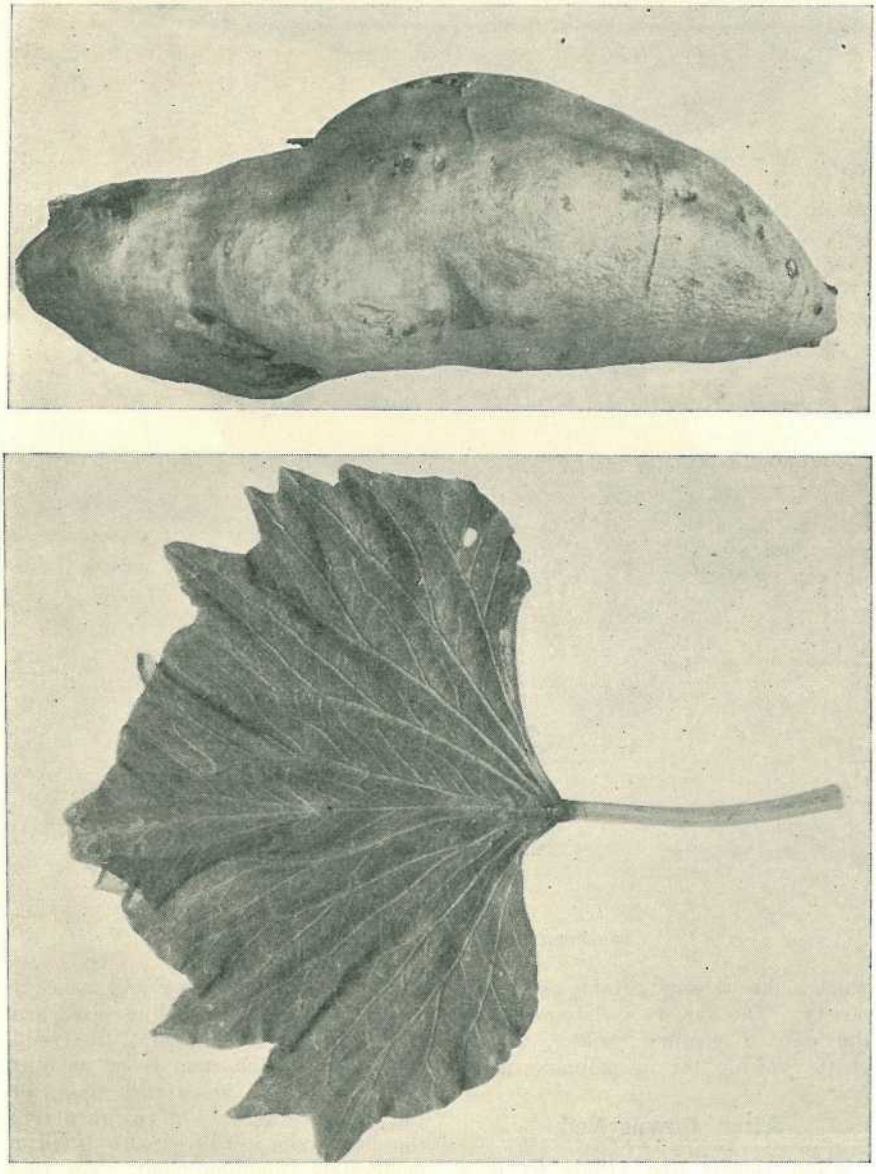


Plate 7.

Brooks' Gem. Root 7½ inches long.

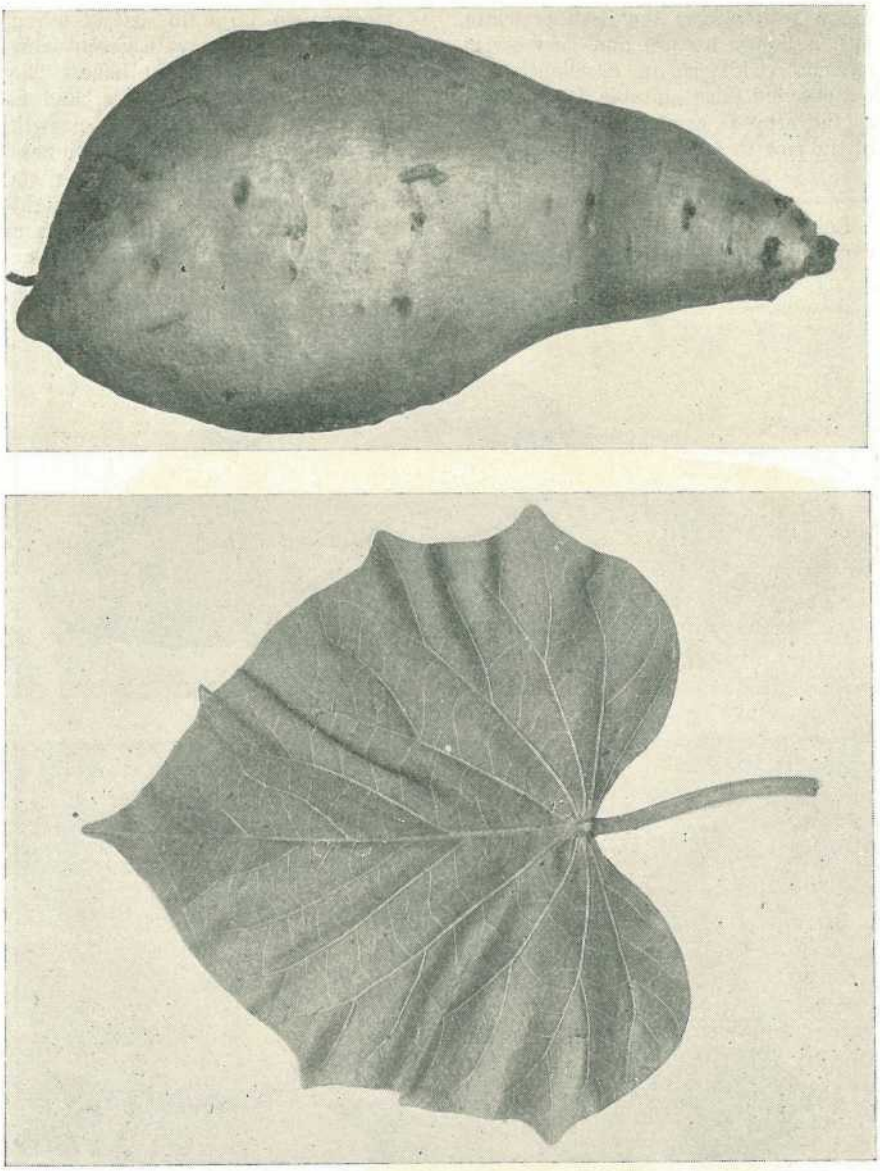


Plate 8.

Louisiana No. 9. Root 7¾ inches long.

which makes it very suitable as a table variety. The variety is late-maturing and only a medium yielder, but is worth growing for its culinary qualities.

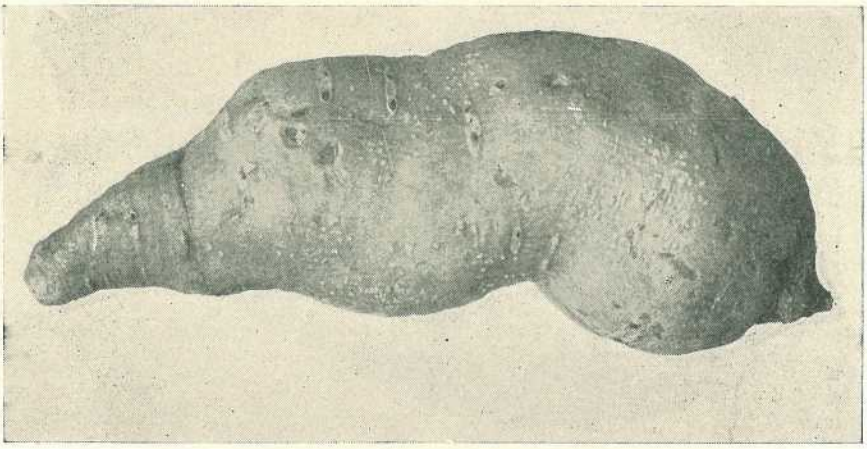
Alton Downs Red.

Alton Downs Red (Plate 9) is a good general-purpose sweet potato which is early maturing and a heavy yielder. The leaf is medium sized and elongated, with shoulders; the veins are purple. The stem is of medium thickness, and is green with tinges of purple merging into deep purple at the leaf axils. The growth is of a moderately rambling habit. The root is elongated, with a smooth, light red

skin; the flesh is yellow, dry and stringless in texture, and of excellent flavour.

Porto Morada.

The Porto Morada variety (Plate 10) has medium sized leaves of elongated shape, with prominently peaked shoulders; the veins are red. The stem is green, reddening with age, and plant growth is bunched. The root is large, with a smooth, light pink to red skin; the flesh is yellow, of



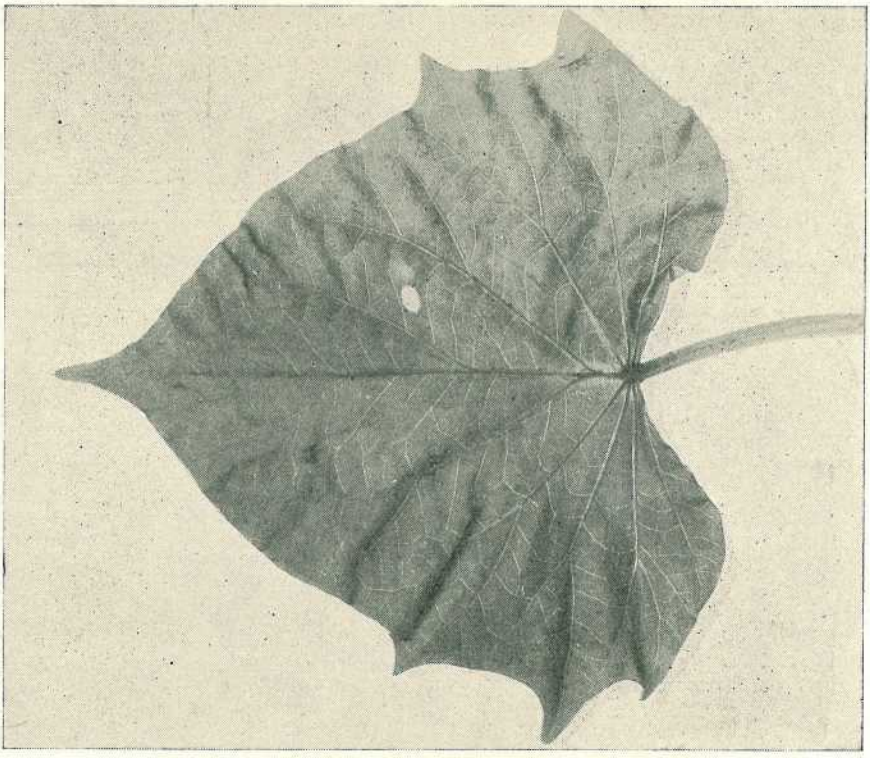


Plate 9.

Alton Downs Red. Root 7½ inches long.

excellent flavour and somewhat dry in texture. It is a late-season variety and crops well. This variety has the habit of forming its crop some distance away from the parent plant, which makes it awkward for digging at harvest. It is, however, well suited to grazing by pigs or cattle.

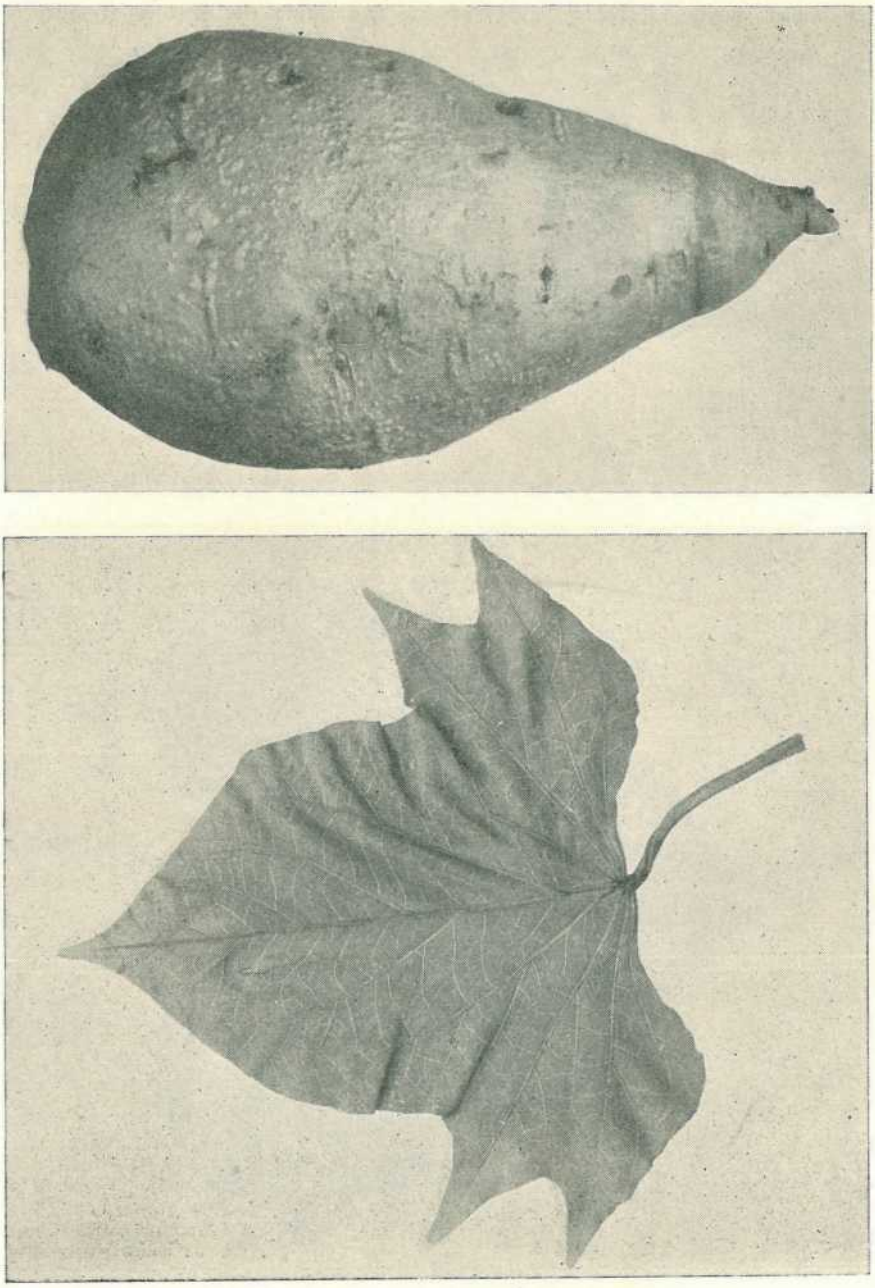


Plate 10.

Porto Morada. Root 6¾ inches long.

The Custard Apple.

By R. L. PREST (Senior Adviser in Horticulture) and A. A. ROSS (Horticulturist).

The custard apple grown commercially in Queensland is probably a hybrid between the cherimoya (*Annona cherimola* fam. *Annonaceae*) and the sugar apple (*A. squamosa*).

It is a large, spreading tree, about 15 ft. high, with light-green, elongate, pinnate leaves, relatively small green flowers and pale-green, knobbly fruit of irregular shape and weighing 1–2 lb. It is semi-deciduous in habit and sheds most of its leaves during the winter months.

Flowering takes places in two stages. The first crop of flowers appears shortly after bud-burst in spring but few of these set fruit; the main crop is formed from flowers thrown in the month of October.

In 1949-50, there were 414 acres of custard apples in Queensland and production amounted to 27,800 bushels of fruit. The crop is grown mainly in the Metropolitan district but a few orchards exist along the coast as far north as Cairns.

Climatic and Soil Requirements.

The custard apple (Plate 1) grows well in the subtropics and is adapted to coastal regions where temperatures are not excessive and the atmospheric humidity is reasonably high during the flowering period. Young trees are rather susceptible to late frosts but the mature trees are semi-deciduous and withstand light frosts without injury. The water requirements of the custard apple are somewhat similar to those of citrus.

Light-textured soils are preferred for custard apples although the crop will do well on clay loams provided the drainage is reasonably good. Shallow soils which overlie an impervious subsoil are unsuitable, as growth may be retarded and crown rot infection may cause the early death of the tree.

Varieties.

The most popular variety was derived from an introduced seedling and is known as Mammoth or Pink's Prolific. The fruit is large with a thick flesh round the seeds. Another commercial type, Island Beauty or Island Gem, has plenty of vigour and bears high quality fruit which is somewhat smaller than that of Mammoth.

Propagation and Orchard Establishment.

Seeds are sown in spring at a depth of approximately ¾ in. in the seedbed and the seedlings are transplanted into nursery rows when about 8 in. high.

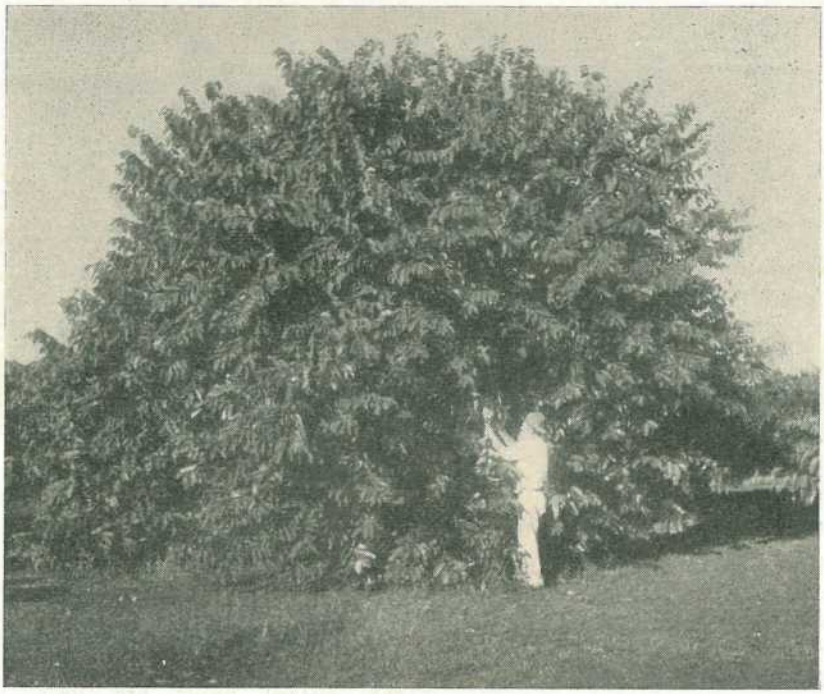


Plate 1.

A Twelve-Year-Old Custard Apple Tree (Variety Mammoth) in Full Bearing.

Seedling stocks may be grafted in late winter or early spring to the required varieties. The side cleft graft is quite satisfactory and is used by most nurserymen. Scion wood is cut in autumn when the leaves have fallen. Subsequent nursery practice is similar to that used for other fruit trees.

Young trees are planted in the orchard from the middle of August until the end of September, just prior to the commencement of spring growth. The usual system of planting is followed, taking care to prevent the roots from drying out. The tree spacing is from 30 to 40 feet, the wider spacings being desirable in the more fertile soils.

Pruning.

The custard apple has a rather straggling habit of growth which is more pronounced in grafted than in budded trees. If allowed to grow unchecked, the pliant branches become pendulous, with the extremities resting on the ground.

At planting, the young trees should be topped at not more than 30 in. from the ground and two leaders are allowed to grow during the first season. These are shortened to about 9 in. in the following winter. Two of the shoots developing from each leader are retained at the next pruning and shortened to about 12 in. Similar treatment—the duplication of branches from short "arms"—is applied the following year. Subsequent shortening is less severe and the development of lateral branches is encouraged, but these should be well placed and sturdy.

In the mature tree, branches which rest on the ground are cut back, inside branches which crowd the centre are removed, and the whip-like terminals on the outside of the tree are shortened back to about one-third of their length.

Plate 2.

Little-leaf, a Disorder in Custard Apples Associated with Zinc Deficiency in the Soil. At the left is a normal leaf. At the right is a terminal shoot with the small leaves and short internodes that are typical symptoms.

Early pruning is detrimental to fruit production, and consequently pruning begins in early spring when sap movement first becomes perceptible. Fruit is produced on both the current year's wood and the previous years' wood, but the percentage set is much higher in the latter.

Soil Management.

Cultivation is necessary to control weed growth and conserve soil moisture in the orchard, but it should always be shallow in order to keep root damage to a minimum. As the custard apple is semi-deciduous, it requires little water during the winter, and the organic matter content of the soil can be built up by growing a cover crop such as New Zealand blue lupins, golden tares, or field peas in winter.

Both yields and fruit quality are improved substantially by the use of supplementary irrigation, particularly during the period of flowering and fruit setting.

Plate 3.

Fruit of the Mammoth Variety of Custard Apple.

The custard apple is known to respond to applications of nitrogen. In most soils, phosphates and potash are also required and consequently an annual dressing in early spring of an 8:10:5 or similar fertilizer at the rate of 1 lb. per tree per year of age, with a maximum of 12 lb., should be effective on most soils. If the trees lack vigour, the rate of application may be increased.

Zinc deficiency symptoms (Plate 2) are prevalent in custard apples in most parts of Queensland, the more important symptoms being small, mottled leaves and tardy growth of the leaders. The disorder can be corrected by spraying the trees with standard zinc sulphate-lime mixture (10:5:100) shortly after the early spring growth appears on the trees.

Harvesting.

As the fruit (Plate 3) matures, the fissures between the segments fill up and become lighter in colour. The fully mature fruit is soft and does not carry well; it must therefore be harvested while still firm. Fruit which is picked too soon does not soften and fails to develop full flavour.

Fruit is picked into shallow baskets and later packed in half-bushel cases or trays with woodwool as the protective material. Packing is somewhat difficult because of the uneven size and irregular shape of the fruit.

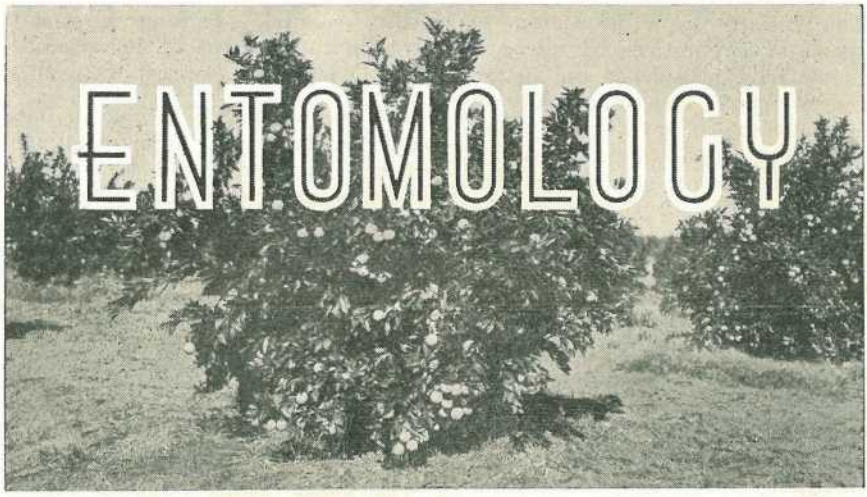
The trees commence to bear in the second or third year after planting out and may be expected to bear 50 fruits per year when they are 5 years old. Mature trees may produce five bushels of fruit but yields are greatly influenced by the season, cultural conditions and variety.

Related Fruits.

Several related fruits are of minor importance in Queensland. They include:—

The Sugar Apple (*Annona squamosa*) which is very similar to the custard apple but contains a greater number of seeds and has a more compact flesh with a very sweet flavour. The sugar apple is grown commonly in Palestine and Central America but mainly as a garden tree. The tree is not grown commercially here, although it is quite common in North Queensland.

The Soursop (*Annona muricata*) is strictly tropical in its requirements; it is grown in coastal North Queensland, mainly as a garden tree. The fruit is large—frequently more than 5 lb in weight—and the flesh has a cottony texture and a sub-acid flavour.



The Grass Caterpillar.

By B. R. CHAMP, Assistant Entomologist.

During late summer and autumn in coastal south-eastern Queensland, the grass caterpillar* often appears in large numbers, attacking pastures, lawns and other grassed improvements.

The grass caterpillar is the larva of a light greyish-brown moth measuring about an inch across the outstretched wings. Large numbers of these moths are attracted to artificial light and may create a nuisance in unscreened homes.

The small larvae that emerge four or five days later are at first almost white but later assume a greyish-green translucent colouring. Feeding generally takes place during the night, the majority of the caterpillars spending the daylight hours sheltering among the grass roots and debris at ground level. After three to four weeks the spindle-shaped larvae are fully grown, then measuring up to 1¼ inches in length (Plate 2).

Plate 1.

Moth of the Grass Caterpillar.

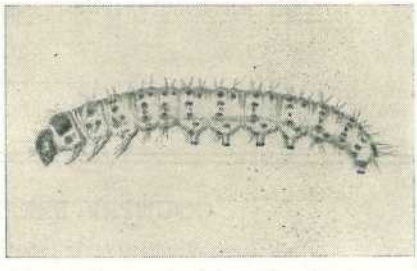


Plate 2.

A Full-grown Grass Caterpillar.

The flat, round, greenish eggs are deposited in groups of five to 15 in grass near the surface of the ground.

Pupation takes place in silken cocoons covered with soil particles and other embedded material and these

* *Psara licarsisalis* (Walk.). In some years other caterpillars may be the predominant species. These, however, are controlled satisfactorily by the treatment recommended for the grass caterpillar.

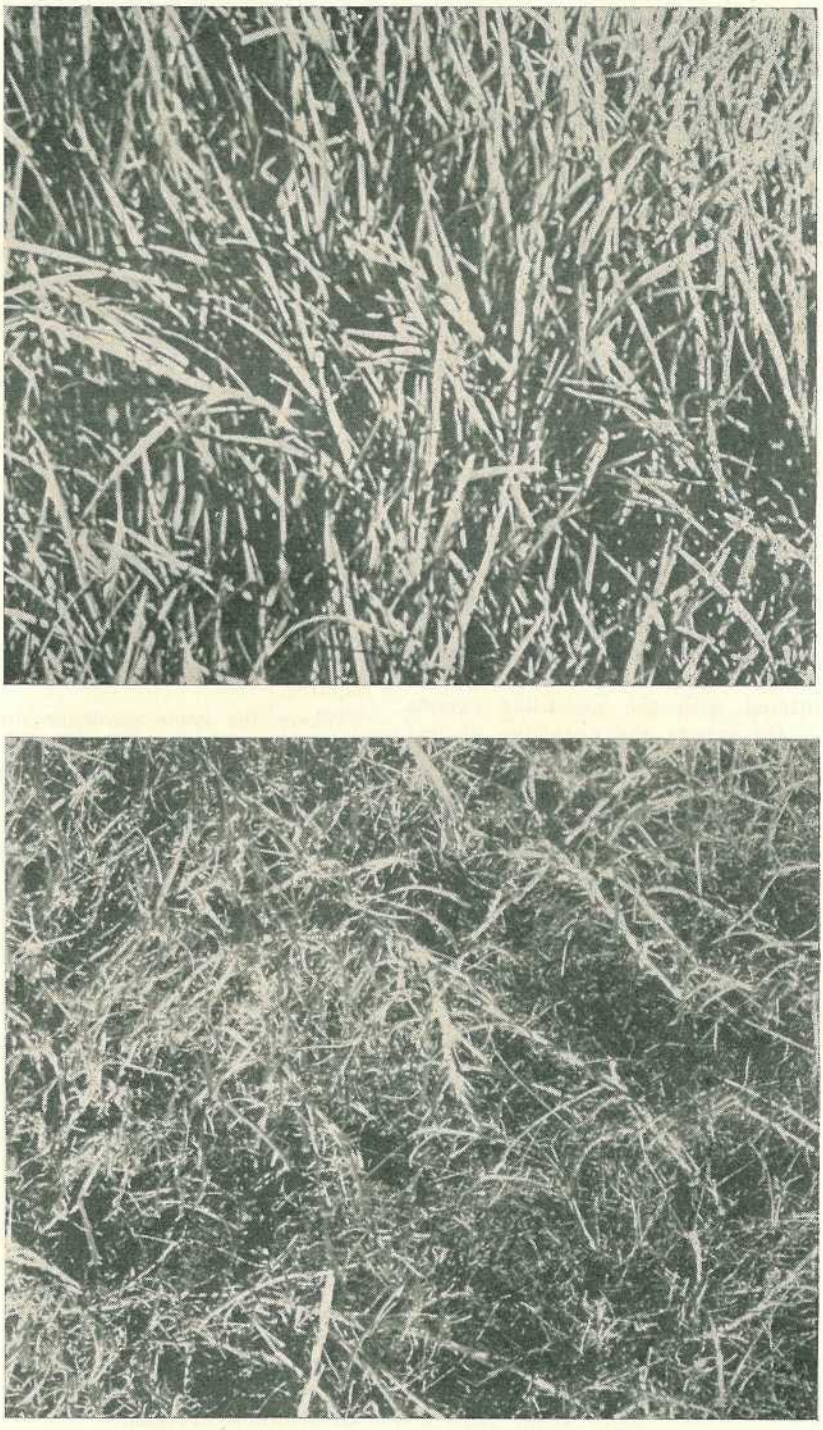


Plate 3.

Kikuyu Grass Before and After Infestation by the Grass Caterpillar.

are generally found on or just below the surface of the ground. At first the pupae are a light brown colour which gradually darkens until the adult moths emerge some eight days later.

The whole life cycle is completed in approximately five weeks and there may be several generations a year.

Natural parasites are active in all outbreaks and usually only one generation of caterpillars is of economic importance.

Damage.

The caterpillars feed on the flag of the grass, leaving only the stems. When these are attacked, areas bare of plant growth may result. The first indication of damage is usually a browning caused by the loss of the green leaf cover. A close inspection reveals the presence of the caterpillars and the denuded grass stalks, while the ground beneath the sward is littered with the pellet-like excreta of the insects and quantities of leaf blade fragments.

Less commonly the caterpillars may be found in large numbers before appreciable damage is done.

The more fertile portions of grassed areas are most subject to attack and accordingly damage of economic importance may be localised during less severe outbreaks.

Control.

Several insecticides may be used to control grass caterpillars, but DDT is the most effective and economical. This material should be applied at the rate of ¼ lb. active ingredient per acre in sufficient water to obtain a thorough coverage of the infested areas. Where a large body of grass is present it may be desirable to increase this rate to ½ lb. per acre.

Treatment should be carried out at the first signs of damage if large numbers of caterpillars are present. A second spraying a fortnight or so later may be necessary, but should only be carried out if close inspection reveals continued high caterpillar populations. Experience is the best guide to when and if treatment is required.

Where the home gardener uses a watering can or other simple and handy appliance to combat grass caterpillars attacking lawns, a DDT strength of 0.05% active ingredient is recommended. Such an application should be followed by a hosing.

Agricultural Chemistry

Copper Deficiency in Plants and Soils.

By C. R. von STIEGLITZ, Officer in Charge, Plant Nutrition Section.

Reports of the stimulating effect on plant growth caused by the use of sprays containing copper, such as Bordeaux mixture, were made as far back as the year 1900.

Experiments by Floyd in 1917 on die-back in citrus showed that the disease could be cured by treating the soil with copper sulphate or by spraying the plant with Bordeaux mixture. Since then it has been shown that applications of copper salts to the soil have cured dieback, or exanthema as it is called, in olives, avocados and various deciduous trees, including pear, peach, plum, apricot and apple.

A disorder known as "reclamation disease" of cereal grains, which occurred on peaty soils in Europe, was also found to disappear following treatment of the soil with copper sulphate.

There now exists ample proof to support the contention that copper must be included in the list of elements essential for best plant growth.

Frequently copper and zinc deficiency occur together, as in "crook neck" in pineapples. This disorder is readily rectified by including copper and zinc salts with the normal fertilizer dressings.

Symptoms.

The field symptoms of copper deficiency vary appreciably with the plant species and even with varieties, but the most characteristic one is that of the death of the young growing tips followed in many cases by stimulation of axillary buds below the dead part. This produces a rosetting or bushy growth. Chlorosis (yellowing) of the leaves sometimes occurs but is usually confined to the older leaves.

Associated with "dieback" in citrus are the primary symptoms of gum pockets, marked fruit, bark excrescences and multiple buds, and the secondary ones of exceptionally dark green leaves, distorted growth of immature angular terminal branches, frenching of foliage and leaves that are long in relation to their width.

In cereals the leaves of copper-deficient plants show loss of turgor, turn backward and are grey and withered in appearance; the newly emerging leaves die back from the tips. Grain formation is restricted.

Copper Deficiency in Soils.

Soils high in organic matter, such as peats and peaty sands, are those with which copper deficiency is frequently associated. Other sandy soils likely to be deficient are those subject to the leaching effects of high rainfall, and many cases have been recorded of copper-deficient cattle in Queensland in the Near North Coast strip.

The cure for copper deficiency in plants, then, is to either apply copper sulphate to the soil or spray the plant with some copper compound. The necessary amount of copper sulphate to add to the soil varies greatly, 5–15 lb. to the acre normally being sufficient, but cases are quoted in the literature where, on peaty soils in Florida, applications as high as 250 lb. of copper sulphate per acre were found to be beneficial.

To date no satisfactory chemical method has been developed for determining "available" copper in the soil, but recent advances in soil microbiological methods are furnishing results which are very promising. In the meantime, we must rely on the visual symptoms of plant growth and animal health to aid our endeavours to distinguish copper-deficient from copper-adequate soils.

Waterproofing and Rotproofing.

By T. J. BECKMAN, Chemical Laboratory.

Each year large numbers of tarpaulins, bags and sacks are lost through rotting. In addition, water damage caused by leaky coverings is considerable.

Bags and tarpaulins exposed to the weather rot very quickly unless they are treated with some mould preventing agent. Nowadays most tarpaulins are treated with water and rotproofing substances during manufacture, but the effect of these substances is not permanent.

There are proprietary waterproofing and rotproofing agents on the market, but these are somewhat difficult to obtain and in some cases are difficult to apply.

During the war it was found that aluminium soaps had marked water-repelling properties when applied to fabrics, whilst copper soaps were found to be excellent mould preventives. These metal soaps are easily prepared from common materials and they are easy to apply.

There are two ways of treating tarpaulins and bags; both give excellent results. In the first the metal soaps are made, then dissolved in a suitable solvent, such as mineral turpentine, and brushed on. The second method consists of forming the soap in the fabric by treating it with alternate baths of soap solution and metal salt solution.

Tarpaulins and tents are best treated by the first method and bags and other small items by the second.

Making Metal Soaps.

The metal soaps for application to tents, etc., are prepared as follows.

Take an old tin of ample capacity such as a large round grease tin. Pour in 5 pints of boiling water. Then shred into it 12 oz. of good bar soap. Stir this mixture over a fire until all the soap dissolves. Care must be taken because soap solutions froth over easily! When all the soap is dissolved, pour in a solution of 6 oz. of copper sulphate (bluestone) in ½ pint of warm or hot water. Then boil and stir the resulting mixture to coagulate the copper soap which forms. Cool and pour off the liquid. The lumps of copper soap can then be tipped out on to a sheet of paper, broken up into small pieces and allowed to dry.

By substituting 8 oz. of alum for the copper sulphate, an aluminium soap for waterproofing can be prepared. This soap does not set hard like the copper soap but is doughy in texture.

Treating Tarpaulins.

For use, 8 oz. of the soap should be dissolved in approximately 1 gallon of mineral turpentine and brushed on to both sides of the fabric. This should be done in the open air or in a well ventilated shed. Great care must be taken to have no flames or lighted cigarettes nearby, since mineral turps is highly inflammable.

When treatment is finished, water sprayed over the material will soon show where the soaps have not

"taken" on the fabric. These areas should be treated again when the material is dry.

Treating Bags.

The baths for the two-bath method are made up as follows. Prepare a hot solution of 16 oz. of good bar soap in 5 gallons of hot water, and a solution of 6 oz. of copper sulphate and 8 oz. of alum in 5 gallons of hot water. The hessian or bags to be treated are soaked first in the soap solution, then allowed to drain but not to dry; they are then dipped into the alum and copper sulphate. The excess copper and alum are allowed to drain off completely, after which the material is hosed or washed well with water. If desired, the treatments may be repeated.

Care must be taken to see that the solutions come in contact with all parts of the material being treated.

EUCALYPTS WITHSTAND HORMONES.

Experiments indicate that bloodwood and ironbark cannot yet be destroyed efficiently with hormone preparations, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said recently.

The excellent results obtained by spraying brigalow with hormones are not being matched in a series of trials designed to determine the value of hormones in controlling eucalypt suckers.

The trials are being made as part of the broad investigational programme planned on the "Brian Pastures" Pasture Research Station, 13 miles from Gayndah. This property was established by the Australian Meat Board and it is under the immediate control of the Department of Agriculture and Stock for pasture research work.

Botanists in the Department of Agriculture and Stock have carried out eucalypt sucker treatments on the property with six chemicals during the last 15 months.

Depending on the age of growth, treatments included frilling the trunk and pouring the hormone preparation in, and foliage spraying on eucalpyt suckers 3 ft. to 4 ft. high. Trials were carried out in spring, late summer and winter, to examine the effect of seasonal conditions on the efficacy of the treatments.

A recent examination indicated that while varying percentages of sucker plants had been killed, fresh suckers are also still being produced in most plots. Unless the hormones prevent new growth, an increase in the percentage of kill cannot be expected. Most of the new suckers so far appear quite healthy.

It is proposed to make a further detailed inspection of the plots late this year to examine the possibility of residual action by the hormone preparation.

Best results—the promise of a 50 per cent. kill—were obtained by frilling and pouring in a 1 per cent. solution of 2,4,5-T in dieselene. As a foliage spray this preparation gave a 40 per cent. kill.

These percentages are too low to give hormone treatment any commercial value, because a kill of at least 90 per cent. is required to make it worthwhile. Better kills are being obtained elsewhere using arsenical poisons.

However, the investigations will be continued and it is planned to test any new preparations that are developed.

Mr. Collins added that, in view of the results obtained to date, his Department could not at present recommend the use of hormone preparations to control bloodwood, ironbark and other eucalypts.

Swine Erysipelas.

By B. A. WOOLCOCK, Assistant Veterinary Officer.

Erysipelas is an infectious disease of pigs causing heavy mortalities in its acute form and considerable economic loss when animals are chronically affected.

Until the winter of 1954, erysipelas was regarded as a disease which caused little trouble in the pig industry of Queensland. It was diagnosed on odd occasions but was restricted almost solely to the chronic forms. Probably the actual incidence of the disease was higher than the number of confirmed cases indicated.

During the past winter, erysipelas assumed a new importance in this State, as major outbreaks of the acute form of the disease occurred in most of the pig raising districts. This development follows the pattern in other States and countries. It may be expected that further serious outbreaks will occur in the future. For this reason, the attention of stockowners is drawn to the disease, which is capable of causing serious losses in the piggery.

THE DISEASE AND ITS CAUSE.

As you read this description of the disease you will find that many aspects of erysipelas are not fully understood. So you are unlikely to get a complete understanding of the way in which it first occurs or the way in which it spreads. However, we do know enough of the disease and the way it behaves to make suggestions for its control.

In the recent outbreaks the Department of Agriculture and Stock has had reports of young pigs, from six weeks to four months, being affected with the acute form of this disease. Older pigs have been chronically affected.

We know the actual cause to be a bacterium known as *Erysipelothrix rhusiopathiae*. It lives in the soil and may be found in the throat of healthy pigs.

We recognise four different forms of erysipelas. These are:—

(1) The acute or septicaemic form.

(2) The arthritic form.

(3) The heart or endocarditis form.

(4) The skin form.

HOW DO PIGS BECOME INFECTED?

Unfortunately, we cannot answer this question with any certainty. It seems that the germ may be present without causing trouble. Most authorities believe that infection follows a build-up of the germ in the soil. The accumulation of dung and decaying vegetable matter in soil assists this

build-up. It may also bring about some change in the nature of the germ, making it capable of infecting pigs.

Overseas veterinarians believe that some strains of pigs are naturally resistant. As in other diseases, you will understand that wormy pigs or pigs lacking in vitamin A would be more susceptible to erysipelas.

How do bacteria enter the body? We know of three possibilities. They may be picked up by mouth. The body may be invaded through small skin abrasions. Blood-sucking parasites such as lice may transmit the infection.

We know that the disease does not spread readily from one pig to another. A diseased pig will, however, contaminate the pen it is running in. In view of this you will understand why in most outbreaks erysipelas is confined to one pen or paddock.

The term "carrier" as it applies to disease is well known these days. The carrier or chronically affected pig is probably the main means of spread from one piggery to another.

THE SYMPTOMS.

These vary with the four types, so we will discuss them under separate headings.

(1) Acute Erysipelas.

The bacteria in their most active form invade the body generally. Severe damage to many tissues is the result. Death may be so sudden that you may not observe any sickness. In the majority of cases the pigs are sick for 2-4 days before death.

A recent outbreak in the Lockyer may give you a complete picture of the disease in its acute form. This was a typical story, although the percentage of deaths was higher than usual.

This farmer had 50 pigs, all about three months, in one large pen. In the first instance he found several pigs dead and had not noticed any sickness. Within 10 days he had lost about 12 pigs. At this stage he noticed that they were sick for two or three days before death. Erysipelas was suspected and the sick pigs were isolated. During the next two weeks another 20 or so pigs became sick and 12 died. These cases lingered for up to five days before death. Some eventually recovered after treatment. During the following month no further acute cases developed but eight of the batch became chronically affected.

Symptoms shown by pigs sick for two or more days were:—

Rise of body temperature up to 107 degrees.

Tendency to lie about in the shade.

Increase in breathing rate.

Lack of appetite but increased thirst.

Reddening of eye membranes and a yellowish eye discharge.

Uniform or patchy reddening of the skin under the throat and belly and inside the thighs.

Constipation.

Some pigs vomited.

Most of the pigs affected towards the end of the outbreak showed lameness and swelling of one or more joints. This is one of the chronic forms (the arthritis form). Others developed the skin form of the disease.

We find much the same story in all outbreaks. In this case, the farmer did not follow out the directions for treating his pigs, so his losses were unduly heavy. Again, his pigs were heavily infested with lice and roundworms. No doubt these parasites added to his losses.

(2) The Arthritic Form.

This chronic form of erysipelas usually follows an acute outbreak, though it is known to occur in herds with no previous history of the disease. Until 1954 it was the common form in Queensland.

In this form you will observe first of all lameness, disinclination to move about, then swelling of the joint. Occasionally, an odd pig will appear to be paralysed in the hindquarters. Most commonly, the hock, knee and stifle joints are affected. Affected pigs may improve slowly and be got away to market. The joint swelling usually remains as a blemish.

This is the most common form of erysipelas.

(3) The Heart Form.

You will not usually see any symptoms with this form. It may be the cause of sudden death in breeding stock. The heart fails due to a growth on the valves, and this gives rise to the dropsical swellings and weakness seen in chronic heart disease.

(4) The Skin Form.

This is rare in this country, though it was observed in the Lockyer outbreak. As seen overseas, dark-reddish, diamond-shaped patches develop in the skin of the ears, back and sides.

In the form seen here the skin died, forming a leather-like crust. This came away leaving healed skin underneath. Some ears and tails were disfigured as a result.

THE POST-MORTEM.

At the outset, a warning! The erysipelas bacterium causes a nasty skin infection in man. If you suspect erysipelas and you wish to open up a carcass, wear gloves and wash yourself thoroughly afterwards.

Sometimes little can be found in a pig which has died suddenly. Usually, however, the changes are very definite. Typically these are:—

Reddening of lining of stomach and small intestine. This may extend also to the large bowel.

Lymph glands in the abdomen are enlarged, juicy and inflamed.

Spleen enlarged.

Liver congested with fluid.

Kidneys congested.

Small blood spots on the surface of the kidneys, heart, intestine and other organs.

There may be fluid in the lungs.

Joints affected with arthritis contain abnormal quantities of clear, straw-coloured fluid.

Heart valve growths may be observed when the heart is opened.

THE DIAGNOSIS.

Seek veterinary advice if you have reason to suspect erysipelas. The disease is notifiable, so you are obliged to advise the Department of Agriculture and Stock.

The veterinarian will base his diagnosis on the history of the outbreak, the symptoms and his findings on post-mortem. He may require confirmation of his suspicions from the laboratory.

The specimens required by the laboratory are:—

(1) Smears of heart blood, spleen and kidney.

(2) Bacteriological pipettes of heart blood, liver, kidney, lymph glands, spleen, bone marrow, heart valve growths and joints.

(3) Unopened joints in a formalin cloth.

(4) If within easy reach of the laboratory, fresh specimens of the above organs may be satisfactory.

Erysipelas may be confused with other diseases and the investigator must consider these alternatives:—

(1) Swine fever—not present in Australia, but has occurred previously and must be considered.

(2) Acute paratyphoid—spreads rapidly and affects more particularly the lungs and large bowel.

(3) Anthrax—not known in Queensland.

(4) Glasser's disease—more commonly occurs in young pigs; post-mortem findings are reasonably characteristic of the disease.

(5) Photosensitisation — resembles the skin form of erysipelas.

(6) Other bacterial causes of the heart valve vegetations.

(7) Other forms of arthritis and injury.

CONTROL OF AN OUTBREAK.

Treatment of affected pigs should be attempted, as good results have been obtained with penicillin and other antibiotics.

Follow this procedure in dealing with an outbreak:—

(1) Leave affected pigs in their pen until they either die or recover.

(2) Burn all carcases.

(3) Place recovered animals in a concrete pen and get them away to slaughter as soon as possible.

(4) Take unaffected pigs out of affected pens, put into a concrete pen and observe carefully for signs of the disease.

(5) Do not use affected pen until concreted or regravelled. If already concreted, it should be thoroughly cleaned, allowed to dry out under direct sunlight, and spelled for at least one month.

(6) Close up large earth pens and small paddocks and do not use again for pigs.

It is as well for you to remember that erysipelas cannot be eradicated with any certainty. Thus, if the trouble continues, you must consider the rebuilding of your piggery on a new site.

Immune serum and vaccines are not available in Australia at present.

TO PREVENT ERYSIPELAS.

You may minimise the risk of an erysipelas outbreak by following straightforward husbandry practices. These are generally accepted by pig-raisers today. They include:—

(1) Well drained accommodation with a preference for concrete sties and pens with concrete wallows.

(2) Safe and frequent disposal of manure and urine by regular cleaning.

(3) Rigid control of worms, lice and mange mites.

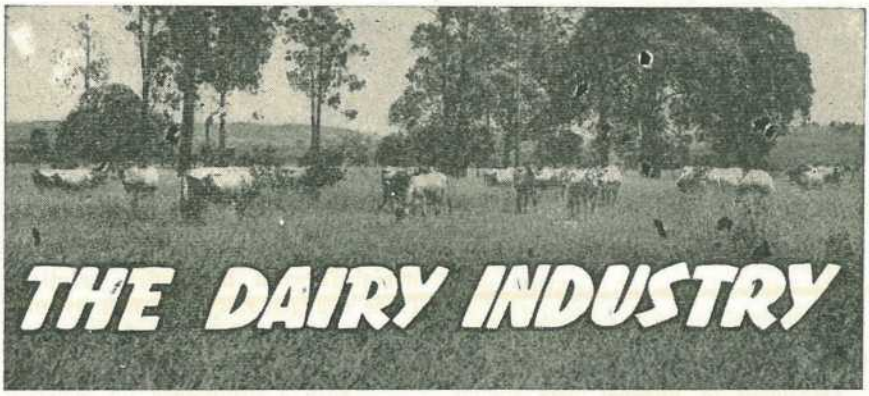
(4) Avoidance of indiscriminate buying at sales. Examine all introduced pigs for signs of arthritis and other chronic forms of erysipelas.

(5) Adequate nutrition.

TO SUMMARISE.

Swine erysipelas is a disease of increasing economic importance in Queensland. Once established in your herd, it may be the cause of continued trouble from the chronic form of the disease, which often follows an acute outbreak.

Erysipelas is difficult to eradicate. You must take prompt action to control an outbreak in the way described. The recommended preventive measures will reduce the risk of introduction of the disease. Hygiene in the piggery is your greatest protection against erysipelas.



A Survey of Milking Times and Practices.

By E. B. RICE and S. E. PEGG, Division of Dairying.

Good milking practices enable the maximum yield to be obtained from the dairy cow under the prevailing feeding conditions, save time spent in the dairy shed, are conducive to better sanitation in production, and assist in the control of udder diseases.

Some leading authorities in other countries have asserted that a saving of about 20% of time spent in the shed and an increase of up to 10-20% of butterfat per cow can accrue from good milking practices. A saving of two minutes daily per cow means one hour less in the milking of a 30-cow herd.

On the other hand, the production of a herd can be reduced and the cows induced to become slow milkers by faulty milking methods, and by milking machines which, due to mechanical defects, are not functioning with full efficiency.

In recent years, much research has been carried out with a view to improving the efficiency of milking, particularly by means of milking machines. Among the foremost of these investigations have been those of Dahlberg at New York and Petersen and his colleagues at Wisconsin in U.S.A., Whittleston in New Zealand, and the National Institute for Research in Dairying in England. Many Queensland dairy farmers have had the opportunity of seeing the practical application of the findings of research workers in the films entitled "The Science of Milk Production," "No Hand Stripping," and "Efficient Machine Milking," which were screened at film evenings during the tours of the mobile film unit of the Department of Agriculture and Stock throughout the dairying districts of this State.

This paper records the results of a survey made of milking practices on Queensland dairy farms in March and April, 1954, in order to secure factual information on existing practices in Queensland.

PRINCIPLES OF GOOD MILKING.

The principles of good milking enunciated as a result of modern research on milk secretion and milking are:—

(1) Provide a well designed shed and holding yards to enable the cows to be systematically marshalled (and preferably trained to enter the bails themselves) and quickly milked; also have everything prepared and in readiness before milking begins so that there is no hold-up during milking.

(2) Condition the cows by gentle handling to like being milked and to give up their milk readily.

(3) Avoid unusual sounds, bad dogs, rough treatment, or other influences likely to frighten, excite or disturb the cows; and milk at the same time each day.

(4) Stimulate the cow to let down her milk by using a strip cup to check the foremilk for mastitis and washing the udder and teats about one minute before commencing to milk her.

(5) Maintain the milking machine in sound mechanical condition and operate it according to the manufacturer's directions.

(6) Avoid hand-stripping, but use the machine for stripping, if necessary. The teat-cups may need pulling down gently by hand for a few pulsations near the end of the milking of the cow if they have tended to crawl up the teat and partly close the teat canal.

(7) Remove the cups from the cow as soon as the milk flow ceases. Most cows will milk out in 4½-5 minutes, but some will take up to 7 minutes.

(8) With a well-trained herd, back chains may be convenient, but leg ropes should be unnecessary.

MATERIAL FOR THE SURVEY.

The necessary data for the purpose of the survey were collected by herd recorders in respect of herds which were being production-recorded under the group herd production recording scheme.

It is pointed out that on all of the farms on which the herds were being milked by milking machines, the releaser type of machine was installed. The bucket-type machine is scarcely used in Queensland, where feeding in the milking shed is not generally done or is confined only to the feeding of small amounts of concentrates. The usual type of milking shed is that fitted with walk-through bails.

During the visit of the herd recorder, however, buckets, with which each officer is provided, must of necessity be used to enable the weighing and sampling of the milk of each cow during the test milkings. It must, therefore, be recognised that this, together with the taking of weights and samples of milk during the visit of the herd recorder to the farm, would make the milking rates rather slower than under normal practice without buckets and the presence of the herd recorder on the farm. Nevertheless, the results of the survey have clearly shown the widely different milking practices and rates of milking which exist on Queensland dairy farms.

The herd recorders were instructed to note the number of cows milked, sets of teat-cups on milking machines, the number of persons engaged in the shed and the time taken for milking the herds from the preparation of the first cow to be milked until completion of milking of the last cow in the herd. No attempt was made to time the milking of each cow individually. Appropriate calculations were made from these data according to the specific item being investigated.

The results of the survey were prepared on a State-wide and district basis.

The total number of farms from which data were obtained was 1,070. On 88, or 8.2%, of the farms, the herds were milked by hand, and on 982, or 91.8%, by means of milking machines.

EXTENT OF HAND- AND MACHINE-MILKING.

The districts into which the dairying areas of the State were divided, the distribution of the herd recording groups and farms in these districts and the numbers and percentages of the farms on which the herds were milked by hand or by machine are given in Table 1.

TABLE 1.

District.	Numbers in Districts.		Number of Hand and Machine-Milked Herds.			
	Herd Recording Groups.	Farms.	Machine.		Hand.	
			Number.	Per cent.	Number.	Per cent.
South-eastern	23	467	415	86·7	52	13·3
Darling Downs	13	203	197	97·0	6	3·0
Burnett	13	234	219	93·6	15	6·4
Central Queensland ..	5	88	83	90·4	5	9·6
Northern Tablelands ..	4	78	68	87·2	10	12·8
Totals	58	1,070	982	91·8	88	8·2

The table clearly reveals the extensive use of milking machines on Queensland dairy farms. A survey made of farms on the Eastern Darling Downs in 1938-39 showed that 40% of the farms had milking machines installed, while in the present survey the percentage in that part of the State had risen to 95. The figures for machine-milking given in the table may be rather higher than on all farms in the State, as estimates obtained early this year from field officers of the Division of Dairying showed that milking machines are installed on about 80% of dairy farms.

There were appreciable variations in the extent of machine-milking in the different sub-districts, the range being from 40% in a couple of sub-districts where dairying is usually a sideline to some other form of agriculture to as high as 99% in sub-districts where the herds are large. It is obvious, then, that milking machines maintained in sound mechanical condition and efficiently operated can play an important part in the milking of the 900,000 milking cows in this State.

MAKES AND SIZES OF MILKING MACHINES.

On the farms included in the survey there were 27 different makes of milking machines installed. Three makes of machines comprised 61·7% of the total number used. It may be mentioned that the same three machines represented 60·8% of the total number used on 826 farms equipped with milking machines which were included in a survey which is also being made of some other aspects of dairy farming in Queensland.

The distribution of the milking machines, according to the number of milking units per machine, is given in Table 2.

TABLE 2.

NUMBER AND SIZES OF MILKING MACHINES.

Size of Machine.	Number of Milking Machines.	Percentage.
Single unit	4	0·4
2 units	194	19·8
3 „	458	46·6
4 „	300	30·8
5 „	12	1·2
6 „	14	1·4
Total	982	100·0

It will be seen from the above table that nearly half of the farms (46·6%) were equipped with a three-unit milking machine, while machines of two, three and four milking units represented 97·2% of all machines installed on the farms included in this survey.

MILKING RATES IN HAND-MILKED HERDS.

The average rate of milking by hand was 6·5 cows per person per hour, or 9·2 minutes per cow. This time includes the time taken to bail the cow, wash the udder and complete the milking. There was a wide divergence, however, in the milking rate among different farms, the slowest milked herd taking an average of 17·6 minutes per cow, or 3·4 cows per person per hour, and the fastest 3·3 minutes per cow, or 18·2 cows per person per hour.

Although most of the researches on milking practices have been concerned with machine-milking, some aspects of the findings apply equally to hand-milking. It is apparent from the results of this survey that, by a more widespread adoption of the recent advances in milking techniques, the rate of hand-milking on many farms in Queensland could be accelerated. At least nine cows per hour can be milked by a good hand-milker if the cows are conditioned by proper handling and training to yield their milk rapidly. The average rate of milking on the 10 farms on the Northern Tablelands which were hand-milked was 8·0 cows per person per hour.

The numbers of hand-milked herds from which data were obtained, the average number of cows milked per hour and average milking time per cow, according to districts, are shown in Table 3.

TABLE 3.

SUMMARY OF HAND-MILKING RATES.

District.	Number of Herds.	Average Number of Cows per Person per Hour.	Average Milking Time per Cow.
			(Minutes).
South-eastern	52	6·3	9·6
Darling Downs	6	5·5	11·0
Burnett	15	6·8	8·8
Central	5	7·5	8·0
Northern Tablelands ..	10	8·0	7·5
Total Herds	88	6·5	9·2

MILKING RATES IN MACHINE-MILKED HERDS.

Analyses were made of the number of sets of cups attended per milker (labour unit), the cows milked per set of cups per hour, the milking time per cow according to the numbers of sets of cups per milking shed, and the number of cows milked per hour per labour unit. The results of these analyses are tabulated in Tables 4 to 10.

These aspects were investigated as it has been shown in New Zealand that as the number of sets of teatcups per person increases there is a marked increase in the number of cows milked per labour unit per hour. Fast milking can also be considered from two viewpoints: (*a*) the milker (that is, a large number of cows milked per labour unit per hour); (*b*) the cow (that is, a large number of cows milked per set of teatcups per hour).

The results of the survey brought to light some most interesting information and clearly spotlighted the waste of time associated with milking on many farms which use milking machines. No doubt some aspects of the inefficiency of machine-milking are connected not only with the actual milking practice itself but also with the imperfect mechanical condition of many milking machines. The results of a survey of mechanical aspects of milking machines, which has been carried out, will shortly be published.

The average rate of milking a cow by milking machine was 8·3 minutes, or 7·2 cows per hour, per set of teatcups. The time to milk a cow by machine was therefore about the same as with hand-milking. As with hand-milking, there were wide variations from these averages, the range on individual farms being from as fast as 2·7 minutes per cow, or 22·2 cows per hour per set of teatcups, to as slow as 24 minutes per cow, or 2·5 cows per hour per set of teatcups.

The average number of cows milked per hour per labour unit in machine-milked herds was 12·6, so that almost twice as many cows were handled per person per hour as on the farms on which the herds were milked by hand.

Sets of Cups per Milker (Labour Unit).

In Table 4 information is set out in relation to the numbers of sets of milking cups which are attended to per person during milking.

It will be noted that on the average dairy farm in Queensland one person handled 1·74 sets of cups. Surveys made in New Zealand and New South Wales gave corresponding figures of 2·4 and 1·8, respectively. The Queensland results are thus about the same as in New South Wales, but lower than in New Zealand. There was little deviation from the average rate of 1·74 in any district. On 81·1% of the farms, compared with 65% in New Zealand, the number of cups handled per person was from 1 to 2·5. On 54, or 5·6% of the Queensland farms, as against 14% in New Zealand, one person was responsible for the management of over 3·5 cups.

The highest number of cups dealt with by an individual was 6. This was on a farm where a three-unit doubled-up milking machine was managed by one man who milked 55 cows in 1 hour 30 minutes. The results indicate that one factor responsible for the lower number of cows milked hourly per person by machine in Queensland is the lesser average number of cups handled per person.

TABLE 4.

SETS OF CUPS PER MILKER.

Sets of Cups per Milker.	State.		South-eastern Queensland.		Darling Downs.		Burnett.		Central.		Northern Tablelands.	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Less than 1	3	0·3	2	·5	..	..	..	..	..	..	1	1·5
1–1·5	473	48·5	211	52·8	82	42·1	108	49·8	34	41·0	31	45·6
1·6–2·5	317	32·3	129	31·9	69	35·1	67	30·6	30	36·1	22	32·4
2·6–3·5	135	13·4	44	10·4	28	13·7	34	15·1	17	20·5	12	17·6
3·6–4·5	46	4·7	21	5·3	16	7·6	10	4·5	..	..	..	..
4·6–5·5	..	..	..	..	..	..	..	..	..	..	..	..
5·6 and over	8	0·9	1	·2	3	1·5	..	..	2	2·4	2	2·9
Average	1·74		1·67		1·87		1·74		1·90		1·73	

TABLE 5.

COWS MILKED PER SET OF CUPS PER HOUR.

Cows per Set of Cups per Hour.	State.		South-eastern Queensland.		Darling Downs.		Burnett.		Central.		Northern Tablelands.	
	Herds.	%	Herds.	%	Herds.	%	Herds.	%	Herds.	%	Herds.	%
Under 6·5	289	29·4	117	28·2	61	31·0	61	27·8	35	43·4	15	22·1
6·6–7·5	174	17·7	62	14·9	35	17·8	56	25·5	13	15·7	8	11·8
7·6–8·5	164	16·7	63	15·2	37	18·8	42	19·2	12	14·4	10	14·7
8·6–9·5	134	13·6	61	14·7	35	17·8	23	10·5	7	8·4	8	11·8
9·6–10·5	86	8·8	44	10·6	11	5·6	17	7·8	5	6·0	9	13·2
10·6–11·5	55	5·6	25	6·0	9	4·5	13	6·0	3	3·6	5	7·4
11·6–12·5	37	3·8	19	4·6	6	3·0	2	0·9	2	2·4	8	11·8
Over 12·6	43	4·4	24	5·8	3	1·5	5	2·3	6	7·2	5	7·4
Average number of cows per hour per set of cups	7·2		7·4		7·0		7·2		6·7		7·9	

Cows Milked per Set of Cups per Hour.

A wide variation in the number of cows milked per set of cups per hour is shown in Table 5. The average was 7·2. In New Zealand and New South Wales the averages were 9·3 and 10·4, respectively.

It cannot, however, necessarily be inferred from these comparisons that Queensland practice is noticeably less efficient than that in the other countries. The New South Wales survey, which was really of a pilot nature, was made on only 72 farms. The apparently lower rate in Queensland would be partly attributable to the survey being made at a time when buckets were fitted to the machines on the test days for herd recording purposes, and some disruption to the normal shed routine, which would obviously make for somewhat slower milking than on other days. However, even allowing for these influences, the results would suggest that there is ample room for attaining a faster milking rate with machine-milked herds in Queensland. This, in view of modern teachings, would ensure more milk and confer other benefits.

Only on 36·2%, or slightly more than one-third of the farms, was the average rate in excess of 8·5 cows per hour, whilst on 47·1% of the farms less than 7·5 cows were milked per hour per set of teatcups. Corresponding percentages in the New Zealand survey were 59 and 24, respectively.

The range on individual farms in the average number of cows milked per set of teatcups per hour is shown in Table 6. It was from 2·5 to 22·6 cows, compared with extremes of 5·5 and 22·0 in New South Wales and 4 and over 16 in New Zealand.

TABLE 6.

RANGE IN COWS MILKED PER HOUR PER SET OF TEATCUPS.

Sets of Teatcups on Machine.	Number of Cows Hourly per Set of Cups.
1	8·8 to 10
2	3·9 to 22·6
3	3·0 to 14·1
4	2·5 to 12·5
5	2·6 to 9·2
6	3·2 to 12·0
7	4·2 to 5·2
8	3·3 to 5·9

Minutes per Cow According to the Numbers of Sets of Cups.

From Table 7 it will be noticed that the average time of milking a cow showed a progressive increase as the number of sets of teatcups on the machine increased. The range on farms was from 5·3 minutes per cow for a single-unit plant to 14·1 minutes for a machine fitted with seven sets of teatcups.

It has been claimed that by leaving the teatcups on the cows for too long the cows tend to become slow milkers, they do not yield as much milk as by rapid milking due to the milk let-down hormone being active for only about 7 minutes, and irritation caused to the teat lining

TABLE 7.

MINUTES PER COW PER SET OF CUPS ACCORDING TO NUMBER OF UNITS PER MACHINE.

Sets of Cups.	State.		South-eastern		Darling Downs.		Burnett.		Central.		Northern Tablelands.	
	Farms.	Min. per Cow.	Farms.	Min. per Cow.	Farms.	Min. per Cow.	Farms.	Min. per Cow.	Farms.	Min. per Cow.	Farms.	Min. per Cow.
1	4	5·9	2	6·35	..	..	..	..	..	..	2	5·3
2	184	6·6	89	6·7	24	6·6	34	6·9	13	6·9	24	5·9
3	428	8·1	177	8·0	75	8·5	104	7·7	39	8·4	33	7·9
4	307	9·0	126	9·0	83	8·6	71	9·4	22	9·6	5	9·6
5	16	10·1	5	9·1	5	8·0	4	13·8	2	10·2	..	..
6	39	11·9	13	10·6	10	12·4	5	11·3	7	13·2	4	13·8
7	2	12·8	1	11·5	..	..	1	14·1	..	..	..	..
8	2	9·7	2	9·7	..	..	..	..	..	..	..	..
	982	8·3	415	8·1	197	8·5	219	8·4	83	8·9	68	7·6

TABLE 9.

COWS MILKED PER HOUR PER LABOUR UNIT.

Cows per Hour per Labour Unit.	State.		South-eastern Queensland.		Darling Downs.		Burnett.		Central.		Northern Tablelands.	
	Herds.	%	Herds.	%	Herds.	%	Herds.	%	Herds.	%	Herds.	%
Under 10	194	19·8	93	22·4	32	16·2	40	18·3	16	19·3	13	19·1
10–14·9	399	40·6	156	37·6	81	41·1	103	47·0	38	45·8	21	30·9
15–19·9	215	21·9	102	24·6	46	23·4	40	18·3	15	18·0	12	17·6
20–24·9	106	10·8	39	9·4	19	8·6	26	11·9	7	8·4	17	25·0
25–29·9	40	4·1	14	3·4	12	6·1	7	3·2	3	3·6	4	5·9
30–34·9	19	1·9	7	1·7	7	3·6	3	1·4	2	2·4	..	..
25–39·9	7	0·7	13	·7	2	1·0	..	..	1	1·2	1	1·5
Over 40·0	2	0·2	1	·2	..	..	..	..	1	1·2	..	..
Average Number of Cows per Labour Unit	12·6		12·3		12·5		12·5		11·9		13·8	

may predispose them to infection with mastitis. It is clear that in many herds the teatcups are being left on cows for some time after actual milk flow ceases. With a view to determining whether this was connected with the amount of labour available during milking, an examination was made of the relationships between the numbers of sets of teatcups looked after per person and various aspects of milking rates. The results are given in Table 8.

TABLE 8.

MILKING RATES ACCORDING TO SETS OF CUPS PER MILKER.

Sets of Cups per Labour Unit.	Herds.	Minutes per Cow per Set of Cups.	Cows per Hour per Set of Cups.	Cows per Hour per Person.
Less than—				
1·5	476	7·4	8·1	10·3
1·6–2·5 ..	317	7·8	7·7	14·0
2·6–3·5 ..	135	10·0	6·0	18·2
3·6–4·5 ..	46	10·3	5·8	23·1
Over 4·5 ..	8	11·8	5·1	27·3

From the figures in Tables 7 and 8, it is evident that despite the relatively longer time which the cups remain on the cows as the sets of cups on the machine increases, the efficiency of milking in terms of cows milked hourly per labour unit increases. In sheds where one person was responsible for over 3·5 sets of cups, more than twice as many cows were milked hourly per person as in sheds where there was less than 1·5 sets of cups per labour unit.

A perusal of Table 8 shows that as the number of sets of teatcups attended per person increased there was a progressive increase in the numbers of cows milked hourly per person. There was a decrease in the number of cows milked hourly per set of teatcups, and the cups remained longer on the cows.

Cows Milked per Hour per Labour Unit (Person).

The distribution of the farms, according to the numbers of cows milked per hour per labour unit, is shown in Table 9. On only 68, or 6·9%, of the farms were more than 25 cows milked hourly per person, while on 60·4% of the farms the average was below 15 cows. Even allowing for the fact that the Queensland survey was based on data obtained during days when buckets were attached to the milking machines, the results compare unfavourably with those obtained in the New Zealand survey, where 33% of the farms had a milking rate of over 25 cows hourly per person and 23% of the farms averaged less than 15 cows.

The average rate in Queensland was 12·6 cows. Comparative figures obtained in New South Wales and New Zealand were 19 and 22, respectively. It is apparent that labour is being more efficiently utilised in the milking sheds in both those places than in Queensland.

The variations in the average numbers of cows milked per hour per labour unit with machines fitted with from one to eight sets of teatcups are shown in Table 10.

TABLE 10.

RANGE IN COWS PER HOUR PER LABOUR UNIT ACCORDING TO SETS OF TEATCUPS ON MACHINE.

Sets of Teatcups.	Number of Cows Milked per Hour.
1	8·8 to 10·0
2	3·9 to 46·1
3	4·8 to 41·3
4	6·2 to 35·3
5	4·4 to 38·7
6	7·1 to 37·5
7	15·0 to 18·2
8	11·5 to 16·7

It will be seen from the table that the highest number of cows milked per person per hour on an individual farm was 46·1 and the fewest 3·9. Incidentally, on each of these farms a two-unit milking machine was installed. The above table clearly depicts the varying degrees of efficiency of use of labour in the milking shed.

OTHER ASPECTS OF MILKING PRACTICE.

The stimulation of milk let-down by examining the foremilk and washing the cows' udders, the omission of hand-stripping of machine-milked cows and the doubling-up of sets of teatcups on the milking units of milking machines, are practices on which attention has been focussed in modern studies on milking techniques. Information on these aspects of dairy shed methods in relation to Queensland farms follows.

Stimulation of Let-down of Milk.

The washing and drying of the cows' teats and udders and the use of a strip-cup to ascertain if there is any abnormality in the foremilk are recognised and advocated as good practices in dairy shed hygiene. It is now known that they are also factors which stimulate the dairy cow to let-down her milk.

Data regarding these practices were not collected in this survey, but in another survey of some aspects of dairy farming conducted on 894 farms, it was found that the cows' udders were washed on 96·3% of the farms. On 24·9% of the farms the foremilk was examined for abnormality, but a strip cup was used for this purpose on only 13·3% of the farms.

Hand-Stripping and Non-Stripping of Cows.

Dr. Petersen strongly advocates that hand-stripping should be avoided wherever possible by training cows to milk out quickly and completely to the milking machine. He believes that injury to the teat predisposes a cow to mastitis. This injury may be brought about internally by the harmful action of the milking machine if the teatcups are left on too long or the vacuum is too high, or by severe hand-

stripping and externally through various causes which occur on a farm. In his opinion, quick, clean milking with machines should, therefore, be a means of attaining maximum production and economy in the actual milking of cows.

TABLE 11.

HAND-STRIPPING AND NON-STRIPPING ACCORDING TO HERD SIZE.

Size of Herd.	All Queensland.				South-eastern				Darling Downs.			
	a.		b.		a.		b.		a.		b.	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Under 20	57	72	22	28	18	69	8	31	13	54	11	46
20–34	234	69	106	31	103	77	31	23	32	43	44	57
35–49	203	66	106	34	93	73	35	27	23	44	29	56
50–64	121	76	38	24	64	80	16	20	21	68	10	32
65–79	43	74	15	26	19	79	5	21	3	43	4	57
80 and over	24	65	13	35	15	65	8	35	4	57	3	43
All herds	682	69	300	31	312	75	103	25	96	49	101	51

Size of Herd.	Burnett.				Central.				Northern Tablelands.			
	a.		b.		a.		b.		a.		b.	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Under 20	18	95	1	5	4	80	1	20	4	80	1	20
20–34	62	82	14	18	15	60	10	40	22	76	7	24
35–49	49	59	34	41	19	83	4	17	19	83	4	17
50–64	18	72	7	28	13	81	3	19	5	71	2	29
65–79	11	85	2	15	7	70	3	30	3	75	1	25
80 and over	3	100	..	..	2	50	2	50	..	..	..	..
All herds	161	74	58	26	60	72	23	28	53	78	15	22

a = Herds which were hand-stripped.
b = Herds which were not stripped.

Table 11 sets out, according to herd sizes, particulars of the numbers and percentages, on a State-wide and district basis, of the farms included in the survey on which the herds were hand-stripped or not stripped.

It will be seen from this table that many farmers have ceased to hand-strip their cows; 69% still continue with hand-stripping, while 31% have abandoned hand-stripping after machine-milking. In the limited investigation in New South Wales the corresponding figures were 65% hand-stripping and 35% non-stripping. A Victorian survey indicated that only 40% of herds were being hand-stripped and in New Zealand the percentage was 46.

It might have been expected that hand-stripping would have been carried out on a more extensive scale in smaller herds, but there appears to be no significant correlation between the size of the herd and the extent to which hand-stripping has ceased excepting in the

largest size herds (over 80 cows). There was, however, an appreciably greater percentage of farms on the Darling Downs than in other districts where hand-stripping had been discontinued. In this district slightly over half the farms (51%) covered in the survey had dropped hand-stripping. In all other districts the percentages of hand-stripped and non-stripped herds did not show any significant trends away from the State average.

TABLE 12.

HAND-STRIPPING AND NON-STRIPPING ACCORDING TO SETS OF CUPS PER MILKING SHED.

Sets of Cups Per Plant.	All Queensland.				South-eastern Queensland.				Darling Downs.			
	a.		b.		a.		b.		a.		b.	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	2	50	2	50	..	..	2	100	..	..	..	..
2	140	76	44	24	69	78	20	22	12	50	12	50
3	307	72	121	28	138	79	38	21	35	45	41	55
4	201	65	106	35	94	74	33	26	40	49	42	51
5	12	75	4	25	4	80	1	20	3	60	2	40
6	17	44	22	56	5	38	8	62	6	60	4	40
7	1	50	1	50	..	..	1	100	..	..	..	..
8	2	100	..	..	2	100	..	..	..	..	..	..
All sizes ..	682	69	300	31	312	75	103	25	96	49	101	51

Sets of Cups Per Plant.	Burnett.				Central.				Northern Tablelands.			
	a.		b.		a.		b.		a.		b.	
	No.	%	No.	%	No.		No.	%	No.	%	No.	%
1	..	..	..	..	..	..	..	..	2	100	..	..
2	30	88	4	12	10	77	3	23	19	79	5	21
3	76	73	28	27	32	82	7	18	26	79	7	21
4	49	69	22	31	14	64	8	36	4	80	1	20
5	3	75	1	25	2	100	..	..	..	..	..	..
6	2	40	3	60	2	29	5	71	2	50	2	50
7	1	100	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..
All sizes ..	161	74	58	26	60	72	23	28	53	78	15	22

a = Herds which were hand-stripped.
b = Herds which were not stripped.

From Table 12 it will be evident that as the number of sets of cups on the milking machine increases there is a decrease in the percentages of hand-stripped herds. New Zealand studies have shown that high output in terms of "cows milked per labour unit per hour" can be achieved most readily by each milker handling a larger number of sets of teatcups and this in turn is made possible when hand-stripping and leg-roping are abandoned.

Doubled-up Teatcups on Milking Machine Units.

The usual procedure with the walk-through bails so common on Queensland dairy farms is to have one set of teatcups placed in each set of bails, the cow on the right side and that on the left side being milked alternately. While a cow on one side is being milked, the cow on the other side is prepared and as soon as the teatcups are removed from a cow on one side they are transferred to the cow on the other side of the bail. When a unit is doubled-up, by fitting two sets of teatcups in each bail, the two sets of teatcups cannot be continuously in use and it is necessary to hang a set for a time on the dummy bail or centre partition after a cow is milked until another is bailed up and prepared for milking. Consequently, fewer cows can be milked per set of cups per hour than in sheds where the teatcups are not doubled-up, but a higher number of cows can be milked per hour per labour unit.

By doubling-up the sets of teatcups a farmer who increases the size of his herd can do so without having to enlarge his milking shed. As doubling-up is a comparatively recent innovation in milking shed practice, the opportunity was taken to ascertain to what extent it had developed and the effect on milking rates.

The survey disclosed that on 66, or 6·7%, of the farms using milking machines the milking units had been either partly or wholly doubled-up. The relevant data are given in Table 13.

TABLE 13.

EXTENT OF DOUBLING-UP OF SETS OF TEATCUPS ON MILKING MACHINES.

Size of Milking Machines.	Number and Percentages of Doubled-Units.		Number of Units Doubled-Up.			
	Number.	Per cent.	1	2	3	4
2 Units	16	8·2	4	12	..	..
3 Units	32	7·0	16	3	13	..
4 Units	18	5·9	2	13	1	2

Table 14 has been prepared to enable a comparison to be drawn between machines fitted with doubled-up sets of teatcups and those with the conventional single set of cups in regard to the milking rates per person hourly and per set of teatcups hourly.

TABLE 14.

Type of Double-up Machine.	Number of Machines.	Milking Rate per Person.	Milking Rate per Set of Teatcups.
2 units ..	12	4·3 min. per cow (4·7) ..	9·5 min. per cow (6·6)
		14·0 cows per hour (12·8) ..	6·3 cows per hour (9·1)
3 units ..	13	4·2 min. per cow (4·9) ..	11·7 min per cow (8·1)
		14·3 cows per hour (12·2) ..	5·1 cows per hour (7·4)
4 units ..	2	4·4 min. per cow (4·6) ..	10·2 min. per cow (9·0)
		13·6 cows per hour (13·0) ..	5·8 cows per hour (6·7)

Note.—Figures in parenthesis are those obtained for cows milked in single-unit sheds.

In the New Zealand survey the average numbers of cows milked per set of teatcups per hour were 9·3 in single-unit sheds and 6·3 in doubled-up sheds. It will be noted from this table that in Queensland there were only slightly more cows milked per hour per labour unit in doubled-up sheds than in single-unit sheds.

SUMMARY AND CONCLUSIONS.

A survey was made of milking practices and rates of milking from data collected on 1,700 farms. On 982, or 91·8%, the herds were milked by machine and on 88, or 8·2%, by hand.

Twenty-seven different makes of milking machines were installed on the farms, but three makes represented 61·7% of the total number of installations. The three-unit milking machine, the most commonly used size in Queensland, was installed on almost half the farms.

The average rate of milking by hand was 6·5 cows hourly per person, or 9·2 minutes per cow. The milking rate per hour per person on farms equipped with milking machines was 12·6 cows, so that almost twice as many cows were handled per person hourly as on hand-milking farms. The range on individual farms was from 4 to 46.

The average rate of milking per set of teatcups was 7·2 cows per hour, or 8·3 minutes per cow per set. On individual farms the range was from 2·5 to 22·2 cows hourly.

The average number of sets of teatcups attended per person was 1·74. There was a clearcut progressive lengthening of the average milking time per cow with increasing numbers of sets of teatcups installed in the milking shed, the range being from 5·9 minutes per cow for a single-unit milking machine to 12·8 minutes for machines fitted with seven sets of teatcups.

On 60·4% of the farms the average number of cows milked hourly per labour unit employed during milking was less than 15, and on 6·9% of the farms it was over 25. The range on individual farms was from 3·9 to 46·1 cows.

Milk let-down is stimulated by the washing of the cows' teats and udders on almost all farms, 96·3% adopting this practice. On 24·9% of the farms the foremilk was examined for abnormality.

The elimination of hand-stripping of cows milked by machine is gaining in momentum, about one-third of the farms having ceased to hand-strip their herds. This practice is more widely followed on the Darling Downs than in other districts. Contrary to what might have been expected, hand-stripping was carried out as extensively in large herds (excepting over 80 cow herds) as in herds of relatively small size. There was, however, a definite tendency to omit hand-stripping on farms which had larger numbers of sets of teatcups per machine.

Doubled-up sets of teatcups were provided on 66, or 6.7%, of the farms which used milking machines. There was a slight increase in the numbers of cows milked hourly per labour unit with doubled-up machines.

The survey has disclosed that there is room for a considerable improvement in the efficiency of milking on many Queensland farms. The results would suggest that often there is inefficient use of labour, faulty handling of the machine and the herd, or lack of training of the herd in good milking techniques.

Another survey recently undertaken has shown that a high proportion of milking machines have mechanical imperfections which decrease their milking efficiency. Although evidence is not available on the extent to which defects in the mechanical condition of machines installed on the farms included in this survey may have contributed to the low average numbers of cows milked per set of teatcups or labour unit, it is reasonable to assume that they had an appreciable influence.

On many farms the improvement of milking shed techniques (including the proper maintenance of the milking machine) should be the aim of a farmer rather than the purchase of a larger milking machine or doubling-up sets of teatcups. By careful attention to the principles of good milking, the enlarging of the existing plant can often be avoided. The animal, the man and the milking machine all play their part in ensuring efficient milking.

The following would appear to be points to which greater attention should be paid—

(1) The time the teatcups remain on the cows.

(2) The number of cups per labour unit.

(3) The efficiency of machine stripping.

(4) The mechanical condition of the milking machine.

The Beef Cattle Industry of Eastern Cape York Peninsula.

By N. C. COPEMAN (District Inspector of Stock) and W. F. MAWSON (Senior Adviser, Cattle Husbandry).

The area under consideration lies between the 14th and 16th parallels of South latitude, and to the east of 143 E. longitude. On the eastern side the South Pacific, including Princess Charlotte Bay, forms the natural boundary.

The section east of the Great Dividing Range is the most important from a cattle raising point of view. This represents a distinct cattle area and the majority of stock turned off use the Laura stock route, via the Byerstown Range, to the saleyards and railhead at Mareeba.

Cooktown and Laura are the only towns in the defined area, but a third town—Coen—is just over the northern boundary. Perhaps Laura and Coen could be better described as "centres." Cooktown does not assume a great deal of importance in connection with the cattle industry, except as a port of entry for supplies. Laura is more central and accessible to the main properties.

Whilst most of the area is devoted to cattle raising there are small holdings being used for agriculture. These agricultural areas are along the McIvor River, about 40 miles north from Cooktown, and also along the Endeavour River. Peanuts are the main crop, but pineapples, maize and citrus are also grown. A small area of land near Laura has been devoted to the production of tobacco.

North of the Annie River is a State forest, the only one in the area.

Topography and Rivers.

With the exception of the Great Dividing Range, the small strip west of the range, and the coastal ranges, the area comprises a number of river basins having an outlet into Princess Charlotte Bay. There are a series of low ranges of about 1,500 feet which run roughly parallel to the coast from Cooktown to Cape Melville. These have the effect of preventing the limited winter rain from extending further inland. Between the Normanby River and the east coast there are low ranges running roughly north and south in parallel and the valleys between the ranges provide good grazing.

Except for those properties which include the Great Dividing Range or its foothills, the altitude of the cattle country is not appreciably above sea-level.

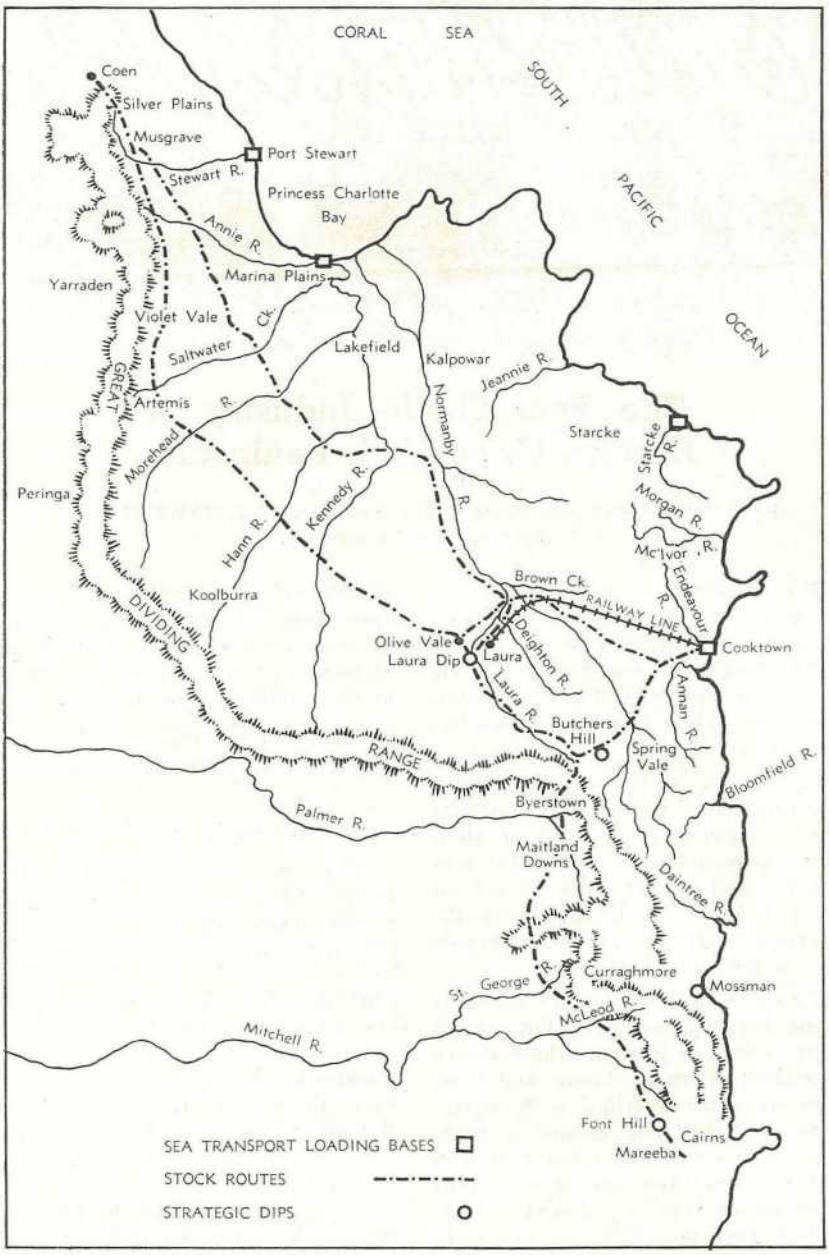


Plate 1.

Sketch Map of Portion of the Eastern Cape York Peninsula, Showing Position in Relation to Cairns.

In most cases there are fair frontages to streams. The areas between streams consist of flat country which gives way to slightly more elevated land finally running into sand ridges, which occupy a considerable area. Marine plains surround the mouths of the Kennedy, Annie, Bizant and Normanby Rivers, extending inland as far as the flow of the high tides. These plains are comparatively level and carry only occasional trees or clumps of trees. Some salt arms appear. Magnetic white ant nests are a feature of both the marine plains and the areas joining river frontages.

A plateau known as the Jeannie Tableland is located between the Bizant and Normanby Rivers.

There is a rather complicated river system, with streams dividing into branches and joining other streams and in some cases producing offshoots which make their own way to the sea or rejoin the main stream. For instance, the Bizant is an overflow from the Normanby.

The two main streams are the Kennedy and the Normanby, both of which flow in a northerly direction into Princess Charlotte Bay. The Morehead and Hann Rivers are the principal tributaries of the Kennedy, while the Jack, Laura and Deighton feed the Normanby. The Jeannie and Starcke are short streams which flow to the coast on the north-eastern aspect. South of Princess Charlotte Bay the river basins reach their combined maximum width of 150 miles.

Lagoons are scattered throughout the eastern portion. These connect with streams during the wet season and later become isolated. Some contain crocodiles, which are dangerous to weak stock during the dry season. Permanent water is present in few of these lagoons.

The coastal rivers are tidal for up to 15 miles from the mouth and the water is salt or brackish for a similar distance.

During the wet season a considerable area of marine plain is under water when streams overflow and merge to inundate the adjoining plains. The extent of this flooding depends on the season.

Salt deposits are found at the eastern edge of Jeannie Tableland and in a number of places adjacent to the coast along Princess Charlotte Bay, especially north-east of the mouth of the Annie River.

Soils and Vegetation.

These are dealt with here in a very general way. More precise information will be available later from reconnaissance surveys.

There are four main soil types, each carrying rather different vegetation. The soils are generally shallow and changes occur at six inches or less on poor types. Flats and plains are of greater depth.

The main soil type is a light grey clay loam overlying a yellow clay. In places this soil is structureless and very soft during the wet season. There is a difference in shades of colour of the soil and in vegetation according to available moisture. Spear grasses (species of *Aristida* and *Heteropogon*), kangaroo grass (*Themeda australis*) and native panicum (*Panicum decompositum*) are associated with narrow-leaf box and bloodwood on the better areas, while spear grasses, wire grasses (species of *Aristida*) and love grasses (species of *Eragrostis*) are found with ironwood, bloodwood, black pear and stunted box. Anthills are very numerous. In gullies or low-lying flats this soil type supports forest blue grass (*Bothriochloa intermedia*), which grows very vigorously.

Of essentially the same soil type are the marine plains, which are characterised by a very uneven topography in the form of depressions from six inches to two feet in depth and up to six feet in length. These depressions are usually rectangular or irregular in shape and vary in width from two to four feet. Areas which are covered by water for

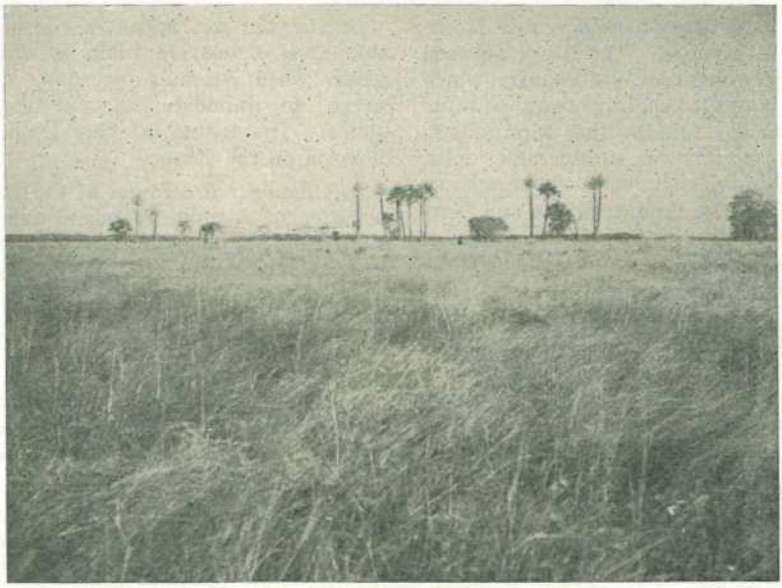


Plate 2.

Marine Plain Country, With Pandanus Palms Marking the Site of an Old Native Well.

periods each year are characterised by dark-coloured soil compared with the more elevated sections. Kangaroo grass and native panicum dominate the higher sections, while wild rice (*Oryza australiensis*) and types of rushes and sedges appear in the swamps.

The mild slopes between the swamps and ridges support a variety of grasses, in which cockatoo grass (*Alloteropsis semialatus*) and blue grasses (species of *Dichanthium* and *Bothriochloa*) are prominent.

Marine couch (*Paspalum vaginatum*) is found on areas subject to tidal water.

The marine plains have probably the highest carrying capacity of the area and could perhaps support 20-30 beasts per square mile if sufficient permanent water was available. It is estimated that marine plains occupy about 250 square miles. They offer the most scope for development from a pasture and grazing point of view. Flooding and the lack of permanent water suitable for stock are the limiting factors.

Sandy soils comprise the second type and can be placed into three groups. The best sandy country (usually found on flats south and south-east of Coen) supports Townsville lucerne (*Stylosanthes sundaica*), which is very useful during the dry season. Stock do not graze Townsville lucerne heavily during the growing season. In late winter and spring, when other pasturage is either non-existent or very unpalatable and lacking in food value, the mature Townsville lucerne provides valuable fodder which is readily eaten by stock.

The second group of sandy soils is found on sandy ridges and adjacent country. It supports tea-tree, currant bush, quinine bush, black pear, grass-tree and various edible shrubs and bushes. Grasses appear in tufts at intervals and comprise white spear, love grasses and fire grass. This country is useful because of the presence of edible shrubs and the fact that the grass will respond to light falls of rain. Its carrying capacity does not vary greatly with the season and is placed at two beasts per square mile.

Plate 3.

Land Typical of the Best of the Low-lying Marine Plain Country. The main grasses are kangaroo grass, native panicums and blue grasses on the higher ground, with rice grass, reeds and sedges in low areas. Note the birds on the lagoon.

Fine white sand comprises the so-called "desert" and it supports tea-tree and little else.

Small areas of black soil plain (for example, on Butcher Hill Station) occur on the fringe of basalt formations. These plains carry few trees but are fringed by gum-topped box. During the wet season an assortment of native legumes and herbage grows profusely along with blue and Flinders grasses. During the storms and immediately after the wet season these plains have a heavy carrying capacity, but during late winter and spring become practically devoid of living vegetation and are subject to cracking and drying out.

The fourth soil type occurs at the northern fringe of the Byerstown Range, at the head of the Hann River, and south of Fairview Telegraph Station. It consists of red and brown volcanic soils carrying mainly gums and box. Kangaroo and spear grasses predominate, with a little blue grass in evidence on the brown soil. Grasses grow quickly during the wet season, and spear grasses in particular quickly become rank and of little value. These soils are probably most useful during the wet season, when they support dense stands of grass.

In the McIvor River region is an area of red volcanic soil of good depth. It resembles the better class forest soil of the Atherton Tableland and supports most of the agricultural activity of the district. Along creeks small areas of softwood scrubs are in evidence, but gums and box are the main tree types; they are associated with blady grass (*Imperata cylindrica* var. *major*).

Climate.

The climate is influenced by the location (16°–14° S. latitude), low altitude and the distance between the coast and the main range.

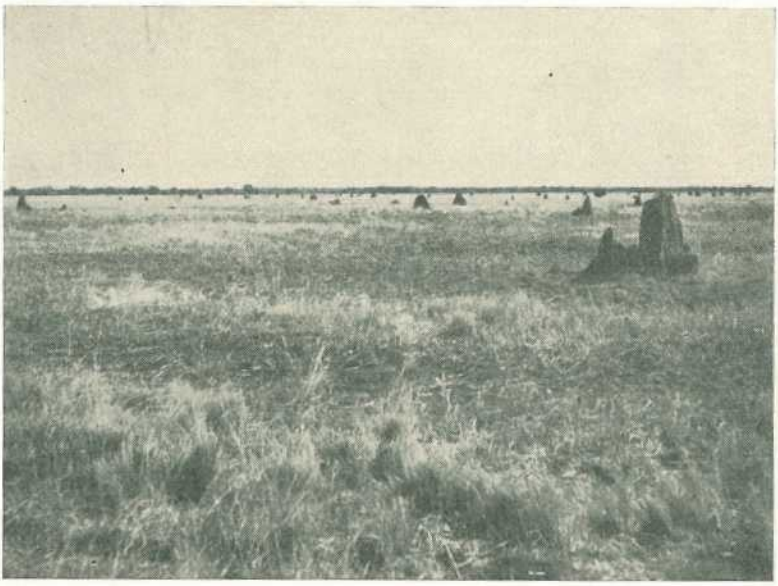


Plate 4.

Portion of the More Elevated Marine Plain Country. This area, south of the Annie River, has been heavily grazed.

Temperatures are high and are accompanied by high humidity, particularly along the coast. Midday recordings of 90° are not uncommon in the middle of winter in the coastal areas. Frosts are unknown.

As in so many districts of Queensland, rainfall is by far the most important single weather factor The rainfall varies in amount from 30 to 70 in. per annum. The heaviest falls occur along the coastal strip north of Cooktown and there is a general decrease westward in parallel with the coast. The Princess Charlotte Bay area is an exception, as the rainfall lines cut across the bay and are thus more uniform than the coast line.

The comparatively small area west of the Great Dividing Range dealt with in this article receives less rain than the eastern side and the rain has a more pronounced seasonal incidence.

The rainfall has a summer incidence, with storms normally occurring in November-December followed by the wet season in January, February and March. Lesser falls then occur until July, when the dry season begins and lasts until the storms.

Along the coastline and particularly between Cooktown and Cape Melville, some useful winter falls are experienced. A rainfall of between 5 and 15 in., according to the distance from the coast, can be expected between May and October. In the area east of a line drawn from Cooktown to the mouth of the Normanby it is not unusual to receive useful falls of rain right through the spring months. This is an important factor, which favours this particular area in comparison with country farther west. Because of the moisture-retaining qualities of the subsoil and the flat topography in much of this area, a fall of half an inch of rain will produce appreciable green feed.

Average monthly and annual rainfall for two centres in the area are shown below:—

	Laura.	Coen.
	Average points.	Average points.
January	908	1,060
February	915	1,079
March	703	975
April	121	388
May	28	49
June	43	40
July	11	23
August	6	12
September	10	5
October	68	48
November	196	207
December	550	626
Annual	3,559	4,512

Transport and Communications.

Road transport is seriously affected by the wet season, as most of the roads are only blazed tracks on which road-making equipment has never been used. A formed road connects Mareeba with Cooktown, via Mt. Molloy and Mt. Carbine. This is trafficable for most of the year, with the Normanby and Annan Rivers the main obstacles. About 50 miles south from Cooktown there is a branch road to Laura which has been formed for about 20 miles. The old road to Laura through Chillagoe, Wrotham Park, Mount Mulgrave and Palmerville is not regularly used. All properties are accessible by a suitable motor vehicle during the dry season.

A railway line extends from Cooktown to Laura and a rail motor normally makes one return trip to Laura per week.

Coastal vessels call at Cooktown with supplies and to take off the agricultural and mining products of the district.

There is a tri-weekly plane service from Cairns to Cooktown. Small aerodromes have been constructed at Laura, Coen and some station properties on which the ambulance plane and commercial aircraft can land.

A telegraph line runs through to Thursday Island, taking in Laura and Cooktown and having several other telegraph stations at various points. Some properties have transceiver sets and can thus contact Cairns and each other.

Coen and Laura are joined by a weekly overland mail service. It is necessary to resort to a pack horse during the wet season but motor transport does the job during the dry.

Stock Routes.

Although some cattle leave this area and travel direct to the Bloomfield or the Daintree Valley for fattening en route to Mossman or Cairns for slaughter, most of the turnoff travels along the stock route from Laura up the Laura River, across the Byerstown Range into Mareeba. The Laura River ceases to flow about the middle of the year but waterholes in that river usually supply sufficient water until July. This also applies to the other watering places from the Byerstown Range to the Mitchell River, which are Spear Creek, Palmer River, Knobby's Flat, Reedy St. George River, Kelly St. George River, and Mitchell River. In those years when the summer rainfall is below average or terminates early, water becomes very scarce on this route and it is often closed to travelling stock on that account at the end of August. Grass and herbage are adequate early in the season but dry out and lose food value rapidly from June onwards. From Laura to the Byerstown Range travelling conditions are good; but from the Byerstown Range to the Mitchell River (a distance of about 60 miles) sections of the route are exceptionally rough and stony. It is not uncommon for some cattle in travelling mobs to be left behind because of sore feet or actual foot rot.

Cattle have to be held on the camp by the droving parties for the whole of the journey, which occupies about 24 days from Laura to Mareeba. Some of this droving is done by contract at a price in the region of £1 per head.

Plate 5.

Sandy Country Carrying Broad-leaved Tea-tree Covers a Large Area.
The soil loses its structure in the wet season and stock may become bogged.

It is generally considered that mature cattle lose about 100 lb. in weight en route to Mareeba.

Strategic dips are situated on the Laura-Mareeba stock route. One dip is located at Laura and the other is at Font Hill station, about 30 miles north-west of Mareeba. Travelling stock are required to dip at both of these strategic dips. Cattle travelling the Daintree route are dipped in the strategic dip at Butcher's Hill Station. All strategic dips are charged with DDT, which is supplied free of charge by the Department of Agriculture and Stock.

It is understood that watering facilities are to be established on this route in the near future.

Water Supplies.

With such a network of streams it could be expected that an excellent supply of water would be available all the year round. In fact, the opposite is generally the case.

As mentioned previously, the rivers are brackish for a considerable distance from the mouth and so are unsuitable for stock watering. Even as early as June such rivers as the Laura, Morehead and Deighton are reduced to a series of holes. The Hann, Kennedy and Normanby can be regarded as permanent streams; occasional lagoons provide permanent water.

Homesteads are usually equipped with wells and windmills, but those facilities have not extended into the main grazing areas. Much of the better class grazing country in the dry season is almost devoid of water. The area best supplied with permanent water lies between Laura and the Great Dividing Range. Some springs occur in this part of the country.

The location and provision of permanent water through the better class grazing country is a prerequisite of improvement.

It may be possible to deepen some lagoons in order to provide permanent water on the marine plains. When available, it is expected that bores will supply ample water farther inland. They would probably need to be fitted with windmills. There is an urgent need for exploratory bores as a guide for future development.

Cattle Production.

The area has potentialities for both breeding and fattening, but the great drawbacks are insufficient permanent water supplies, difficulties in tick and buffalo fly control and the absence of essential fences for the proper handling of cattle. The nearest saleyard and railhead connected to the State rail network is at Mareeba, which is 3½-4 weeks' journey by stock route from Laura, six weeks from the Princess Charlotte Bay area, and seven weeks from Coen. Many cattle are fat when mustered, but owing to the absence of bullock paddocks have to be "tailed" (that is, held without the aid of fences) for a considerable time before being put on the stock route and are generally in store condition by the time they reach Mareeba.

Size and Number of Holdings.

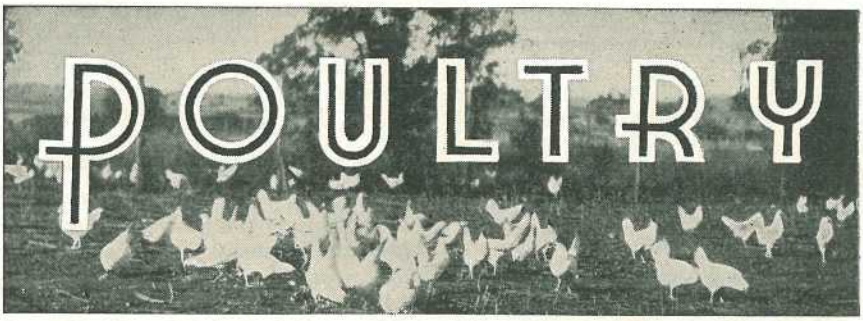
The grazing land is held by about 23 persons or companies. The holdings, which usually consist of two or more blocks, vary in size from 200 sq. miles to 1,200 sq. miles. On a holding which contains a mixture of soil types, five to six beasts to the square mile is taken as a reasonable carrying capacity under present conditions.

Most of the holdings are Crown leases. There are two Pastoral Development leases and also some small areas of freehold in the McIvor River district.

[TO BE CONTINUED.]

Plate 6.

A Type of Sand Ridge Country With Box, Bloodwood, Ironwood and Tea-tree.
Wire grasses are the dominant grasses.



The Rate of Lay—Its Influence on Poultry Farm Profits.

By E. O. BURNS and T. KUDYBA, Division of Marketing.

Queensland's poultry industry is facing grave problems at the present time.

As an integral part of the Australian industry it depends to a large extent for its stability on overseas markets, principally the United Kingdom, which in 1953-54 took more than one-third of Australia's commercial traders in the first half of 1953, which together with an increased home supply of eggs caused a significant drop in prices paid for Australian imported eggs.

During the 1953-54 season Australian egg producers were still protected from the full effects of the reduction of egg-in-shell prices by the

TABLE 1.

AVERAGE MONTHLY RATE OF LAY, 1953–54—BY SIZE GROUPS.

Month.	Size Groups.					Weighted Average for Whole Commercial Section.
	1,000 and over.	500–999.	251–499.	100–250.	1–99.	
July ..	14·51	14·75	14·11	12·35	12·31	14·19
August ..	17·52	18·16	17·62	15·91	15·43	17·42
September	18·01	18·43	18·56	16·45	16·50	17·95
October ..	18·06	17·98	17·97	16·16	16·24	17·74
November	16·61	14·90	16·44	14·79	14·76	15·88
December..	15·29	14·84	15·54	14·03	13·54	15·02
January ..	14·95	14·42	14·63	13·20	13·44	14·52
February ..	12·46	12·42	11·60	10·63	11·11	12·10
March ..	12·72	13·38	12·73	10·24	11·01	12·55
April ..	10·83	11·48	11·00	9·06	9·90	10·79
May ..	10·39	10·14	10·49	8·59	9·02	10·09
June ..	10·16	10·05	11·00	8·82	9·52	10·07
	171·51	170·95	171·69	150·23	152·78	168·32

egg production. Unfortunately, however, prospects on these markets have declined.

Importation of eggs-in-shell into the United Kingdom reverted from the Ministry of Food to private continuation for one year of a guaranteed price for egg-pulp. This guarantee, however, has now been removed, and sales of both eggs-in-shell and egg pulp are now on a private trading basis, competing with Danish, Dutch, English and other supplies. As

a consequence, Australian producers can expect much lower returns and also a restriction on quantities exported to that market.

The situation is one that calls for the utmost efficiency on poultry farms in order to reduce the cost of production per egg.

Although in the present structure of the Australian economy many (though not all) of the items comprising a poultry farmer's costs of production are beyond his control, there is still a field for improvement in individual farm efficiency. This can be brought about in two main ways—by improvement in management practices (that is, in capital allocation, utilisation of labour and husbandry practices), and by increasing the average rate of lay of flocks. Feed costs per egg are obviously affected directly by variations in the rate of lay.

Rates of Lay.

It is proposed in this article to examine rates of lay in south-eastern Queensland, and to illustrate, by means of the egg-feed ratio, the influence which the rate of lay has on profitability. The data relating to rates of lay have been obtained from monthly reports furnished by a cross-section of poultry farmers in the area of the South Queensland Egg Marketing Board, which extends from north of Bundaberg to the border and westward beyond Goondiwindi.*

The rate of lay, which expresses average productivity per hen, varies from month to month and from farm to farm. Monthly variations are largely caused by natural factors such as climatic conditions and biological adjustments to seasonal changes throughout the year, whilst variations between flocks are determined largely by such factors as geographic location, general poultry husbandry and feeding practices.

Tables 1 and 2 illustrate the seasonal pattern exhibited by average monthly rates of lay for all flocks in the 1953-54 season. The same pattern was observed in all size groups and in all districts. These tables reveal that Queensland poultry farmers are already operating at a fairly high level of productivity.

The average rate of lay has been calculated at 168 (14 dozen) eggs, which is equal to or higher than most overseas countries, including the United Kingdom, Ireland, Canada and Denmark, but is exceeded by the United States of America and the Netherlands, where the averages are reported to be 178 and 175 eggs.

Peak production of between 17 and 18 eggs per bird occurred in the months of August, September and October, after which there was a gradual tapering off of productivity, with a slight halt to the decline in March until the lowest point of 10 eggs was reached in May and June.

This table reveals a marked variation in the rate of lay between farms with over 250 birds and those with fewer. The former group averaged

* Since November, 1952, the Division of Marketing has conducted a permanent survey of the poultry industry in south-eastern Queensland, based upon data supplied by approximately 300 poultry farmers selected on the principle of stratified-random and segment-master sampling. The sample is classified into the following flock size-groups:—(i) 1,000 birds and over; (ii) 500-999 birds; (iii) 251-499 birds; (iv) 100-250 birds; (v) 1-99 birds; and is representative of all farms which are required to register with the Board (that is, with farms of 251 birds and over) and of those farms with fewer than 251 birds which have registered voluntarily. The sample comprises one-tenth of the universe of enquiry, in respect of number of farms, number of birds and production of eggs. Data are collected monthly by the mailed questionnaire method, and from them and ancillary information relative to hatchery activity are calculated poultry population, classified into laying and other categories, daily, monthly and annual rates of lay, diminution of poultry by slaughterings and flock mortality, forecasts of egg production, egg price-feed cost ratio, etc. This information is embodied in Reports on the Poultry Industry issued quarterly.

TABLE 2.

AVERAGE MONTHLY RATE OF LAY, 1953–54—BY DISTRICTS.

Month.	Egg Marketing Board Districts.					Weighted Average for Whole Commercial Section.
	District 1.	District 2.	District 3.	District 4.	District 5.	
July ..	14·75	15·14	12·80	13·40	12·48	14·19
August ..	17·16	17·94	17·27	16·83	15·43	17·42
September	17·49	18·57	17·29	18·00	16·63	17·95
October ..	16·95	17·41	16·84	17·93	17·68	17·74
November	15·68	15·63	14·62	15·80	15·76	15·88
December..	14·80	14·73	14·34	14·71	13·98	15·02
January ..	14·21	14·19	14·48	14·33	13·44	14·52
February ..	12·34	11·80	11·69	11·79	10·68	12·10
March ..	12·89	12·87	11·56	11·93	11·16	12·55
April ..	11·96	10·82	10·36	9·79	9·33	10·79
May ..	10·90	9·99	9·57	9·15	9·04	10·09
June ..	10·98	10·82	10·01	8·66	9·07	10·07
	170·11	169·91	160·83	162·32	154·68	168·32

171 eggs per annum, which was 20 eggs greater than the average of 151 achieved by the smaller flocks. This implies a higher degree of management efficiency expressed in poultry husbandry and feeding practices on the larger farms.

Individual flocks exhibit a wide range of productivity. The averages appearing in Table 1 have been computed from flock yields which ranged from 9.99 to 20.54 dozens per annum. Quite a number of flocks averaged over 18 dozens, and many commercial flocks reported 14 to 18 dozens. The fact that some flocks have averaged 18 dozens and even more per hen per annum indicates that there is a realistic scope for improvement in general efficiency. Flocks of 1-250 birds, almost without exception, reported rates of lay smaller than flocks of 251 and over. This finding is contrary to the widely held view that the smaller poultry flocks are more efficient and have a higher productivity than the commercial flocks.

Some variation is also apparent in comparing average rates of lay in different districts. For this purpose, the administrative districts of the South Queensland Egg Marketing Board were used.*

Table 2 shows that the highest rates were found in Districts 1 (Wide Bay, South Burnett and near North Coast) and 2 (Northern suburbs of Brisbane, Pine and Redcliffe), where the average was 170 eggs per annum.

* These districts are defined as follows:—

District 1—The cities of Bundaberg, Gympie, and Maryborough; Shires of Biggenden, Burrum, Caboolture, Gayndah, Gooburrum, Isis, Kilcoy, Kilkivan, Kingaroy, Kolan, Landsborough, Maroochy, Mundubbera, Murgon, Nanango, Noosa, Perry, Tiaro, Widgee, Wondai, Woocoo and Woongarra.

District 2—City of Brisbane (Northern Suburbs); town of Redcliffe and Shire of Pine.

District 3—City of Brisbane (Southern Suburbs); and Shire of Redland.

District 4—City of Ipswich; town of South Coast, and Shires of Albert, Beaudesert, Boonah, Esk, Gatton, Laidley and Moreton.

District 5—The cities of Toowoomba and Warwick; the towns of Dalby and Goondiwindi; Shires of Allora, Cambooya, Chinchilla, Clifton, Crow's Nest, Glengallan, Inglewood, Jondaryan, Millmerran, Murilla, Pittsworth, Rosalie, Rosenthal, Stanthorpe, Tara, Waggamba and Wambo.

The Egg-Feed Ratio.

The extent to which the individual farm unit's profits may be modified by variations in the rate of lay can be ascertained for any farm provided the necessary input-output data are available. In the absence of individual farm data, some useful generalisations can be drawn from examination of the "egg-feed" ratio. This is a ratio designed to establish the relationship between egg prices and the cost of poultry feed.

The use of the ratio to indicate the influence of the rate of lay on profitability is a special usage. The primary purpose of the ratio is to provide a guide to the relative profitability of egg production at different periods.

"Egg-feed" ratios have been constructed for South Queensland for the last five years. It seems desirable at this stage to explain their construction and refer briefly to their implications before returning to our main topic, which is the influence of the rate of lay on profitability.

The egg-feed ratio is computed by dividing the price of one dozen eggs by the price of one pound of poultry feed; it represents the number of pounds of feed that can be bought with the proceeds of one dozen eggs.

The use of ratios connecting two variables is widespread in business circles, but it must be remembered that a ratio is only an indicator to one aspect of the enterprise. The egg-feed ratio gives us information relative to egg and feed prices. It says nothing about the other items which go to make up the poultry farmer's costs of production. Moreover, consideration of one ratio at one point in time tells us very little. The usefulness of the ratio consists in the fact that relative movements in the two main factors governing the profitability of egg production can be observed over a period of time.

In calculating egg-feed ratios in Table 3, the egg price used is the average net return per dozen paid by the South Queensland Egg Marketing Board.

To calculate feed prices, we have used a balanced ration recommended by the Poultry Branch of the Department of Agriculture and Stock.* The items comprising this ration have been valued at prices charged by produce merchants to poultry raisers. The selection of a ration to use in calculations of this nature is of necessity largely arbitrary. There are probably wide variations in the rations actually fed to flocks. There are also variations in the prices paid for feed, in the quantities purchased, and the period for which the items were stored prior to consumption. Some farmers purchase ready-made mashes—others mix their own.

The significance of the ratio is not the cost of feed and the price of eggs in absolute terms, nor the relationship at any particular point in time, but the changes which occur in one variable relative to the other.

Annual egg-feed ratios calculated on this basis for 1949-50 to 1953-54 are shown in Table 3.

This table indicates that the ratio between feed costs and egg prices moved sharply against poultry farmers during the period 1949-50 to 1951-52, but the industry made some recovery during the next two years, and by

* The ration is, in respect of each 100 lb. of feed:—50 lb. of grain, comprising equal portions of wheat, maize and grain sorghum; and 50 lb. of mash, comprising 10 lb. bran, 5 lb. pollard, 11¾ lb. wheatmeal, 15 lb. sorghum meal, 5½ lb. meatmeal, 2½ lb. lucerne meal and ¼ lb. salt. It sometimes occurs that one or more of the items comprising the ration is unavailable or in very short supply. Whenever this has occurred an attempt has been made to keep the egg-feed ratio realistic by varying the proportions of the remaining items in such a manner as it is believed a poultry farmer would do in practice, when faced with a similar situation.

TABLE 3.

ANNUAL EGG-FEED RATIOS—SOUTH QUEENSLAND.

Year.	Feed Costs per lb.	Egg Prices per doz.	Egg-feed Ratio.	Index (1949–50 = 100).
	d.	*d.*		
1949–50	1·594	26·34	16·524	100
1950–51	1·946	28·61	14·702	89
1951–52	3·240	36·98	11·414	69
1952–53	3·036	40·01	14·496	88
1953–54	2·993	43·15	14·417	87

1953-54 the ratio was approximately the same as for 1950-51, although considerably lower than for the base year 1949-50.

The egg-feed ratio does not show the profitability of egg production at any particular time. An individual farmer can, however, apply this ratio usefully, if he knows the quantities of feed consumed and his output of eggs. The construction by the farmer of egg-feed ratio tables for his farm as a regular farm management tool would prove a valuable indicator of favourable or unfavourable tendencies.

The effect of changes in egg prices or feed costs or both of these is often difficult to assess without considering the structural relationship between the two. An increase in the price of eggs does not necessarily mean an improvement in the farmer's economic position, as the price of feed may have increased to a similar or greater extent. On the other hand, increased profitability could follow a decline in egg prices if accompanied by a greater proportional decline in feed prices.

The egg-feed ratio has as much significance for the poultry farmer as the somewhat analogous ratios—relating, for example, raw material cost and selling price of product; or cost of goods sold and net sales—have for the manufacturer in secondary industry.

How the Rate of Lay Affects Profitability.

The effect which rates of lay have on profitability is illustrated in Table 4. It has been assumed that a hen consumes 91.25 lb. of feed annually, or 4 oz. daily. Using data shown in Table 3 for the year 1953-54, Table 4 shows the excess over feed costs represented by egg production at different levels of production.

TABLE 4.

COST OF FEED, SALES REALISATIONS AND SURPLUS OVER FEED COSTS—1953–54 PER HEN.

Production. Level.	Sales Realisations.	Feed Cost.	Surplus Over Feed Cost.
Dozens.	*s. d.*	*s. d.*	*s. d.*
10	36 0	22 9	13 3
12	43 2	22 9	20 5
14	50 4	22 9	27 7
16	57 6	22 9	34 9
18	64 9	22 9	42 0
20	71 11	22 9	49 2

On these calculations, a flock averaging 20 dozens per bird in the 1953-54 season returned to its owner £2 9s. 2d. per bird in excess of feed costs, whereas a flock averaging 10 dozens returned only 13s. 3d. per bird in excess of feed costs.

Similar information in respect of the last five years, on the bases of production of 12, 14 and 16 dozen eggs, is illustrated graphically in Figure 1.

The important role which the rate of lay plays in determining farm profits can be seen by considering the relative positions of three hypothetical farmers over the last five years using the data shown in Figure 1. It will be assumed that each farmer had 1,000 laying birds throughout this period, but that rates of lay varied as follows—Farm A, 12 dozens, Farm B,

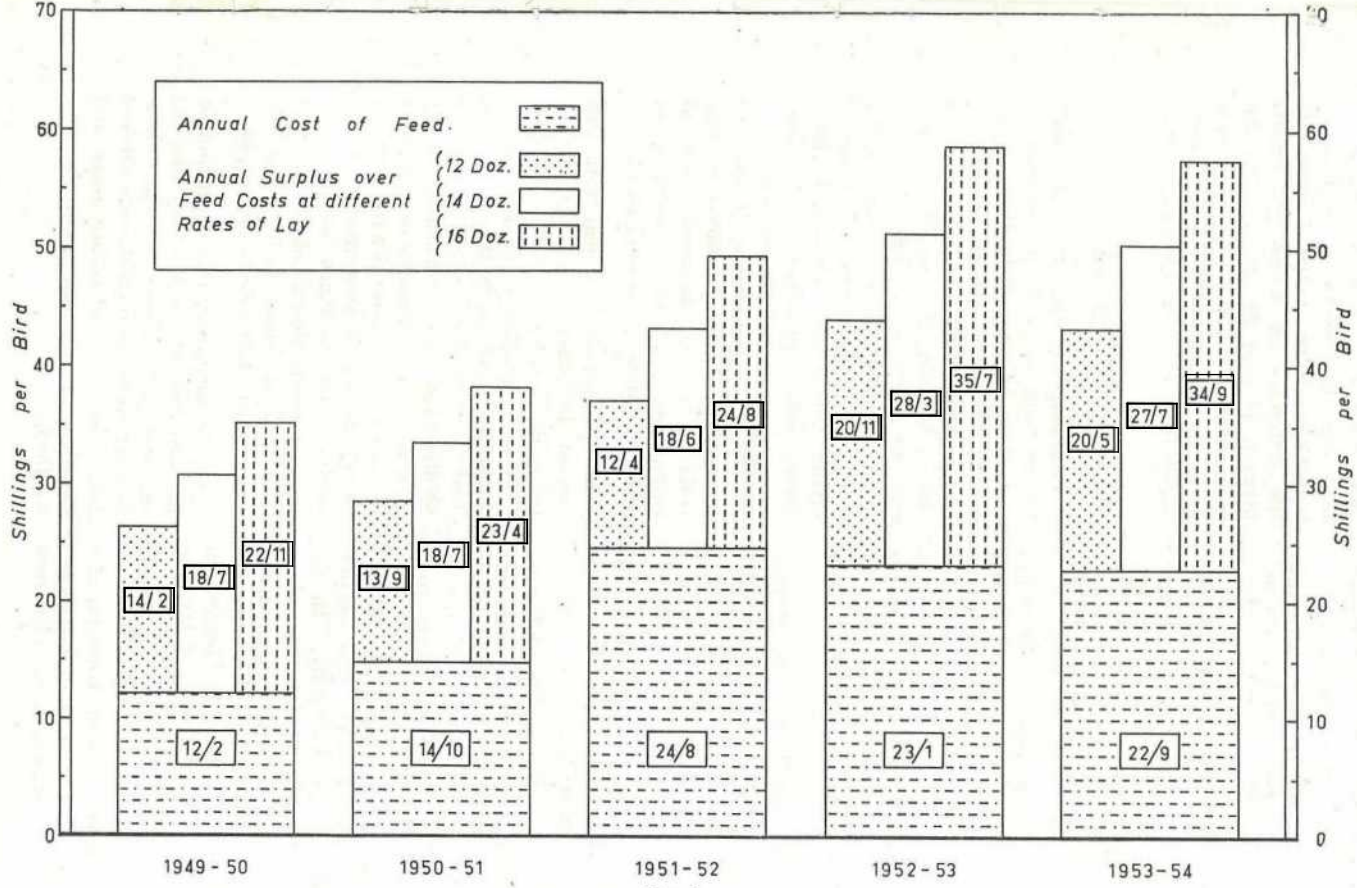


Fig. 1.

Illustrating Differences Between Gross Returns and Feed Costs Per Bird at Different Rates of Lay.

14 dozens, Farm C, 16 dozens. The differences between sales realisations and feed costs are as follows:—

	Farm A. (12 doz. av.)	Farm B. (14 doz. av.)	Farm C. (16 doz. av.)
	£	£	£
1949–50 ..	708	929	1,146
1950–51 ..	687	929	1,167
1951–52 ..	617	925	1,233
1952–53 ..	1,046	1,412	1,779
1953–54 ..	1,021	1,379	1,737
	4,079	5,574	7,062

On these hypotheses a 1,000-bird flock laying at the average South Queensland rate of 14 dozens per annum realised over the 5-year period £1,495 more than a flock of similar size laying at the rate of 12 dozens per annum, which is the figure generally accepted as being the Australian average.

Similarly, a flock with an average rate of lay of 16 dozens shows an increase in realisations of £1,488 over the flock with 14 dozens, and £2,983 over the flock with 12 dozens. (The difference between £1,495 and £1,488 is accounted for by the omission of fractions of a penny in the data illustrated in Figure 1.)

These figures represent the difference between proceeds of sales and feed costs, and all other costs have still to be deducted before net profits can be ascertained. Some of these costs would be fixed and would not be varied by any change in output. The remaining costs would vary with output, either directly or indirectly. In the example, the difference in sales realisations between Farms A and C is £2,983. After deducting from this sum the increase in variable costs incurred in achieving the higher rate of lay, the result is the increase in net profit gained over the 5-year period.

Details have not been shown for any rates of lay in excess of 16 dozens per annum. An increase of from 14 dozens to 16 dozens is one which is perhaps more likely to appeal as being practical, and the increase in profitability is marked. More marked, of course, is the difference in monetary returns between 14 and 20 dozens. On the same 5-year basis and with 1,000 bird flocks the difference is approximately £4,500, or well over £900 per year!

Conclusion.

Feed costs constitute more than half of the total costs of egg production, and there is very little the poultry farmer can do to reduce the cost of feed consumed per bird. As has been shown, however, the cost of feed per egg can be reduced substantially by increasing the flock's average laying rate. The achievement of a higher laying rate involves changes in farm management practices and some reorganisation of the existing cost structure. For example, it may be necessary actually to increase some costs at present incurred, such as culling and veterinary services, in order to reduce the overall costs.

It is impossible to deal with this subject in other than very general terms in the absence of specific data relating to poultry farm management operations and variability of costs. This information could only be obtained from a comprehensive survey of management practices on a number of farms. The most useful type of survey would be concerned with the analysis not so much of monetary costs of production as of the physical quantities of input factors and the isolation of their effects on output.

In the meantime, this discussion of the two elements—rate-of-lay and the egg-feed ratio—indicates that there is much to be done on the less efficient farms in order to reduce costs and explains why the attempt to do so is worthwhile.