

Macadamia grower's handbook

Reprint – information current in 2004



REPRINT INFORMATION – PLEASE READ!

For updated information please call 13 25 23 or visit the website www.deedi.qld.gov.au

This publication has been reprinted as a digital book without any changes to the content published in 2004. We advise readers to take particular note of the areas most likely to be out-of-date and so requiring further research:

- Chemical recommendations—check with an agronomist or Infopest www.infopest.qld.gov.au
- Financial information—costs and returns listed in this publication are out of date. Please contact an adviser or industry body to assist with identifying more current figures.
- Varieties—new varieties are likely to be available and some older varieties may no longer be recommended. Check with an agronomist, call the Business Information Centre on 13 25 23, visit our website www.deedi.qld.gov.au or contact the industry body.
- Contacts—many of the contact details may have changed and there could be several new contacts available. The industry organisation may be able to assist you to find the information or services you require.
- Organisation names—most government agencies referred to in this publication have had name changes. Contact the Business Information Centre on 13 25 23 or the industry organisation to find out the current name and contact details for these agencies.
- Additional information—many other sources of information are now available for each crop. Contact an agronomist, Business Information Centre on 13 25 23 or the industry organisation for other suggested reading.

Even with these limitations we believe this information kit provides important and valuable information for intending and existing growers.

This publication was last revised in 2004. The information is not current and the accuracy of the information cannot be guaranteed by the State of Queensland.

This information has been made available to assist users to identify issues involved in macadamia production. This information is not to be used or relied upon by users for any purpose which may expose the user or any other person to loss or damage. Users should conduct their own inquiries and rely on their own independent professional advice.

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained in this publication.



Queensland Government



INDEX

A

- A. lutescens lutescens* 131
 - Acacia 137
 - access roads 20, 22
 - acephate 42, 200
 - Acrocercops chionosema* 134
 - action levels 54
 - air grading 66
 - airblast machines 154
 - airblast sprayers 56
 - airshear nozzles 152
 - alternaria blight 201
 - aluminium 46
 - Amblypelta nitida* 131
 - ammonium 109
 - acetate 202
 - AMS News Bulletin 196
 - anthracnose 201
 - aphids 200
 - APVMA 62, 150, 199
 - Armillaria root rot 27, 55
 - assassin bug 144
 - Australian Macadamia Society
 - 186, 196, 197, 198
 - Australian Standards 16
 - AVG 24
 - azinphos-methyl 54, 200, 202
- ## B
- Bacillus thuringiensis* 54, 200, 202
 - bana grass 29, 58
 - bananaspotting bug 130, 200
 - life cycle, host plants 131
 - bangalow palm 136

- Banksia 135
- bark grafting 183
- bark splitting 14
- Basta 53
- bearing trees 44
 - management 90. *See also* canopy management; trees-management
- benomyl 201, 202
 - plus carbendazim 201
- best practice groups 82
- beta-cyfluthrin 54, 200, 202
- black citrus aphid 200
- black scale 200
- blossom blight 55, 201
 - control measures 55
 - management 138
- books, publications 196
- borax, bearing trees 47
- boric acid 110
- boron 91, 108, 110
 - bearing trees 47
- botrytis 138, 161
 - blight 201
- Botrytis cinerea* 138
- branch dieback 55
- broad mite
 - in potted seedlings 179
- bruising 68
- brush box 136
- brushcutters 41
- Buckinghamia 135
- bud grafting 175

- budding 176, 179
 - punch 181
- bud stick 175, 176
- budwood 175, 179
- C**
- C-Probe 123
- cage nozzles 152
- calcareous 110
- calcium 46, 108, 109
 - bearing trees 47
- calibrating sprayers 155
- callus tissue 174
- cambium 174
- canegrubs 200
- canopy management 160, 165
 - bearing trees 51
 - costs 73
 - developing tips 164
 - growth 161
 - light interception 162
 - partial removal 183
- capacitance probes 126
- capital required 5
- carbaryl 42, 200, 202
- carbendazim 55, 201, 202
- carbon:nitrogen (C:N) ratios 170
- carpet grass 30, 166
- Casuarina* 137
- caterpillars 200
 - in potted seedlings 179
- cation exchange capacity 46, 105
- central leader system 39
- ChemCert Training 16, 158
- chemical accreditation 158
- chemical trade names 202
- chemicals
 - APVMA 199
 - information 193
 - pest handy guide 200, 201
 - questions 15
 - storage 15, 16
- chlorophyll 107, 109
- chlorosis 107
- chlorpyrifos 200, 202
- cincturing 175
- citrus 136
- citrus mealybug 200
- Class A pan evaporation 127
- clay loams 122
- climate 6
- clinometer 20
- clones 175, 181
- coastal brown ants 144
- cobbler's pegs 41
- Colwell soil test 108
- compost
 - applying 173
 - making, monitoring 171
 - problems 172
 - vermi, passive, thermophilic 169
 - when is it ready? 172
- composted nut husk 41
- concentrate spraying 151
- consignment 67
- consultants 187
- container-grown plants 178
- contract services 187
- Controlled Droplet Application sprayers 155
- copper 36, 91, 108, 111
 - ammonium acetate 201
 - excessive use of 106
 - fungicide 43
 - hydroxide 201
 - hydroxide plus metalaxyl-M 201
 - oxychloride 43, 55, 201
 - sulfate 201, 202
- cornelian butterfly 200
- COSOP 78
- costs
 - annual variable 73
 - fixed 74
- couch grass 30, 166
- coumatetralyl 58, 200, 202
- crop production handy guide 203
- crop, selling 15
- cross-pollination 26
- Cryptoblabes hemigyssa* 133
- Cryptophlebia ombrodelta* 131
- cucurbits 136
- cuprous oxide 201, 202
- cutter-bar 27
- cuttings 181
- D**
- Dactyloctenium australe* 163
- Daddow
 - characteristics 100
- DAP 50
- dehusking 14, 63, 64
 - equipment 166, 193
- diazinon 200, 202
- dilute spraying
 - required volume 151
- diseases
 - Armillaria root rot 27, 55
 - bearing trees 55
 - blossom blight 55
 - branch dieback 55
 - control measures 55
 - husk rot 55
 - husk spot 10, 55

- management details 137
- trunk canker 55
- disorders 56
 - rats 57
 - tree decline 56
- Diviner 123
- dolomite 108, 109
 - bearing trees 47
 - young trees 38
- DPI&F Call Centre 195
- DPI&F Publications 196
- drainage 89
- drift spraying 153
- drippers 34
- drop height 68
- drought 13
- drumMUSTER 157
- drying 14, 63
 - and storage 66
- dwarfing rootstocks 163
- E**
- early nut drop 13
- earthworms 106
- economic analysis 72
- economics 9
- Elachertus* sp. 146
- endosulfan 16, 42, 200, 202
 - legal requirements 80
- environmental effects on growth, flowering 88
- EnviroSCAN 123
- Epsom salts 109
- equipment
 - manufacturers 192
 - suppliers 192
- Eriococcus ironsidei* 134
- erosion control costs 73
- ethephon 62
- ethoprophos 200, 202
- Eucalyptus* 137
- evaporation figures 129
- evaporation pan 123
- F**
- farm needs 6
- FarmBis 195
- felted coccid 13, 42, 55
- fertigation 38, 118
 - bearing trees 50
 - young trees 38
- fertiliser. *See* foliar fertilisers; organic; poultry manure
 - acidifying effect 117
 - bearing trees 45, 46, 48
 - bearing trees; foliar 49
 - bearing trees; mixed 49
- bearing trees; placement 50
 - before planting 32
 - boron 48
 - calcium 48
 - choosing 116
 - for potting mix 177
 - inorganic 49
 - magnesium 48
 - nitrogen 48
 - nutrient content 50
 - organic 49
 - phosphorus 48
 - potassium 48
 - when to apply 12
 - young trees 38
 - zinc 48
- field grafting 184
- firebreak 59
- first grade kernel 69
- fixed costs 74
- flotation grading 15, 66
- flower caterpillar 54
- flower thrips 13, 55, 200
- flowering 86
- flowers
 - blossom blight 55
- flowers, dying 13
 - felted coccid damage 13
 - flower thrips damage 13
 - macadamia flower caterpillar 13
 - raceme blight disease 13
 - redshouldered leaf beetle damage 13
- flushing 86
- foliar fertilisers 14, 49
- forced-air drying 15
- fracturing 68
- frost 88
 - on young trees 37
- frost damage
 - to flowers 13
- fruitspotting bug 130, 200, 144
 - life cycle, host plants 131
- fungus 14
- G**
- G1K 69. *See also* glossary
- girdling 175
- glufosinate-ammonium 53
- glyphosate 33, 53
- Gopher 123
- Government technical services 195
- grading, flotation 66
- grafting 174, 179. *See also* budding
 - field 184
- grafting mastic 181
- Granomag 109

green manure 33
 green vegetable bug 136, 200
 monitoring 149
Grevillea banksii 133
Grevillea glauca 133
Grevillea pinnatifida 133
Grevillea robusta 133
 grey mould 138
 gross margin 74
 ground cover 13, 22, 30, 53,
 60, 161, 163, 167, 168
 grower organisations 186
 growing-on 178
 growth cycle 85, 87
 diagram 88
 gumming 14
 gypsum 12, 108
 bearing trees 47
 blocks 123

H

H2 decline 169
 HACCP 78
 HAES 508 decline 169
 HAES variety characteristics 96
 hairy caterpillar
 monitoring 148
 hairyline blue butterfly 200
Hakea 135
 hammer mill 65
 handling damage 68
 hares 42
 harvest, when to 14
 harvesting 61
 equipment 193
 management 26
 mechanical 62
 preparation 60
 tree 62
 harvesting and marketing costs 73
 heading 164. *See also* topping
 hedgerow
 light in 162
 hedging 164
Hemiberlesia lataniae 136
 herbicides 41, 53
 management 168
 hibiscus mealybug 200
 high density planting 93
 honeybees 59
 hot spots 131
 husk rot 55
 husk spot 10, 11, 13, 24, 55, 94
 control measures 55
 management 139
 spray coverage 153

HV A variety characteristics 94
 HV A4 decline 169
 hybrid forage sorghum 33
 hybrid varieties 181
 hydraulic nozzles 152

I

income, return on 10
 information search services 198
 inorganic fertilisers 49, 116
 integrated pest management (IPM) 54, 140
 inter-row ground cover 53
 iprodione 55, 201, 202
 iron deficiency 107
 irrigation. *See also* watering
 essentials 122
 in young trees 91
 monitoring system 122
 questions 11
 rates - bearing trees 51
 irrigation scheduling 127
 irrigation system—installing 33
 ISO 9002 77

K

kangaroos 42
 kernel discolouration 24
 kernel first grade 69
 kernel recovery 94
 boron effect 110
 sound 69
 kikuyu 30, 166
 krasnozem soil 47, 107, 110, 113, 114, 122
 water infiltration rates 122

L

labour 8
 land
 clearing 21
 preparation 27, 166
 latania scale 42, 55, 130, 136, 144, 200
 monitoring 148
 late nut drop 24
 leaf analysis
 bearing trees 46
 interpreting results 115
 sampling leaves 46
 understanding results 112
 when to do 12
 leaf fall 14
 leaf nutrient recommended levels 113
 leafeating caterpillars 200
 leafminer 42, 55, 99
 legumes 136
Leptospermum petersonii 29

- library 198
- limb
 - breakage 39
 - removal 165
- lime 108
 - young trees 38
- liming 90
- living mulch ground covers 168
- loamy sands 122
- long soft scale 42, 200
- longtailed mealybug 200
- M**
- M. integrifolia* 26, 84
 - consigning 68
- M. ternifolia* 133
- M. tetraphylla* 84
 - consigning 68
- macadamia growing areas 1
- macadamia cup moth 200
- macadamia felted coccid 130, 200
 - life cycle, host plants 134
 - monitoring 146
- macadamia flower caterpillar 13, 130, 145, 200
 - life cycle, host plants 133
 - monitoring 145
- macadamia husk spot 201
- Macadamia Industry Approved Supplier Program
 - 16, 44, 76
- macadamia lace bug 200
- macadamia leafminer 130, 200
 - life cycle, host plants 134
 - monitoring 146
- macadamia mussel scale 200
- macadamia nutborer 130, 200
 - life cycle, host plants 131
 - monitoring 144
- macadamia seedbed (drawing) 178
- macadamia twig-girdler 130, 135, 200
 - monitoring 147
- macadamia white scale 200
- machinery and equipment 7
- MacMan 45, 77
 - development 80
 - record keeping 79
 - recording 81
- magnesium 46
 - bearing trees 47
 - deficiency 109
- main diversion drain 30
- maize 136
- management in young trees 89
- management in bearing trees 44
- manganese 108
- manure 50
- marketing 60, 68
- Material Safety Data Sheet 159
- maturity testing 63
- mealybugs 200
- mechanical harvesting 62
- Melaleuca armillaris* 29
- metalaxyl 43, 201, 202
 - + copper oxychloride 55
- metalaxyl-M 201
- methidathion 42, 200, 202
- MIASP 78. *See* Macadamia Industry Approved Supplier Program
- microbial contamination 66
- millet 166
- minisprinkler 38
- misting
 - house 182
 - machines 154
- mock orange 131
- moisture content 15, 66
- monitoring pests 140
 - do-it-yourself 141
 - procedure 142
- monitoring system—irrigation 122
- monolepta beetle 42
- mulch 167, 168
 - composted nut husk 41
 - on-farm composting 169
 - with young trees 41
- mulcher—offset flail 168
- mulching 57, 168
 - bearing trees 53, 167
- Murraya paniculata* 131
- N**
- N:P:K 116
- native bees 59
- natural thinning 13
- nematodes 106
- Neodrepta luteotactella* 135
- neutron probe 123
- newsletters 198
- Nezara viridula* 136
- nitrogen 12, 90, 106, 107
 - application 12
 - bearing trees 46, 47, 48
- NSW Rural Assistance Authority 195
- nursery tree suppliers 186
- nut drop
 - early 13
 - ethephon to promote 62
- nut husks, as organic fertiliser 49
- nut stemborer 200
- nut-in-husk 64

- nut-in-shell 64, 72
 - boron spray 110
 - drying, storage 66
 - grading 65
 - prices 69, 74
 - sorting 64
- nut/kernel characteristics 92
- nutborer 13, 24, 54, 96, 144, 200
 - action level 54
 - spray coverage 153
- nutrients 106
 - content of common fertilisers 50
 - deficiency 14
 - release - bearing trees 49
 - understanding 107
- nutrition
 - costs 73
 - in young trees 90
 - management 103
 - management program 111
- nuts
 - after harvest 14
 - maturity testing 63
 - production 87
- O**
- oats 33, 166
- offset flail mulcher 168
- open micropyle 24
- optimum moisture content NIS 65
- optimum soil nutrient levels 112
- orchard
 - access roads 18, 20
 - diversion drains 30
 - economic life of 10
 - establishing 10
 - establishment 18, 166
 - layout 20
 - management 26
 - yields 9
- orchard floor management 91, 166
- organic carbon 106
- organic fertilisers. *See also* fertiliser
 - bearing trees 49
 - nut husks 49
 - poultry manure 12
- organic growing 10
- organics organisations 194
- P**
- paraquat 53
- passionfruit 136
- passive composting 169
- pecan 136
- Persoonia* 135
- pest
 - action levels 54
 - monitoring 54, 140
- pest and disease control costs 73
- pest management
 - approaches 140
 - bearing trees 54
 - young trees 42
- pest monitoring chart; guidelines 143
- pesticide
 - application 150
 - applying the correct dose 150
 - safety 157
- pests 54
 - chemical handy guide 200, 201
 - felted coccid 42, 55
 - flower caterpillar 54
 - flower thrips 55
 - latania scale 42, 55
 - leafminer 42, 55
 - long soft scale 42
 - major occurrences 130
 - monolepta beetle 42
 - nutborer 54
 - redshouldered leaf beetle 42, 55
 - scale insects 42
 - spotting bug 54
 - twig-girdler 42, 55
- petroleum oil 42, 200, 202
- pH 104
 - bearing trees 47
- Pheidole megacephala* 144
- phosphorous acid 43, 55, 201, 202
- phosphorus 12, 90, 106, 107, 108
 - bearing trees 47, 48
 - fixing soils 108
- photosynthesis 88, 107, 109
- Phytophthora 106
- Phytophthora cinnamomi* 137
- Phytophthora root rot 201
- Phytophthora trunk/collar rot 201
- pink disease 201
- pink wax scale 200
- Plant Variety rights 24
- plant water use 120
- planting density 166
- plants, container grown 178
- pollination 91
 - management 59
- Polyosma cunninghamii* 134
- postharvest handling, hygiene & safety 63
- potassium 90, 108, 109
 - application 12
 - bearing trees 46, 47, 49
- potato weed 41

potting mix 176
 poultry manure 12, 49, 50. *See also* fertiliser
 pre-germination 24
 prepare the land 27
 prices 4, 69
 processing 26
 processor quality reports 69
 processors 191
 prochloraz 201, 202
 production costs 4
 propagation 174
 understanding the basics 176
 proteoid roots 88
 pruning. *See also* trees—managing
 bearing trees 12
 side 164. *See also* hedging
 young trees 91
 pruning actions 39
Pseudocercospora macadamiae 139
 punch budding 181

Q

quality management 76
 in bearing trees 44

R

raceme blight disease 13
 racemes 84
 Racumin 58
 rats 24, 29, 130, 200
 bait station 58
 management 57, 132
Rattus rattus 132
 record keeping 44, 79
 red bottlebrush 133
 red flat mite 200
 redshouldered leaf beetle 13, 42, 55, 200
 registrations 202
 replacement rates 113
 rodenticide 58
 root growth 87
 rooting media 182
 roots
 desiccation 14
 rootstocks 25, 174, 175
 seedlings for 176
 rotary hoe 33
 rows
 deep ripping 29
 direction 21
 marking out 29
 preparation 33
 spacing options 26
 runoff 166

S

S7 sales 16
 salt index table 117
 sandy loams 122
 sandy soils
 nitrogen rates 116
 scale 200
 in potted seedlings 179
 scale insects 42
 scion 174, 184
 seedlings 177
 shade house 183
 side trimming 13, 51, 164
 silky oak 133
 silos 67
 skirting 165
 bearing trees 51
 slope 20
 measuring 20
 sodium 46
 soft brown scale 200
 soft sprays 140
 soil
 biological health 106
 depth 18
 drainage 18, 89
 erosion 14, 20
 fertility and health 104
 health indicators 106
 improving structure 106
 map 19
 moisture 88
 pH 104
 sampling 46
 soil analysis 32
 bearing trees 46
 interpreting results 114
 understanding results 112
 when to do 12
 soil auger (diagram) 19
 soil nutrients
 optimum levels 112
 soils
 alkaline 110
 amount of water held 121
 krasnozem 48
 nutrients 107
 Solubor 110
 bearing trees 47
 sorting nut-in-shell 64
 sound kernel recovery 69
 South African egg parasitoid 145
 southern one year canegrub 200
 spacing. *See* trees—establishing: spacing

- spiders 144
 - spinning disk nozzles 152
 - splitting 165
 - spotting bugs 10, 13, 54, 130
 - action level 54
 - monitoring 143
 - spray accreditation 16
 - spray equipment 153
 - sprayer calibration 155
 - spraying
 - application 56
 - concentrated 151
 - dilute 151
 - information 193
 - keeping records 16
 - records 157
 - safety requirements 158
 - staghorning 183
 - stem canker 201
 - Stenocarpus salignus* 134
 - stick-rake 27
 - sticktight nuts 24, 93, 99
 - stomata 108, 121
 - stumping 183
 - suckers 11
 - sulphur 106, 109, 200, 202
 - surface drainage 22
 - sweet smother grass 13, 30, 56, 60, 163, 166, 168
 - systemic fungicide 14
- T**
- taxation 74
 - tebufenozide 54, 200, 202
 - Teddington 63
 - temperature range 89
 - temperature–optimal range 88
 - tensiometers 12, 123
 - monitoring, installing 124
 - tetraphylla varieties 181
 - thermophilic composting 169
 - thiram 201, 202
 - thrips
 - in potted seedlings 179
 - tip cuttings 182
 - tomato 136
 - topping 164
 - topworking 175, 183
 - trace elements 110
 - trade names 202
 - transpiration 120
 - tree characteristics 92
 - features 84
 - size, shape, nut drop periods 25
 - tree harvesting 62
 - tree problems
 - decline 14, 56, 169
 - frost–young trees 37
 - root death 14
 - yellowing 14
 - tree removal 165
 - tree suppliers 186
 - trees—establishing 167
 - guards 38
 - marking out sites 33
 - nursery 34
 - ordering 27
 - planting procedure 35
 - planting windbreaks. *See* windbreaks
 - preparing rows 33
 - spacing 11, 23, 25, 26
 - when to plant 34
 - trees—managing
 - bearing 44
 - bearing; nutrition management 112
 - cloned 175
 - control weeds - young trees 41
 - diseases in young trees 43
 - fertigation 38
 - fertilising while young 38
 - major pests - young trees 42
 - mulching 53
 - mulching bearing trees 167
 - nutrient deficiencies 14
 - nutrition management for young, non-bearing 111
 - optimum size 162
 - pruning 12, 39
 - pruning while young 11
 - shaping 51
 - side trimming 51, 164
 - skirting 51
 - soil erosion 14
 - training 39
 - watering - young trees 38
 - young trees 37
 - tribasic 201, 202
 - trichlorfon 200, 202
 - trickle tape 34
 - trunk canker 14, 55, 94, 99, 201
 - control measures 55
 - in young trees 43
 - management 137
 - twig dieback 14
 - twig-girdler 42, 55, 99, 100, 147
 - in potted seedlings 179

U

under-tree ground cover 53
 under-tree minisprinklers 33
 under-tree sprinklers 7
 undersized nuts 24

V

v-drains 30
 construction 30
 diagrams 31
 varieties
 arrangement in orchard 26
 best performing 24
 characteristics 94
 choosing 23
 for central New South Wales 101
 for northern New South Wales 101
 for central Queensland 102
 for north Queensland 102
 for southeast Queensland 102
 issues when selecting 24
 process for selecting 92
 questions on 10
 selection 163
 suitability (close planting) 25
 trials 100
 vegetative flush. *See* vegetative growth 85
 vermicomposting 169

W

water; how much? 12
 water bath 66
 water stress
 bearing trees 50
 water supply 7
 water—limited 129
 watercourses and dams 22
 watering. *See also* irrigation
 bearing trees 50
 young trees 38
 weak crotch 165
 weed control
 bearing trees 53
 costs 73
 young trees 41
 whip graft 179
 white wax scale 200
 wind 89
 windbreaks 21, 27
 maintenance 59
 planting 29
 temporary 28
 woody pear 133
 worms 169

X

Xylomelum 135
Xylomelum pyriforme 133

Y

yields 3, 9
 young trees
 establishment 89
 pruning 11

Z

zinc 47, 48, 91, 108, 110
 banding 48
 sulphate 12

