

Index

Note: Page references in *italic* refer to tables in the text; those in **bold** refer to figures

- abscission 121–122
- abortion 121–122
- agidi 420
- allelopathy 35
- aluminium: toxicity 167
- angle of repose 258–259
- anthracnose 290, 437
- antibiosis 311, **316**
- Anticarsia gemmatalis* 312
- antinutritional factors 389–392
- antixenosis 311
- aphids 303–304
 - Aphis glycines*: integrated management 313–315, **316**
- Argentina 19, 26, 28, **132**
- Australia 28
- AVRDC (World Vegetable Centre) 444, 445–446, 447, 452

- bacterial pustule 281–282, 436
- baculoviruses: for leaf feeder control 312
- bean pod mottle 282–283
- beetles: disease vectors 282–283
- Binodoxys communis* 312
- biodiesel 466, 475, 476–477
- biological control: of pests 311–313
- biopeptides 383–384
- biosystematics 77
- blanching 415

- boron 165, 166–167
- Bowman-Birk factor 384, 388, 389–390
- Brazil 19, 28, **132**
- breast cancer 381–382
- breeding
 - China 16–17
 - crossing methods 95–97
 - for increased nitrogen fixation
 - bacteria 235
 - plants 235–237
 - objectives
 - abiotic stress tolerance 100
 - agronomic traits 97–98, 99
 - disease resistance 101
 - herbicide tolerance 100–101
 - improving nutritional value 102, 389–395
 - insect resistance 101–102, 310–311
 - nematode resistance 336–337
 - seed composition 99–100
- procedures
 - hybridization 103
 - release of cultivar or germplasm 107
 - seed production categories 107–108
 - selection methods 103–105
 - testing and trials 105–106
- use of wild species 77–78
- vegetable soybean *see under* vegetable soybean

- cake, soybean 19, 358, 361
- calcium
 - deficiency 166, 168
 - fertilizers 175
 - requirements 164
- cancer 381–382, 384, 410
- canker, stem 287–288
- carbon, organic: effects of soybean on soil content 32
- carbon dioxide: effect on nitrogen fixation 234
- cardiovascular disease 382–383, 410
- Cercospora kikuchii* 289
- Cercospora sojina* 285, 437
- charcoal rot 290–291
- China
 - breeding 16–17
 - vegetable soybean 442
 - cropping systems 26, 28
 - farming practices 17
 - germplasm collection 81
 - place of soybean origin 77–78
 - evidence 2–3
 - multiple origins theory 5
 - northeast China theory 3–4
 - south China theory 5–6
 - Yellow River valley theory 4–5
 - processing 17–18
 - production 1–2, 18
 - average yields 1962–2006 132
 - cultivation regions 14–15
 - vegetable soybean 430, 431, 432, 433–434
 - uses of soybeans 2, 16
 - wild soybean distribution 7, 9
- cholesterol 384, 386, 410
- classification *see* taxonomy and classification
- climate
 - effect of rain on productivity 199
 - influence on nitrogen fixation 31
 - requirements 162
- cobalt 165
- coefficient of friction 259, 260
- Colletotrichum* spp. 290, 437
- conservation: for biological control of pests 312–313
- copper 165
 - deficiency and toxicity 166
- cosmetics 388
- cotyledons 55
- crop rotation 214
- cropping systems
 - mixed/intercropping 26–27, 150–151
 - prevention of disease spread and pests 35–36
 - sequential 27, 28
 - and nitrogen economy 37–38, 239–241
 - residual effects of soybean: productivity 36–37
- crossing *see* under breeding
- cultivars, competitive 215
- cultivation
 - dissemination of cultivated varieties 78–79
 - farming practices
 - China 17
 - cropping systems *see* cropping systems
 - no-till 39
 - nutrient management *see* under nutrients
 - pest management in organic production 306–308
 - plant population and planting geometry 147–149, 200, 214–215
 - seed priming 150
 - sowing method and depth 146–147, 199–200
 - sowing time 144–146, 201
 - straw mulching 149
 - tillage/seedbed preparation 142–144
 - water management *see* under water
 - weed management *see* under weeds
 - regions *see* under production
 - vegetable soybean *see* under vegetable soybean
- damage-response curve: insect pests 305, 306
- damping-off 280
- defoliation: by insects 301–303
- determinate stem type 58
- development *see* growth and development
- diabetes 383
- Diaporthe* spp. 288
- diet, human
 - benefits of soybean 349–350, 368–369
 - minerals and vitamins in soybean 378–379
 - polyunsaturated fatty acids (PUFA) in soybean 377–378
 - soy food products *see* under products, soy
 - soybean protein equivalent to animal protein 376–377
- diseases
 - anthracnose 290, 437
 - bacterial pustule 281–282, 436
 - bean pod mottle 282–283

- Cercospora* leaf blight 289
- charcoal rot 290–291
- disease resistance 101
- diseased plant 278
- estimated worldwide loss due to disease 276
- frogeye leaf spot 284–285
- management practices summary 291
- nematodes *see* nematodes
- Phytophthora* root and stem rot 280–281, 436
- purple seed stain 437
- rust 285–286, 437
- Sclerotinia* stem rot 283–284
- seasonal symptoms 277
- seed decay 278–279
- seedlings 279–280
- soybean mosaic 283, 438
- stem canker 287–288
- sudden death syndrome 288–289
- distribution
 - cultivation regions *see under* cultivation
 - wild species 7, 9, 76
- diversity, genetic: centres 79–80
- domestication 48
 - comparison: wild, semi-wild and cultivated species 11
 - evidence of domestication in ancient times 9
 - focus on seed size 10
 - loss of genetic diverstiy 10
- downy mildew 437
- drought 192–194
- drying
 - mathematical models 250–253, 255–256
 - methods 250, 255–256
 - stress crack models 250–253
 - water diffusion 261
- drylands 182–183
- Dt* genes 58, 59
- E*-genes
 - regulation of flowering 59, 60, 62
 - regulation of post-flowering phase 63, 66
- edamame *see* vegetable soybean
- emasculation 96
- evapotranspiration 117
- exports *see under* trade, international
- feed, animal 376, 390–391, 392–393, 411
 - soybean cake 19, 358, 361
- fermentation 414, 418–419
- fertilizers
 - calcium and magnesium 175
 - economics of use 183–185
 - integrated nutrient management 176–179
 - with water management in drylands 182–183
 - micronutrients 176
 - nitrogen 170
 - phosphorus 170–172, 173
 - potassium 172–174
 - recommendations based on soil tests 179–182
 - sulphur 174–175
 - for vegetable soybean 434–435
- fixation, nitrogen
 - benefits of crop rotation 239–241
 - effect of herbicides 219–220
 - effects on succeeding crops 37–38
 - factors determining efficiency 29–30
 - climatic factors 31
 - crop factors 30–31
 - edaphic factors 30
 - management factors 31
 - global importance of soybean fixation 227–228
 - improvement through bacterial and plant breeding 235–237
 - limited by environmental factors 237–239
 - methods for improvement 38–40
 - microbiology
 - bacterial biochemistry in nodules 232–233
 - bacterial genetics and control of fixation 230–232
 - infection process 229–230
 - quantification 27–29
 - soybean nitrogen metabolism 233–234
 - varies with cultivation conditions 27, 29, 163
- flour, soy 361, 407–408
 - uses 419–420
- flowering
 - abortion and abscission 121–122
 - duration 62
 - flower production related to node number 121
 - flowering profiles 118
 - photoperiod effects 61–62
 - regulated by *E*-genes 59, 60, 62
 - synchronization 65–66
- flowers
 - flower-pod relationship 120
 - morphology 52–53, 94–95
- foaming 405

- foods *see under* products, soy
 - functional *see* functional foods
- formulas, infant 411
- friction coefficient 259, 260
- frogeye leaf spot 284–285
- functional foods 19–20, 346–347
 - and breeding objectives 102
 - improved nutritional content 392–395
 - removal of antinutritional factors 389–392
- health benefits of soybean 350, 369, 410–411
- soybean components significant for health
 - biopeptides 383–384
 - estrogens 411
 - isoflavones *see* isoflavones
 - lecithin 356, 364, 384–385
 - list 379–380
 - oligomeric proanthocyanidin 387–388
 - oligosaccharides 386–387
 - phytosterols 386, 387
 - prebiotics 386–387
 - saponins 386
 - tocopherols 358, 384
- fungi
 - Cercospora kikuchii* 289
 - Cercospora sojina* 285, 437
 - Colletotrichum* spp. 290, 437
 - Diaporthe* spp. 288
 - Fusarium* spp. 288–289
 - Macrophomina phaseolina* 290–291
 - Peronospora manshurica* 437
 - Phakopsora* spp. 285–286, 437
 - Phomopsis longicolla* 279
 - Phytophthora sojae* 280–281
 - Pythium* spp. 280
 - Rhizoctonia solani* 280
 - Sclerotinia sclerotiorum* 283–284
 - Fusarium* spp. 288–289
- galls 328
- gels 405
- genes
 - Dt* genes 58, 59
 - E*-genes *see* *E*-genes
 - Rag1* 311, 316
- genetic diversity: loss during domestication 10
- genetically modified (GM) soybean
 - implications 479–481
 - as a constraint to trade 478
 - as driver of trade 469–470, 474
 - for enhanced nitrogen fixation 237
- genetics, bacterial: in nitrogen fixation 230–232
- germination 54
 - used in food product manufacture 413–414, 418
- germplasm
 - collection
 - China 81
 - India 74–75, 80–81
 - perennial *Glycine* collection, Canberra 76
 - conservation 84–85
 - documentation 84
 - future perspectives 86–87
 - genetic variability 81–84
 - promising donor genotypes 82, 83
 - registration 84
 - release 107
 - utilization 85–86
- globulin storage proteins 377
- grades and grade requirements 263
- growth and development
 - flowers 52–53
 - flowering *see* flowering
- germination and seedling development 54–56
- juvenile phase 60–61
- maturity and senescence 66–68
- Pods and seeds 54
 - abortion and abscission 121–122
 - seed-filling phase duration 64
 - post-flowering phase regulation 62–64
- secondary growth
 - roots 52
 - stem 51
- vegetative development
 - determinate *vs.* indeterminate stem types 58–59
 - effect of cultivar maturity 115–116
 - node development rate 56–58, 59–60
 - and yield production *see under* yield
- harvesting 247–248
- health *see* functional foods
- height, plant 97
- herbicides
 - effects on soil microflora 219–220
 - mixtures and sequential application 216
 - promising substances 154–156, 217–218
 - residues 220
 - resistance 100–101, 220–221
 - weed management in resistant soybean 221–222

- for vegetable soybean 435
- Heterodera glycines* 287, 330–333
- hulls, soybean 357
- hybridization 103
- hypertension 383–384
- image processing 263–264
- imports *see under* trade, international
- indeterminate stem type 59
- India
 - cropping systems 26, 28
 - culinary uses of soybean 417–418, 420
 - germplasm collection 74–75, 80–81
 - production 18, 24, 79, 348
 - soy food industry and market 368–370
 - soy exports 367
 - soybean oil industry 366, 367
- inhibitor, trypsin 389–390
- inoculation: of seed with *Bradyrhizobium* 39, 231–232
- insects
 - damage-response curve 305, 306
 - infestations during storage 265–267
 - control 271
 - detection 267–270
 - on growing plants
 - classification based on plant growth stage 302
 - defoliators 301–303
 - phloem feeders 303–304
 - reduced by soybean cropping systems 36
 - seed and pod feeders 304
 - stem borers and root feeders 304–305
 - pest management
 - biological control 311–313
 - insecticides 309–310
 - integrated management: *Aphis glycines* 313–315, 316
 - in organic production 306–308
 - replacement by secondary pest 308, 309, 310
 - resistance of pest to insecticides 308
 - resurgence (pest population rebound) 308, 309, 310
 - in vegetable soybean 435–436
 - resistance of soybean to insects:
 - breeding objective 101–102, 310–311
- intolerance, lactose 388
- Iran 26
- iron 165
 - deficiency 166, 169
- irrigation 152–153
 - in saline conditions 197–198
 - scheduling 195–197, 201–202
 - of vegetable soybean 435
- isoflavones 411
 - breeding for lower levels 395
 - concentration in seeds 381
 - structure 381
 - therapeutic effects 20
 - breast cancer 381–382
 - cardiovascular disease 382–383
 - diabetes and renal disease 383
 - osteoporosis 383
- Japan 18, 431, 432, 433
- kidney disease 383
- kinako 416
- Korea 18, 448–449
- Kunitz trypsin inhibitor 389–390
- lactose intolerance 388
- lactosera 19–20
- ladoo 420
- leaf feeder (*Anticarsia gemmatilis*) 312
- leaves 49
 - culinary uses 418
 - diseases
 - Cercospora* leaf blight 289
 - frogeye leaf spot 284–285
 - rust 285–286
 - insect defoliation 301–303
 - leaf area and solar radiation interception 115–116
 - senescence 67–68, 124
- lecithin 356, 364, 365, 384–385
- lectins 392, 410
- liming 169–170
- linolenic acid 393–394
- liposomes 388
- lipoxygenases 394–395, 449
- lodging 97–98
- lunasin 384, 410
- machine vision systems 263–264
- Macrophomina phaseolina* 290–291
- magnesium
 - deficiency 166
 - fertilizers 175
- manganese 165
 - deficiency 169
- mao dou *see* vegetable soybean

- maturity and senescence 66–68
 - breeding for maturity period 98
 - effect of cultivar maturity on vegetative growth 115–116
- meal, soy 367
- Meloidogyne* spp. 326–330, 338, 339, 340
- methanol stress test 83–84
- micronutrients 165
 - fertilizers 176
- milk, soy 353, 408
 - lactose-free 388
 - manufacture 413
 - effect of blanching 415
 - uses 420–422
- miso 418–419
- models
 - of drying 250–253, 255–256
 - of stress cracks 254–255
- molasses, soy 357
- molybdenum 165
 - deficiency 166, 169
- morphology
 - flowers 52–53
 - leaves 49
 - Pods and seeds 54
 - roots 51–52
 - shoot apex 56
 - stems 50–51
 - young vegetative plant 50
- mulching 149, 202, 214
- mycotoxins 249

- natto 419
- near-infrared spectroscopy 264–265
- nematodes
 - estimated loss caused 325
 - future prospects 340
 - lesion nematodes (*Pratylenchus* spp.) 333–334
 - management advances
 - biofertilizers and biopesticides 337–340
 - breeding for resistance 336–337
 - nematode-suppressive soil 336
 - phytosanitary regulations 335–336
 - remote sensing 337
 - reniform nematodes (*Rotylenchulus reniformis*) 334–335
 - root-knot (*Meloidogyne* spp.)
 - damage threshold 328–329
 - epidemiology and biology 327–328
 - life cycle stages 327
 - management 329–330
 - soybean cyst nematode 287
 - soybean cyst nematode (*Heterodera glycines*)
 - damage threshold 332
 - epidemiology and biology 330–332
 - management 332–333
- neutraceuticals *see* functional foods
- Nigeria 28
- nitrogen
 - deficiency 165, 168
 - effects of soybean on soil nitrogen
 - content 32–33
 - fertilizers 170
 - fixation *see* fixation, nitrogen
 - metabolism 233–234
 - requirements 163–164
- nodules, root 51–52
 - bacterial biochemistry 232–233
 - effect of drought 193
 - effect of herbicides 219–220
 - effect of liming 169
 - formation 229
 - super- and hypernodulating cultivars 236
- nutrients: for humans *see* diet, human
- nutrients: needed by soybean
 - calcium *see* calcium
 - deficiencies and toxicities 165–167
 - fertilizers *see* fertilizers
 - management
 - overview 151–152
 - nitrogen *see* nitrogen
 - nutritional constraints of soils 167–170
 - phosphorus *see* phosphorus
 - potassium *see* potassium
 - relative uptakes 163
 - requirements 162–165
 - sulphur *see* sulphur
- nuts, soy 351–352, 353, 416

- obesity 384, 388
- oil, soybean
 - breeding for oil quality 99
 - constituents 363
 - crude oil refinement 362, 363
 - polyunsaturated fatty acids 377–378
 - production
 - comparison with other crops 25, 348–349
 - India 348
 - properties 362–363
 - quality enhancement 364, 366
 - uses 19, 354, 363–364, 408–409
 - biodiesel 466
- oilseeds: global production 347
- okara 353–354

- oleic acid 393–394
- oligosaccharides 386–387, 390–391
- organic production 306–308
- origin
 - China 77–78
 - evidence 2–3
 - theory: multiple origins 5
 - theory: northeast China 3–4
 - theory: south China 5–6
 - theory: Yellow River valley 4–5
- polyploid 7
- osteoporosis 383
- partitioning 128–129
 - in time 129–131
- Peronospora manshurica* 437
- pests *see* insects
- Phakopsora* spp. 285–286, 437
- Phomopsis longicolla* 279
- phosphatide 20
- phosphorus
 - deficiency 165, 168
 - effects of soybean on soil content 33
 - enhances nitrogen fixation 40
 - fertilizers 170–172
 - requirements 164
- photoperiod
 - and flowering 4, 61–62
 - and post-flowering development 62–64
- photosynthesis
 - canopy photosynthesis 116–117
 - determines yield 113, 126–127
- phytochrome 57
- phytic acid 391–392
- phytoestrogens 350
- Phytophthora sojae* 280–281, 436
- phytosanitary regulations 335–336
- phytosterols 386, 387
- planting *see* under cultivation
- plastochron 57
- Pods
 - abortion and abscission 121–122
 - determination of fruit number 118–120
 - flower-pod relationship 120
 - growth and development 54
 - insect pests 304
 - seed-filling phase 64
 - shattering 82
- pollination, artificial 96–97
- polypeptide, soybean
- polyunsaturated fatty acids (PUFA) 377–378
- poot kong *see* vegetable soybean
- potassium
 - deficiency 165–166
 - effects of soybean on soil content 33–34
- fertilizers 172–174
- requirements 164
- Pratylenchus* spp. 333–334
- prebiotics 386–387
- priming, seed 150
- proanthocyanidin, oligomeric 387–388
- processing
 - by-products 356, 357–358
 - China 17–18
 - India
 - soybean oil industry 366, 367
 - procedures in food product manufacture
 - blanching 415
 - boiling 415
 - dry roasting 415–416
 - extrusion 354, 416
 - fermentation 414, 418–419
 - frying 416
 - germination 413–414
 - soaking 413
 - products *see* products, soy
 - safety: processing plant and environmental 364, 366
 - seed preparation 360
 - technology
 - crude oil refinement 362
 - dry extrusion 361
 - effect on protein composition and properties 405–406
 - extraction processing 354, 355
 - extruders/expanders 354, 359
 - extrusion/expelling plants 362
 - mechanical extraction 361
 - range of approaches 358–359
 - solvents 358, 359–360
 - supercritical fluid extraction (SCFE) 360–361
 - vegetable soybean 449–450
- production
 - regional data
 - Africa 13
 - Americas 13
 - Argentina 19
 - Asia 11–13
 - Brazil 19
 - China 14–15, 18
 - comparison: selected countries 12, 161, 347, 463
 - Europe 13
 - India 18, 79, 161–162, 348
 - Japan 18
 - Korea 18
 - USA 18–19
 - worldwide 1, 92, 345–346, 347, 463
 - vegetable soybean 430–432

- products, soy
 - feed, animal 376, 390–391, 392–393, 411
 - soybean cake 19, 358, 361
 - foods *see also* functional foods
 - culinary uses of soybean in India 417–418, 420
 - flakes and grits 410
 - flour 361, 407–408
 - flour-based products 419–420
 - infant formulas 411
 - manufacturing procedures *see under* processing
 - milk 353–354, 391–392
 - milk-based products 420–422
 - miso, natto, tempeh 418–419
 - nuts 351–352, 353, 416
 - okara 354
 - preboiled soybeans 407
 - protein concentrate 409
 - range of foods produced 417
 - shoyu (sauce) 419
 - sprouts 413–414, 418
 - texturized soy protein (TSP) 354
 - tofu 353, 421
 - vegetable soybean (edamame) *see* vegetable soybean
 - lecithin 356, 364, 365
 - non-food products and ingredients 357, 411–412
 - oil *see* oil, soybean
 - overview 19–20, 350–351, 355, 356, 406
 - vegetable soybean 449–450
- protein, soybean
 - in animal feed 376
 - breeding for protein quality 99–100, 392–393
 - composition and functional properties 405–406
 - concentrate 409
 - economic benefits 349
 - equivalent to animal protein 376–377
 - texturized soy protein (TSP) 354
 - uses 19
- Pythium* spp. 280
- quality
 - changes during storage 262–263
 - machine vision systems 263–264
 - near-infrared spectroscopy 264–265
- quarantine 335–336
- radiation-use efficiency (RUE) 117
- raffinose 386–387, 390–391
- Rag1* 311, 316
- rainfall 199
- regulations, phytosanitary 335–336
- repose, angle of 258–259
- reproductive sink 119–120
- Rhizobium*
 - breeding for improved nitrogen fixation 235
 - inoculation of soybean seed 39, 231–232
- Rhizoctonia solani* 280
- roots 51–52
 - insect pests 304–305
 - lesion nematodes 333–334
 - nodules *see* nodules, root
 - reniform nematodes 334–335
 - root-knot nematodes 326–330
 - rot 280–281, 283–284
- rot, root and stem 280–281, 283–284
 - charcoal rot 290–291
- Rotylenchulus reniformis* 334–335
- rust, soybean 285–286, 437
- salinity 197–198
- saponins 386
- Sclerotinia sclerotiorum* 283–284
- seeds
 - breeding for oil and protein quality 99–100
 - effect of waterlogging 194
 - germination 54
 - germinability testing 83–84
 - inoculation with *Bradyrhizobium* 39, 231–232
 - insect pests 304
 - morphology 54
 - priming 150
 - production
 - categories 107–108
 - characteristics relating to seed number 122
 - effect of shade 118
 - seed filling 64, 122–123
 - seed growth rate 123, 124
 - vegetable soybean 439–440
 - purple seed stain 437
 - seed decay 278–279
 - sowing *see under* cultivation; vegetable soybean
- selection
 - backcross selection 105
 - bulk selection 105
 - pedigree selection 104–105
 - points to consider 103–104
 - recurrent selection 105
 - single seed descent 104
- senescence 67–68, 124

- products, soy
 - feed, animal 376, 390–391, 392–393, 411
 - soybean cake 19, 358, 361
 - foods *see also* functional foods
 - culinary uses of soybean in India 417–418, 420
 - flakes and grits 410
 - flour 361, 407–408
 - flour-based products 419–420
 - infant formulas 411
 - manufacturing procedures *see under* processing
 - milk 353–354, 391–392
 - milk-based products 420–422
 - miso, natto, tempeh 418–419
 - nuts 351–352, 353, 416
 - okara 354
 - preboiled soybeans 407
 - protein concentrate 409
 - range of foods produced 417
 - shoyu (sauce) 419
 - sprouts 413–414, 418
 - texturized soy protein (TSP) 354
 - tofu 353, 421
 - vegetable soybean (edamame) *see* vegetable soybean
 - lecithin 356, 364, 365
 - non-food products and ingredients 357, 411–412
 - oil *see* oil, soybean
 - overview 19–20, 350–351, 355, 356, 406
 - vegetable soybean 449–450
- protein, soybean
 - in animal feed 376
 - breeding for protein quality 99–100, 392–393
 - composition and functional properties 405–406
 - concentrate 409
 - economic benefits 349
 - equivalent to animal protein 376–377
 - texturized soy protein (TSP) 354
 - uses 19
- Pythium* spp. 280
- quality
 - changes during storage 262–263
 - machine vision systems 263–264
 - near-infrared spectroscopy 264–265
- quarantine 335–336
- radiation-use efficiency (RUE) 117
- raffinose 386–387, 390–391
- Rag1* 311, 316
- rainfall 199
- regulations, phytosanitary 335–336
- repose, angle of 258–259
- reproductive sink 119–120
- Rhizobium*
 - breeding for improved nitrogen fixation 235
 - inoculation of soybean seed 39, 231–232
- Rhizoctonia solani* 280
- roots 51–52
 - insect pests 304–305
 - lesion nematodes 333–334
 - nodules *see* nodules, root
 - reniform nematodes 334–335
 - root-knot nematodes 326–330
 - rot 280–281, 283–284
- rot, root and stem 280–281, 283–284
 - charcoal rot 290–291
- Rotylenchulus reniformis* 334–335
- rust, soybean 285–286, 437
- salinity 197–198
- saponins 386
- Sclerotinia sclerotiorum* 283–284
- seeds
 - breeding for oil and protein quality 99–100
 - effect of waterlogging 194
 - germination 54
 - germinability testing 83–84
 - inoculation with *Bradyrhizobium* 39, 231–232
 - insect pests 304
 - morphology 54
 - priming 150
 - production
 - categories 107–108
 - characteristics relating to seed number 122
 - effect of shade 118
 - seed filling 64, 122–123
 - seed growth rate 123, 124
 - vegetable soybean 439–440
 - purple seed stain 437
 - seed decay 278–279
 - sowing *see under* cultivation; vegetable soybean
- selection
 - backcross selection 105
 - bulk selection 105
 - pedigree selection 104–105
 - points to consider 103–104
 - recurrent selection 105
 - single seed descent 104
- senescence 67–68, 124

- shoyu 419
- soil
 - allelopathy 35
 - beneficial effects of soybean 25, 31–32
 - on biological properties 34
 - on chemical properties 32–34
 - on physical properties 34
 - effect of herbicides 219–220
 - herbicide residues 220
 - influence on nitrogen fixation 30
 - nematode-suppressive soil 336
 - nutritional constraints 167–170
 - requirements 162
 - solarization 154, 213–214
- solarization, soil 154, 213–214
- solubility, protein 405
- soy nuts 351–352, 353, 416
- soybean cyst nematode 287, 330–333
- soybean mosaic 283, 438
- soysilk 412
- sprouts, soybean 413–414, 418
- stachyose 386–387, 390–391
- stale seedbeds 213
- stay-green trait 68
- stems
 - canker 287–288
 - determinate *vs* indeterminate types 58–59
 - insect pests 304–305
 - morphology 50–51
 - rot 280–281, 283–284
- stomata 49
- storage
 - drying
 - mathematical models 250–253, 255–256
 - methods 250
 - stress crack models 250–253
 - water diffusion 261
 - effect of foreign material 248
 - fungus growth and mycotoxins 249, 250
 - good storage practices 271
 - insect infestations 265–267
 - control 271
 - detection 267–270
 - moisture content
 - and physical properties 257–260
 - for safe storage 248–249
 - and thermal properties 260–261
 - quality changes 262–263
 - machine vision systems 263–264
 - near-infrared spectroscopy 264–265
- sudden death syndrome 288–289
- sulphur
 - deficiency 166, 168
 - fertilizers 174–175
 - requirements 164–165
- taxonomy and classification 7
 - biosystematics 77
 - Glycine* species list 8, 76
- tempeh 419
- texturized soy protein (TSP) 354
- tillage 142–144
 - no-till 39, 200
- tocopherols 358, 384
- tofu 353, 421
 - effect of phytic acid 391–392
- tolerance: to herbicides 100–101
- tolerance: to insects 311
- trade, international
 - changing patterns
 - constraints 477–479
 - effects of policy 476–477
 - future trends 472–474
 - price trends 474–476
 - of production and demand 470–472
- drivers of trade
 - biodiesel 466
 - economic factors 468, 469
 - foods and animal feeds 466–467
 - population growth 468
 - technological and biotechnological advances 469–470
- exports
 - global 462, 464
 - oilseeds 462
- imports 461
 - global demand 463–464
- past trends 464–466
- vegetable soybean 450–451
- trichomes 49, 50–51
- trypsin inhibitor 389–390
- tua rae *see* vegetable soybean
- United States
 - breeding
 - vegetable soybean 442–443
 - cropping systems 26, 28
 - production 18–19
 - average yields 1962–2006 132
 - vegetable soybean 431
- ureides 234, 338
- vegetable soybean
 - breeding
 - AVRDC (World Vegetable Centre) 444, 445–446, 447
 - China 442
 - history 441–442
 - Korea 448–449

- vegetable soybean *continued*
 - breeding *continued*
 - objectives 442–444, 447–448
 - United States 442–443
 - culinary uses in India 417–418
 - cultivation
 - disease control 436–438
 - fertilizers, weed control and irrigation 434–435
 - location, season and cropping system 432
 - pest control 435–436
 - soil conditions and sowing 433–434
 - definition 428
 - distinction from grain soybean 428–429
 - harvesting 438–439
 - historical references 427–428
 - international trade 450–451
 - nutritional value 407, 429–430
 - potential for developing countries 451–452
 - processing and use 449–450
 - seed production 439–440
- viruses
 - baculoviruses for leaf feeder control 312
 - bean pod mottle virus (BPMV) 282–283
 - soybean mosaic virus (SMV) 283, 438
 - transmission by insects 304
- water
 - management
 - factors affecting water use 199–203
 - with integrated nutrient management in drylands 182–183
 - irrigation in saline conditions 197–198
 - irrigation scheduling 195–197, 201–202
 - overview 152–153
 - rain water conservation and use 198–199
 - requirements 192
 - effect of waterlogging 194
 - effects of drought 192–194
- weeds
 - critical period of competition 212–213
 - effect on yield 153
 - integrated management 153–154, 219
 - in cultivation of vegetable soybean 435
 - cultural methods 213–215
 - economics 222, 223
 - in herbicide resistant soybean 221–222
 - herbicides *see* herbicides
 - mechanical methods 215–216
 - prevention 212–213
 - losses due to weeds 210, 211
 - major weeds 153, 209, 210
 - wild soybean species 77–78, 79–80, 93–94
 - distribution 7, 9
- Xanthomonas axonopodis* 282, 436
- yield
 - average yields 1962–2006 132
 - average yields 2006–2207 347
 - comparative data
 - China 15
 - selected countries 12
 - dependence on photosynthesis 113
 - determination
 - partitioning 128–131
 - seed number 126–128
 - source-sink limitations 128
 - effect of drought 193–194
 - effect of planting geometry and density 147–149
 - effect of seed inoculation 231–232
 - future yield growth 131–134
 - heritability estimates 99
 - influence of sowing date 144, 145, 146
 - loss due to weeds 153, 211
 - major breeding objective 98
 - relationship with stay-green trait 68
 - yield production phases 113–114
 - yield production phases I: vegetative growth 114–115
 - leaf area and solar radiation interception 114–115
 - yield production phases II: flowering & pod set 117
 - determination of fruit number 118–123
 - flowering profiles 118
 - yield production phases III: seed filling 122–123
 - seed fill duration 64, 125–126
 - seed growth rate 123, 124
- zinc 165
 - deficiency 166, 168–169