

Contents

1. Introduction	17
1.1. The potato crop is important	19
1.2. The potato is special	26
1.3. Several ways to multiply the potato	27
1.4. High quality seed tubers matter!	28
1.5. Readers' guide to this book	31
2. Yield formation of a seed potato crop	33
2.1. What does a potato plant look like?	35
2.2. Crop ecology of plant growth and tuber formation	37
2.3. How to calculate yield	43
2.4. Yield can be described by yield components	43
2.5. Yield is affected by environmental factors and cultivar	47
3. Development of cultivars	51
3.1. Introduction	53
3.2. How to obtain new cultivars	55
3.2.1. Testing and selecting existing cultivars	55
3.2.2. Selection within a population of breeding materials	58
3.2.3. Complete breeding programme	59
4. Quality characteristics of seed tubers	65
4.1. Introduction	67
4.2. Size of seed tuber or seed piece affects quality	69
4.2.1. Number of eyes	69
4.2.2. Plant vigour	71
4.3. Physiological age determines number and vigour of sprouts	75
4.4. Number of main stems per tuber determines stem density	87
4.4.1. How many sprouts per tuber?	87
4.4.2. How many sprouts develop into main stems?	87
4.5. Tuber health	89
4.6. Are all cultivars behaving similarly?	91

5. Control and manipulation of physiological seed tuber quality	95
5.1. Conditions during seed tuber production affect physiological seed tuber quality	97
5.1.1. There is variation <i>within</i> seed lots	101
5.1.2. There is variation <i>between</i> seed lots	103
5.1.3. Haulm destruction influences physiological seed quality	105
5.1.3.1. Tuber maturity at haulm destruction	105
5.1.3.2. Method of haulm destruction	106
5.1.3.3. Duration of the interval between defoliation and harvest	107
5.1.3.4. Haulm treatments before haulm destruction	108
5.1.4. Physical factors influence physiological ageing	108
5.1.4.1. Temperature during tuber growth	109
5.1.4.2. Temperature during skin set and early storage	110
5.1.4.3. Interaction between growing temperatures and storage temperatures	110
5.1.4.4. Photoperiod during tuber growth	111
5.1.4.5. Light intensity during tuber growth	112
5.1.4.6. Rainfall	112
5.1.5. Agronomic factors	113
5.2. Conditions during storage modify physiological seed tuber quality	113
5.2.1. Temperature	116
5.2.2. Combining storage temperature with foliar GA application before harvesting	121
5.2.3. Relative air humidity	123
5.2.4. Composition of the atmosphere	123
5.2.5. Light and photoperiod	124
5.2.6. De-sprouting	127
5.3. Treatments after storage manipulate physiological seed tuber quality	128
5.3.1. Chemical breaking of dormancy	128
5.3.2. Cutting of seed tubers	128
5.3.3. Chitting and pre-sprouting	131
6. Control and manipulation of seed tuber health	135
6.1. Introduction	137
6.2. Viruses, viroids and phytoplasmas	138
6.3. Bacteria	149
6.4. Fungi	153
6.5. Nematodes	165
6.6. Insects	171
7. Production of pre-basic seed	173
7.1. Introduction	175
7.1.1. Rationale of multiplication systems	176
7.1.2. Why rapid multiplication?	177
7.1.3. Genetic drift	177

7.2. In vitro systems	178
7.2.1. Nodal cuttings	179
7.2.2. Microtubers	181
7.3. Systems in protected or well-controlled environments	185
7.3.1. Sprout cuttings	185
7.3.2. Stem cuttings	186
7.3.3. Leaf-bud cuttings	189
7.3.4. Single-node cuttings	190
7.3.5. Minitubers	193
7.3.5.1. Hydroponic systems	194
7.3.5.2. Systems on solid media without repetitive harvesting	195
7.3.5.3. Systems on solid media with repetitive harvesting	197
7.4. Systems under field conditions, with emphasis on clonal selection	202
7.5. Field performance of (pre-)basic plant materials	203
7.5.1. In vitro plants	206
7.5.2. Tubers	206
7.5.3. In vivo cuttings and transplants	210
7.6. Comparing pre-basic seed production systems	212
8. Agronomy of seed potato production	217
8.1. Introduction	219
8.2. Crop husbandry to influence tuber number and physiological quality	221
8.2.1. How to manipulate tuber number	221
8.2.2. How to protect the progeny tubers and influence their shape	228
8.2.3. How to manipulate the physiological age of progeny tubers	230
8.3. How to manage seed tuber health	231
8.4. Other aspects of crop husbandry with multiple effects	234
8.5. Overview of the differences in crop management between seed tuber production and ware production	240
9. True potato seed (TPS)	243
9.1. Introduction	245
9.2. Characteristics of TPS	246
9.3. How to produce TPS	249
9.3.1. Components of TPS yield	249
9.3.2. Plant growth, flowering and berry set	249
9.3.3. Genetic aspects	250
9.3.3.1. Open pollinated seed	250
9.3.3.2. Hybrid seed	251
9.3.4. Influence of environmental factors and genotype	253
9.3.5. Effects of crop husbandry	255
9.4. How to make use of TPS	255
9.4.1. Direct sowing of TPS in the field	256

9.4.2. Use of seedling transplants derived from TPS	258
9.4.3. Use of seed tubers derived from TPS	260
9.5. Comparison of different TPS propagules	264
9.6. Developments and future prospects of TPS use	265
10. Quality control and seed certification	269
10.1. Introduction	271
10.1.1. Quality control and seed certification are necessary	271
10.1.2. Quality control, inspection and certification require a legal framework, international conventions and agreements	274
10.2. Control of seed quality and seed inspection	275
10.2.1. Formal seed programmes are linked to other formal and informal bodies	275
10.2.2. Seed inspection involves many organisations and other actors	277
10.2.3. Main principles of quality control and seed inspection	278
10.2.4. Inspection procedures	279
10.2.5. Main quarantine diseases and methods to limit their spread	286
10.3. Seed certification systems	286
10.3.1. Organisation and management of seed certification	286
10.3.2. What do seed certification agencies do?	288
10.3.3. Administrative procedures	289
10.3.4. Examples: the internal seed certification systems of Brazil and the Netherlands	290
10.4. Seed certification standards	291
10.4.1. Possible seed certification standards	291
10.4.2. Assessment of standards	292
10.4.3. How to implement an efficient seed certification system	293
11. Seed supply systems	297
11.1. Practical aspects of supply systems	299
11.1.1. Process of seed tuber degeneration	299
11.1.2. Rate of multiplication	301
11.1.3. Implications for seed multiplication	302
11.2. Supply systems of seed tubers	302
11.2.1. Formal seed systems	303
11.2.2. Informal seed systems	308
11.2.3. Interaction between formal and informal seed systems	308
11.2.4. On-farm methods of maintaining seed quality	309
11.3. Supply systems of true potato seed	312