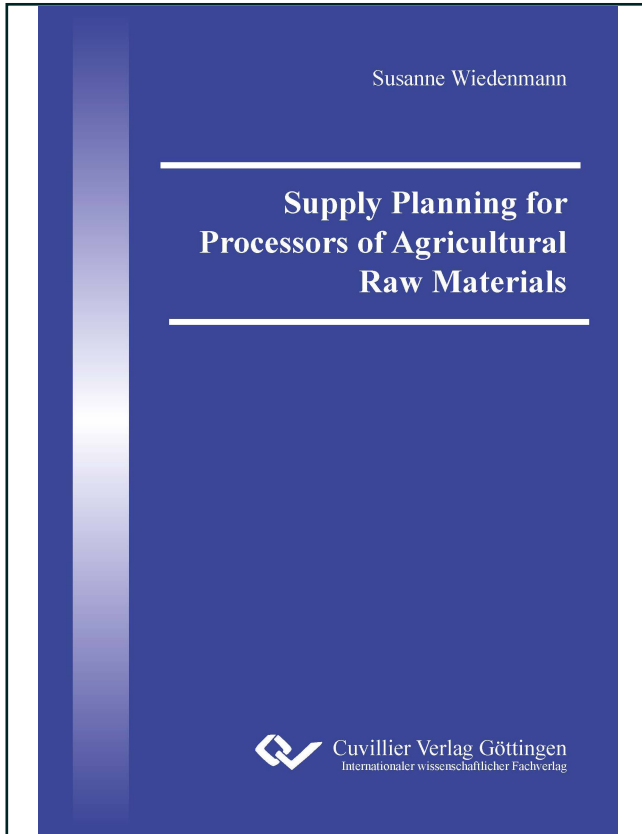




Susanne Wiedenmann (Autor)

Supply Planning for Processors of Agricultural Raw Materials



<https://cuvillier.de/de/shop/publications/6553>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen, Germany

Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>



Contents

| | |
|---|------------|
| List of Figures | V |
| List of Tables | VII |
| List of Abbreviations | IX |
| Variables Declaration | XI |
| 1 Introduction | 1 |
| 1.1 Initial Situation and Problem Statement | 1 |
| 1.2 Objective and Solution Approach | 3 |
| 2 Material Use of Agricultural Products from Oil Crops | 7 |
| 2.1 Industrial Use of Oil Crops | 8 |
| 2.1.1 Composition of Oils | 8 |
| 2.1.2 Reactions with Triglycerides and Fatty Acids | 11 |
| 2.2 Industrial Use of Linseed | 15 |
| 2.2.1 Use of Linseed Oil in Industry | 16 |
| 2.2.2 Use of By-Products of Linseed Oil Production | 17 |
| 2.2.3 Quality, Land Productivity and Price of Linseed | 18 |
| 2.3 Summary | 22 |
| 3 Supply Planning under Uncertainty | 23 |
| 3.1 Tasks of Supply Planning | 24 |
| 3.2 Sources and Consideration of Supply Uncertainty | 27 |
| 3.2.1 Safety Stock | 31 |
| 3.2.2 Diversifying Sources of Supply | 34 |
| 3.2.3 Hedging with Tradeable Contracts, especially Derivatives | 37 |
| 3.2.4 Hedging with Real Options, Especially Non-Tradeable Flexible Con- tracts | 41 |
| 3.2.5 Supply Chain Coordination | 44 |
| 3.2.6 Discussion of Strategies | 44 |
| 3.3 Supply Planning for Agricultural Raw Materials | 45 |
| 3.3.1 Agricultural Commodity Markets | 45 |
| 3.3.2 Contract Farming | 47 |
| 3.3.3 Option Contracts | 49 |
| 3.4 Summary | 51 |



| | | |
|----------|--|------------|
| 4 | Quantitative Methods to Model Uncertainty | 53 |
| 4.1 | Values for Uncertain Parameters | 53 |
| 4.2 | Quantitative Methods to Handle Uncertain Data | 56 |
| 4.2.1 | Forecasting Approaches | 57 |
| 4.2.2 | Scenario Analysis | 58 |
| 4.2.3 | Fuzzy Optimization | 59 |
| 4.2.4 | Online Optimization | 59 |
| 4.2.5 | Robust Optimization | 60 |
| 4.2.6 | Stochastic Programming | 61 |
| 4.2.6.1 | Advantages and Applications | 61 |
| 4.2.6.2 | Two-stage Stochastic Programs | 62 |
| 4.2.6.3 | Measures to Evaluate the Stochastic Solution | 64 |
| 4.2.6.4 | Finding a Suitable Probability Distribution | 65 |
| 4.2.7 | Sensitivity Analysis | 67 |
| 4.3 | Summary | 68 |
| 5 | Decision Support for Supply Planning of the Processor | 71 |
| 5.1 | The Decision Situation | 71 |
| 5.2 | Development of the Basic Stochastic Program | 74 |
| 5.3 | Verification of the Basic Model | 81 |
| 5.4 | Modifications of the Basic Model | 86 |
| 5.4.1 | Selling By-products | 87 |
| 5.4.2 | Proportional Penalty Costs | 87 |
| 5.4.3 | Price Escalation Clause | 88 |
| 5.4.4 | Two Sources of Optional Supply | 88 |
| 5.4.5 | Two Industrial Customers | 90 |
| 5.4.6 | Two Quality Grades on the Commodity Market | 92 |
| 5.5 | Summary | 94 |
| 6 | Application of the Models and Numerical Analysis of Results | 97 |
| 6.1 | Values for the Parameters and Random Variables | 97 |
| 6.2 | Results of the Basic Stochastic Model | 100 |
| 6.3 | Sensitivity Analysis | 104 |
| 6.4 | Results of the Modified Models | 107 |
| 6.4.1 | Selling By-products | 107 |
| 6.4.2 | Proportional Penalty Costs | 108 |
| 6.4.3 | Two Sources of Optional Supply | 108 |
| 6.4.4 | Two Industrial Customers | 109 |
| 6.4.5 | Two Quality Grades on the Commodity Market | 109 |
| 6.5 | Summary | 110 |
| 7 | Industrial Case Study: Supply Planning for a Seed Company | 113 |
| 7.1 | Present Supply Planning Process | 113 |
| 7.2 | Development of the Model | 117 |
| 7.3 | Numerical Analysis | 120 |
| 7.3.1 | Values of Deterministic Parameters | 120 |



| | | |
|-----------|--|------------|
| 7.3.2 | Values for Random Land Productivity α | 122 |
| 7.3.3 | Values for Random Purchase Price P_c | 123 |
| 7.3.4 | Values for Random Inventory Level Q_{S0} | 123 |
| 7.3.5 | Results of Simulations | 124 |
| 7.3.6 | Sensitivity Analysis | 126 |
| 7.4 | Summary | 127 |
| 8 | Conclusions and Outlook | 129 |
| 8.1 | Conclusions | 129 |
| 8.2 | Outlook on Further Research | 131 |
| 8.2.1 | Further Research Concerning Models for Supply Planning | 131 |
| 8.2.2 | Further Research Concerning the Applied Methodology and Other Applications | 132 |
| 9 | Summary | 135 |
| 10 | Appendix | 139 |
| | References | 145 |