Wetenschappelijke **Bodemvorming** onder de **Voedselbosbouw**

hogeschool

Manual

Calculation tool 4.0 for food forests

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1. Introduction

This is a manual for calculation tool 4.0 for food forests. Calculation tool 4.0 is an Excel file that calculates the financial feasibility of a food forest. The tool shows the profitability of a food forest and which inputs and outputs need to be taken into account. The calculation tool is intended for beginning food forest farmers who would like to gain insight into the financial situation. This manual will explain step by step the use of the calculation tool.
Within the calculation tool, there are two options. The first option is the basic version in which only basic data about the food forest needs to be entered. The manual for this basic version can be found in Chapter 1 of this document. The second option is the expert version. In this version it is possible to enter additional data. This results in a more specific outcome of the calculation tool. The expert version can be found in chapter 2 of this document.
Stichting Voedselbosbouw Nederland defines a food forest as a robust ecosystem designed by humans to the example of a natural forest, with the purpose of producing food (Stichting Voedselbosbouw Nederland, s.d.).
Food forestry offers several advantages. There is a high diversity of high-quality food products in a food forest. It is possible to harvest year-round from a food forest. The cost of a food forest decreases with years. A food forest is a habitat for many different plants, animals and microorganisms. This is good for biodiversity. A food forest absorbs CO2. Climate adaptation is also an important benefit of a food forest. This is due to the increased water capacity of the soil and direct and indirect buffering of climate extremes. A food forest provides a differentiated range of products that can be processed and sold regionally. In addition to all these benefits, there are other benefits for local people and education (Rijksoverheid, s.d.).
Besides the many advantages, there are also some disadvantages. Current legislation is often not yet adapted to the new concept of food forestry. Officials evaluating applications for food forests cannot fall back on current regulations. This can create difficulties with getting permits, for example (Voedsel uit het bos, s.d.). Start-up costs can be a barrier to starting a food forest. One of the biggest costs of a food forest are the high start-up costs due to, for example, the cost of plants and planting material. Because the food crops are largely perennial, these costs are recouped over time (Buiter & De Waard, 2018). This calculation tool can be used to calculate when the investments can be recouped.

2. Manual basic user

This is the manual of calculation tool 4.0 for the basic user. This version of the calculation tool is the simplified version of the calculation tool, intended for future food forest farmers who want to evaluate the financial feasibility of their food forest plans. This manual explains step by step what the user needs to do to arrive at the correct outcome.

Step 1: Homepage

This is the first sheet seen when the calculation tool is opened. As can be seen, this sheet consists of several parts. On the left are the first input fields. In these, the name, location and number of hectares of the food forest can be entered. Filling in the number of hectares in the food forest is essential, as this is used in the calculations of the tool.
To the right are three different boxes containing different buttons. Each button navigates the user to a different worksheet. The basic user uses only the buttons in the green box (basic user input). These buttons will navigate the user through the tool so that eventually everything is completed. The yellow box containing various buttons is not applicable for the basic user. The sheets in the yellow box are protected. The blue box contains buttons to the sheets that display the results. Note! The outcome worksheets only display correct information if all the fields of the calculation tool are completed.
There is a warning at the bottom of the page. This is red when not all information has been entered. This colors green when all input cells are filled in. Only when this is green will correct information be displayed in the outcome sheets.
To get back to this home page, there is an icon of a house on each worksheet. When this is clicked, the user automatically returns to the homepage. Then the user can click the next button to get to a new worksheet.

Step 2: Plantlist

The first entry sheet is that of the plant list. This list contains many different species that can be planted in a food forest. Here the user enters which plants and in what quantity they will be present in the food forest. The entry should be made in the "quantity" column. Specific plants can be searched in the plant list with the function ctrl+F. It is important to consider the unit of the plants. Some species are entered per plant and some per m^2. It is important for the outcome that a realistic amount of plants is given here. Something must be entered everywhere in this list. For the species that will not be present, 0 must be entered.

Stap 3: Investment & Financing

All investments are entered in this sheet. Both initial investments and subsequent investments can be entered in this sheet. The sheet contains a few examples of investment categories. There is also an option under "other" to add an additional investment category. This can be, for example, a replacement investment that needs to be done in the future, because new investments need to be made after the lifetime of previous investments.

In the table "Investments" all investments are listed below each other and information about the investments must be entered in the columns. In the column "In possession?" it must be entered whether the investment is already owned. Here you can choose between "Yes" or "No" by clicking in the box, after which a gray icon appears next to the box. By clicking on the gray icon, the choice can be made. "Yes" is most appropriate for land and buildings, for example. This requires the book value of the asset in the "Purchase" column. "No" is most appropriate for, for example, plant assets that have yet to be purchased. Here the column "Purchase" should contain the purchase amount. In the column "Purchase year" the year in which the investment is made should be entered. In the column "Useful life in years" an estimate of how long the investment will last can be entered.

In the "Financing" table, information about the financing of the investment can be entered. In the column "Type of financing" can be chosen from "Private" or "External". Private is chosen if the financing is done from private capital. External is chosen if money is borrowed. This can be from a bank, for example. Note that in this column only private or

external can be chosen. The "Interest rate" column shows the interest rate agreed upon if the financing is foreign. A recommended interest rate of 2% is entered here. This can be adjusted as the user sees fit. In the column "Time span" the time in which the financing is paid off must be entered. The last column "Calculated interest rate" shows the interest rate for investments made with private capital or already in possession. As an example, land that is already in possession is entered under investments with in possession "yes". Purchase amount is the value of the investment and the remaining depreciation. By means of the calculated interest, an amount is calculated on the capital invested, since this capital should yield a return. A recommended interest rate of 0.5% has been introduced here. This can be adjusted at the discretion of the user.

Step 4: Other income

In this sheet, fill in all sources of income that add to the primary yields of food forest produce. The value of these sources of income should be entered in the correct unit for each source, in the next column. For example, wood yield should be entered per hectare and biodiversity in the value of subsidy per year. It is important that something is entered everywhere. If a source does not apply, then 0 should be entered.

Step 5: Costs

In this sheet, enter all costs not covered by investment. This sheet also lists different categories of labor. The different categories of labor are divided into food forest farmer (FF farmer) labor and external labor. FF farmer labor refers to the entrepreneur's labor. Here it is important to think carefully about the division between these. After all, an entrepreneur only has a limited number of hours available per week. External labor refers to staff or outside labor. It is important to enter all costs in the right unit. For example, insurance costs should be entered per hectare and certification costs should be entered in total value. Something must be entered everywhere in the sheet. If a particular cost does not apply, 0 must be entered.

Step 6: Other input

This sheet lists other fields to be entered. The first table lists the effects on a food forest.

- Harvest percentage is a percentage to be decreased from 100% if an optimal harvest cannot be achieved. This could be, for example, if the food forest is in an area with less precipitation on average. As a result, less production can then be expected. A value between 0 and 100% should be entered here.
- Distribution quality A/B is a quality determination. Several factors can influence the quality of the yield. A product of A quality can generally be sold for more than a product of B quality. A value between 0 and 100% should be entered here.
- Price A quality is the price obtained for a product of A quality. It will be 100% in most cases, but an adjustment is possible.
- Price B quality is the price that can be asked for B quality products. This price is based on the price of A quality products. The B quality price can be adjusted at the user's discretion.
- Effect soil type is the influence of soil quality on the production. All figures in the calculation tool are based on an average soil quality. If the soil quality is less, a percentage below 100% can be entered. If the soil quality is higher than average, a percentage higher than 100% can be entered.
- Effect picking performance is the efficiency with which production can be harvested. In the picking rates sheet, optimal picking conditions were assumed. Low-cost labor often has lower picking rates. If this is the case, this percentage can be decreased.

In the second table, the yield distribution over channels can be divided into percentages. Note that the total of these can never exceed 100%. The cost price option is in there to control the cost price calculation. If this is set to 100%, the operating result over 20 years added together should come to 0.

In the third table there is room for entering private withdrawals. It is important to enter a realistic monthly amount here. The yearly amount is automatically calculated.

Step 7: Results

The last two sheets are the results sheets. The "Results" sheet contains several tables of results of the calculation tool. The first table "Operating result" shows the financial results of the food forest. This result does not include the entrepreneur's (FF farmer) labor. The second table is the "Net Operating result". This is the operating result including the entrepreneur's labor and the calculated interest payment for private investments. The third table shows the profit calculation. This calculation includes all variable costs and incomes regarding the production of plants. The last table shows the cash flow development. This is a budget of annual incomes and expenses. Also shown are numbers with and without private withdrawals and the cumulative cash flow development. It also shows the capital demand divided into private and external investment, and working capital.
The second sheet shows the same outcomes in graphs. These graphs visualize the results of the first result sheet. The last graph "combined results" shows all results combined in one graph.

3. Manual expert user

This is the manual of calculation tool 4.0 for the expert user. This version of the calculation tool is an extended version of the calculation tool. This manual explains step by step what the expert user needs to do to arrive at a correct result.

Step 1: Homepage

This is the first sheet seen when the calculation tool is opened. As can be seen, this sheet consists of several parts. On the left are the first input fields. In these, the name, location and number of hectares of the food forest can be entered. Filling in the number of hectares in the food forest is essential, as this is used in the calculations of the tool.
To the right are three different boxes containing different buttons. Each button navigates the user to a different worksheet. The basic user uses only the buttons in the green box (basic user input). These buttons will navigate the user through the tool so that eventually everything is completed. The yellow box containing various buttons is not applicable for the basic user. The sheets in the yellow box are protected. The blue box contains buttons to the sheets that display the results. Note! The outcome worksheets only display correct information if all the fields of the calculation tool are completed.
There is a warning at the bottom of the page. This is red when not all information has been entered. This colors green when all input cells are filled in. Only when this is green will correct information be displayed in the outcome sheets.
To get back to this home page, there is an icon of a house on each worksheet. When this is clicked, the user automatically returns to the homepage. Then the user can click the next button to get to a new worksheet.

Step 2: Plantlist

The first entry sheet is that of the plant list. This list contains many different species that can be planted in a food forest. Here the user enters which plants and in what quantity they will be present in the food forest. The entry should be made in the "quantity" column. Specific plants can be searched in the plant list with the function ctrl+F. It is important to consider the unit of the plants. Some species are entered per plant and some per m^2. It is important for the outcome that a realistic amount of plants is given here. Something must be entered everywhere in this list. For the species that will not be present, 0 must be entered.

Step 3: Production list

This list shows the yield a species gives per year. The unit is given in the sheet plantlist (per plant or per m^2). The basic data are entered in the plantlist sheet. For the expert user it is possible to adjust yields per year in the production list sheet.

Step 4: Picking rates

This worksheet shows the amount that can be harvested per hour in kg/hour. The light yellow color of fields indicates that it is unknown what the picking performance of the specific species is. In these cases, an average number of 4 was chosen. The darker boxes are more precise estimates of picking performance. In Appendix 1 the reader will find the method explaining the origin of the given picking performances.
For the expert user, it is possible to change the picking performance per plant by entering a new value.

Step 5: Sales price per sales channel

This page shows the sales price for each sales channel. Currently there are three different channels in the calculation tool.

- Scenario 1, supermarket price per kg: this price is based on organic products from supermarkets. These are the prices excluding VAT divided by 2.
- Scenario 2, price catering per kg: this is the price obtained when the products are sold to a catering company.
- Scenario 3, price direct to consumer per kg: this is the price obtained when the products are sold directly to consumers without intermediate parties.
- Scenario 4, cost price per kg: this is the price the products cost to produce. This price can be used to determine whether the selling price is high enough. This price cannot be adjusted but is calculated automatically.

The expert user can adjust the price per kg if in practice, for example, a different price is paid for the products.

Step 6: Investment & financing

All investments are entered in this sheet. Both initial investments and subsequent investments can be entered in this sheet. The sheet contains a few examples of investment categories. There is also an option under "other" to add an additional investment category. This can be, for example, a replacement investment that needs to be done in the future, because new investments need to be made after the lifetime of previous investments.

In the table "Investments" all investments are listed below each other and information about the investments must be entered in the columns. In the column "In possession?" it must be entered whether the investment is already owned. Here you can choose between "Yes" or "No" by clicking in the box, after which a gray icon appears next to the box. By clicking on the gray icon, the choice can be made. "Yes" is most appropriate for land and buildings, for example. This requires the book value of the asset in the "Purchase" column. "No" is most appropriate for, for example, plant assets that have yet to be purchased. Here the column "Purchase" should contain the purchase amount. In the column "Purchase year" the year in which the investment is made should be entered. In the column "Useful life in years" an estimate of how long the investment will last can be entered.

In the "Financing" table, information about the financing of the investment can be entered. In the column "Type of financing" can be chosen from "Private" or "External". Private is chosen if the financing is done from private capital. External is chosen if money is borrowed. This can be from a bank, for example. Note that in this column only private or external can be chosen. The "Interest rate" column shows the interest rate agreed upon if the financing is foreign. A recommended interest rate of 2% is entered here. This can be adjusted as the user sees fit. In the column "Time span" the time in which the financing is paid off must be entered. The last column "Calculated interest rate" shows the interest rate for investments made with private capital or already in possession. As an example, land that is already in possession is entered under investments with in possession "yes". Purchase amount is the value of the investment and the remaining depreciation. By means of the calculated interest, an amount is calculated on the capital invested, since this capital should yield a return. A recommended interest rate of 0.5% has been introduced here. This can be adjusted at the discretion of the user.

Step 7: Other income

In this sheet, fill in all sources of income that add to the primary yields of food forest produce. The value of these sources of income should be entered in the correct unit for each source, in the next column. For example, wood yield should be entered per hectare and biodiversity in the value of subsidy per year. It is important that something is entered everywhere. If a source does not apply, then 0 should be entered.

Step 8: Other income expert

This sheet is the same sheet as under step 7, except the expert user can adjust the yields year by year. Note that after an adjustment is made, the original formula is overwritten. If the original figures need to be reconstructed, they can be put in manually.

Step 9: Costs

In this sheet, enter all costs not covered by investment. This sheet also lists different categories of labor. The different categories of labor are divided into food forest farmer (FF farmer) labor and external labor. FF farmer labor refers to the entrepreneur's labor. Here it is important to think carefully about the division between these. After all, an entrepreneur only has a limited number of hours available per week. External labor refers to staff or outside labor. It is important to enter all costs in the right unit. For example, insurance costs should be entered per hectare and certification costs should be entered in total value. Something must be entered everywhere in the sheet. If a particular cost does not apply, 0 must be entered.

Step 10: Costs expert

This sheet is the same sheet as under step 9, except the costs can be adjusted year to year. Note that after an adjustment is made, the original formula is overwritten. If the original figures need to be reconstructed, they can be put in manually. In this sheet, harvest hours must be manually divided between FF farmer and external labor. It is important to make a realistic division between these.

Step 11: Other input

This sheet lists other fields to be entered. The first table lists the effects on a food forest.

- Harvest percentage is a percentage to be decreased from 100% if an optimal harvest cannot be achieved. This could be, for example, if the food forest is in an area with less precipitation on average. As a result, less production can then be expected. A value between 0 and 100% should be entered here.
- Distribution quality A/B is a quality determination. Several factors can influence the quality of the yield. A product of A quality can generally be sold for more than a product of B quality. A value between 0 and 100% should be entered here.
- Price A quality is the price obtained for a product of A quality. It will be 100% in most cases, but an adjustment is possible.
- Price B quality is the price that can be asked for B quality products. This price is based on the price of A quality products. The B quality price can be adjusted at the user's discretion.
- Effect soil type is the influence of soil quality on the production. All figures in the calculation tool are based on an average soil quality. If the soil quality is less, a percentage below 100% can be entered. If the soil quality is higher than average, a percentage higher than 100% can be entered.
- Effect picking performance is the efficiency with which production can be harvested. In the picking rates sheet, optimal picking conditions were assumed. Low-cost labor often has lower picking rates. If this is the case, this percentage can be decreased.

In the second table, the yield distribution over channels can be divided into percentages. Note that the total of these can never exceed 100%. The cost price option is in there to control the cost price calculation. If this is set to 100%, the operating result over 20 years added together should come to 0.

In the third table there is room for entering private withdrawals. It is important to enter a realistic monthly amount here. The yearly amount is automatically calculated.

Step 12: Other input expert

This sheet is the same as the sheet in step 11. The only difference is that adjustments can be made to the entry year by year. Note that after an adjustment is made, the original formula is overwritten. If the original figures need to be reconstructed, they can be put in manually.

Step 13: Results

The last two sheets are the results sheets. The "Results" sheet contains several tables of results of the calculation tool. The first table "Operating result" shows the financial results of the food forest. This result does not include the entrepreneur's (FF farmer) labor. The second table is the "Net Operating result". This is the operating result including the entrepreneur's labor and the calculated interest payment for private investments. The third table shows the profit calculation. This calculation includes all variable costs and incomes regarding the production of plants. The last table shows the cash flow development. This is a budget of annual incomes and expenses. Also shown are numbers with and without private withdrawals and the cumulative cash flow development. It also shows the capital demand divided into private and external investment, and working capital.
The second sheet shows the same outcomes in graphs. These graphs visualize the results of the first result sheet. The last graph "combined results" shows all results combined in one graph.

4. Discussion

Establishing a food forest is a lengthy process. A fully-grown food forest takes 20 years, at least. Because the concept of food forests is relatively new in the Netherlands, little information can be found about it. Most information is missing on production figures from year 10 and on. The picking performance of products from a food forest is also very difficult to determine due to the lack of information. The figures are expected to become more accurate in the coming years as more information becomes available.

Labor

The calculation tool lists different categories of labor, which can be chosen to be performed by the FF framer or by external labor (including staff). However, the number of available hours of the FF farmer must be taken into account. An example in practice is that there might be peaks during harvesting. The calculation tool tracks hours on an annual basis, but not per season during the year. Harvest hours may be many times higher in September than in January. These hours cannot all be filled by the FF farmer at that time.

Reinvestments

Replacement investments can be entered into the calculation tool. These can be made after the end of the useful economic life or the useful technical life. The useful economic life span may have ended earlier than the useful technical life span. As a result, you will therefore have to reinvest earlier, which also creates new depreciation. Depreciation affects the result. By not including replacement investments or including them later, the result can look more positive than it really is.

Yield calculation

A choice can be made as to the division into different sales channels and quality A or B. A calculation is made based on the division. However, the calculation assumes that the sales channels receive both quality A and B. Although in practice a certain outlet may receive only quality A or only quality B, this cannot be entered. Because this would make the calculation tool very complex, this has not been incorporated into the calculation tool. The current method gives a better and representative average yield using entered data.

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Appendix 1: Method picking rates

The picking rates sheet in calculation tool 4.0 shows the picking rates of different species present in a food forest. This appendix explains for each species how the figures were established. The picking rate is the amount an average worker can pick per hour of a particular species.

The calculation tool shows dark colored boxes and light colored boxes. The picking performance of the dark colored boxes is estimated. The method of estimation for each species is shown below. The picking performance in the light yellow colored boxes are of species for which too little information is available. An estimated average of 4 kg/hour was chosen for these.

Actinidia arguta (Hardy kiwi): According to estimates, the picking rate of this plant is comparable to cranberry. The picking rate of Vaccinium macrocarpon (cranberry) is approximately 16 kg/hour.

Actinidia deliciosa (Hardy kiwi): According to estimates, the picking rate of this plant is comparable to cranberry. The picking rate of de Vaccinium macrocarpon (cranberry) is approximately 16 kg/hour.

Actinidia komikta (Hardy kiwi): According to estimates, the picking rate of this plant is comparable to cranberry. The picking rate of de Vaccinium macrocarpon (cranberry) is approximately 16 kg/hour.

Amelancier alnifolia (Saskatoon serviceberry): The fruit of the Saskatoon serviceberry is comparable to the blueberry. The picking rate of Vaccinium corymbosum (blueberry) is approximately 5 kg/hour. According to estimates the picking rate of the Saskatoon serviceberry is similar.

Amelanchier laevis (Saskatoon serviceberry): The fruit of the Saskatoon serviceberry is comparable to the blueberry. The picking rate of de Vaccinium corymbosum (blueberry) is approximately 5 kg/hour. According to estimates the picking rate of the Saskatoon serviceberry is similar.

Amelanchier lamarckii (Saskatoon serviceberry): The fruit of the Saskatoon serviceberry is comparable to the blueberry. The picking rate of de Vaccinium corymbosum (blueberry) is approximately 5 kg/hour. According to estimates the picking rate of the Saskatoon serviceberry is similar.

Arbuntus unedo (strawberry tree): The fruit of the strawberry tree are approximately 2cm. This results in the estimate that the picking rate will be approximately half that of the plum. Prunus domestica (plum) heeft een picking rate of approximately 24,5 kg/hour. According to estimates the picking rate of the strawberry tree is 12,25 kg/hour.

Aronia arbutifolia (chokeberry): The chokeberry is similar to the blueberry. The picking rate of Vaccinium corymbosum (blueberry) is 5 kg/hour. The estimate is that the picking rate of the two species will be similar. For that reason the picking rate of chokeberry has been estimated to be 5 kg/hour.

Aronia melanocarpa (chokeberry): The chokeberry is similar to the blueberry. The picking rate of Vaccinium corymbosum (blueberry) is 5 kg/hour. The estimate is that the picking rate of the two species will be similar. For that reason the picking rate of chokeberry has been estimated to be 5 kg/hour.

Aronia prunifolia (chokeberry): The chokeberry is similar to the blueberry. The picking rate of Vaccinium corymbosum (blueberry) is 5 kg/hour. The estimate is that the picking rate of the two species is similar. For that reason the picking rate of chokeberry has been estimated to be 5 kg/hour.

Berberis aristata (European barberry): The fruit of this plant is similar to barberry. The picking rate of berberis vulgaris (barberry) is 5 kg/hour. The estimate is that the picking rate of European barberry will be similar.

Berberis vulgaris (barberry): The barberry is similar to the blueberry. The picking rate of Vaccinium corymbosum (blueberry) is 5 kg/hour. The estimate is that the picking rate of the two species is similar. For that reason the picking rate of barberry has been estimated to be 5 kg/hour.

Castanea mollissima (sweet chestnut): This plant, like Castanea sativa, is a chestnut tree. The estimate is that C. mollisima has the same picking rate, namely 15,5 kg/hour.

Castanea sativa (sweet chestnut): The picking rate of sweet chestnut is 15,5 kg/hour (Heijs, n.d.).

Chaenomeles cathayensis (Chinese quince): The Chinese quince is similar to apple and pear. The picking rate of Pyrus communis (pear) is 110 kg/hour. The picking rate of Malus domestica (apple) is 122,5 kg/hour. The average of these two is 116,25 kg/hour. The estimate is that this is approximately the picking rate for quince.

Chaenomeles speciosa (Japanese quince): The Japanese quince is similar to apple and pear. The picking rate of Pyrus communis (pear) is 110 kg/hour. The picking rate of Malus domestica (apple) is 122,5 kg/hour. The average of these two is 116,25 kg/hour. The estimate is that this is approximately the picking rate for quince.

Chaenomeles spp. (flowering quince): The flowering quince is similar to apple and pear. The picking rate of Pyrus communis (pear) is 110 kg/hour. The picking rate of Malus domestica (apple) is 122,5 kg/hour. The average of these two is 116,25 kg/hour. The estimate is that this is approximately the picking rate for quince.

Cornus kousa (Japanese dogwood): The fruit of this tree is similar to raspberry. The picking rate of Rubus ideaus (raspberry) is 3,5 kg/hour. The estimate is that the picking rate of the two species is similar. For that reason the picking rate of C. kousa has been estimated to be 3,5 kg/hour.

Cornus mas (Cornelian cherry): The fruit of this plant is similar to cranberry. The picking rate of Vaccinium macrocarpon (cranberry) is 16 kg/hour. The estimate is that the picking rate of the two species is similar. For that reason the picking rate of C. mas has been estimated to be 16 kg/hour.

Cornus sanguinea (dogwood): The fruit of this plant is similar to black currant. The picking rate of Ribes nigra (black currant) is 9 kg/hour. The estimate is that the picking rate of the two species is similar. For that reason the picking rate of C. sanguinea has been estimated to be 9 kg/hour.

Crateagus persimilis (hawthorn): The fruit of this plant is similar to cranberry. The picking rate of Vaccinium macrocarpon (cranberry) is 16 kg/hour. The estimate is that the picking rate of the two species is similar. For that reason the picking rate of C. mas has been estimated to be 16 kg/hour.

Crateagus pinnatifida (hawthorn): The fruit of this plant is similar to cranberry. The picking rate of Vaccinium macrocarpon (cranberry) is 16 kg/hour. The estimate is that the picking rate of the two species is similar. For that reason the picking rate of C. mas has been estimated to be 16 kg/hour.

Cydonia oblonga (quince): The quince is similar to apple and pear. The picking rate of Pyrus communis (pear) is 110 kg/hour. The picking rate of Malus domestica (apple) is 122,5 kg/hour. The average of these two is 116,25 kg/hour. The estimate is that this is approximately the picking rate for quince.

Diospyros virginiana (persimmon, kaki): According to estimates the picking circumstances of this plant are similar to apples. For that reason the picking rate has been estimated to equal that of Malus pumila, namely 122,5 kg/hour.

Diospyrus kaki (persimmon, kaki): According to estimates the picking circumstances of this plant are similar to apples. For that reason the picking rate has been estimated to equal that of Malus pumila, namely 122,5 kg/hour.

Diospyrus virginia (persimmon, kaki): According to estimates the picking circumstances of this plant are similar to apples. For that reason the picking rate has been estimated to equal that of Malus pumila, namely 122,5 kg/hour.

Elaeagnus umbellata (autumn olive): The fruit of this plant is similar to red currant. The picking rate of Ribes rubrum (red currant) is approximately 9 kg/hour. The estimate is that the picking rate of the two species is similar. For that reason the picking rate has been estimated to be 9 kg/hour.

Feijoa sellowiana (pineapple guava): The fruit of this plant is, size wise, best comparable to peaches. The picking rate of Prunus salicina (perzik) is 105 kg/hour. The estimate is that this is approximately the picking rate for pineapple guava.

Hippophae rhamnoides (sea buckthorn): The fruit of this plant is similar to cranberry. The picking rate of Vaccinium macrocarpon (cranberry) is 16 kg/hour. The estimate is that this is approximately the picking rate for sea buckthorn.

Hovenia dulcis (Japanese raisin tree): The fruit of the Japanese raisin tree is similar to blueberry. The picking rate of Vaccinium corymbosum (blueberry) is approximately 5 kg/hour. The estimate is that this is approximately the picking rate for Japanese raisin tree.

Ilex aquifolium (holly): Due to growth habit and presence of thorns, the picking rate of holly is best comparable to blackberry. The picking rate of Rubus fruticosus (braam) is 5,5 kg/hour. The estimate is that this is approximately the picking rate for holly.

Lonicera caerulea (honeysuckle): The fruit of this plant is similar to blueberry. The picking rate of Vaccinium corymbosum (blueberry) is 5 kg/hour. The estimate is that this is approximately the picking rate for honeysuckle.

Lycium barbarum (gojiberry): The fruit of this plant is similar to honeysuckle. The picking rate of Lonicera caerulea (honeysuckle) is 5 kg/hour. The estimate is that this is approximately the picking rate for gojiberry.

Malus domestica (apple): The picking rate of all varieties of apples is 80 to 165 kg/hour (Heijs, n.d.). The average of this is 122,5 kg/hour.

Malus pumila (apple): Malus pulima is an apple tree like Malus domestical. For that reason the estimate is that the same picking rate will be valid: 122,5 kg/hour. This value is supported by KWIN Fruitteelt rapport by Wageningen University & Research (Heijerman-Peppelman & Roelofs, 2010).

Morus alba (white mulberry): The fruit of this plant is similar to blackberry. The picking rate of Rubus fruticosus (braam) is 5,5 kg/hour. The estimate is that this is approximately the picking rate for white mulberry.

Morus nigra (black mulberry): The fruit of this plant is similar to blackberry. The picking rate of Rubus fruticosus (braam) is 5,5 kg/hour. The estimate is that this is approximately the picking rate for black mulberry.

Prunus armeniaca (apricot): Apricot has a picking rate of 50 to 55 kg/hour (Heijs, n.d.). The average of this is 52,5 kg/hour.

Prunus avium (cherry): The picking rate of cherry is 12 kg/hour (Heijs, n.d.).

Prunus cerasifera (cherry plum): The cherry plum is related to Prunus domestica (plum) (Eet Verleden, 2018). The fruit of both plants are similar. Prunus domestica has a picking rate of 24,5 kg/hour. The estimate is that this is approximately the picking rate for cherry plum.

Prunus cerasus (sour cherry): The picking rate of sour cherry is 12 kg/hour (Heijs, n.d.).

Prunus domestica (plum): The picking rate of plum is 13 to 36 kg/hour (Heijs, n.d.). The average of this is 24,5 kg/hour.

Prunus insititia (damson): Damson is similar to pluot. Prunus salicina x Prunus armeniaca (pluot) has a picking rate of 38,25 kg/hour. The estimate is that this is approximately the picking rate for damson.

Prunus persica (peach): According to estimates a peach has twice the mass of an apricot. The picking circumstances will be similar. For that reason the estimate is that the picking rate will be twice that of apricot with a picking rate of 105 kg/hour.

Prunus persica nusipersica (nectarine): This plant is comparable to Prunus persica (perzik). The picking rate of peach is 105 kg/hour. The estimate is that this is the picking rate for nectarine.

Prunus salicina (Japanese plum): According to estimates a peach has twice the mass of an apricot. The picking circumstances will be similar. For that reason the estimate is that the picking rate will be twice that of apricot with a picking rate of 105 kg/hour.

Prunus salicina x Prunus armeniaca (pluot): This fruit is a cross between plum and apricot. Prunus domestica (plum) has a picking rate of 24,5 kg/hour. Prunus armeniaca (apricot) has a picking rate of 52 kg/hour. The average of this is 38,25 kg/hour.

Prunus tomentosa (Nanking cherry): According to estimates the picking rate is similar to cherry. The picking rate of Prunus avium (cherry) is 12 kg/hour.

Pyrus bretschneideri (Chinese white pear): The picking rate of Chinese white pear is similar to the picking rate of pear. For that reason the estimate is a picking rate of 110 kg/hour.

Pyrus communis (pear): The picking rate of pear is 60 to 160 kg/hour (Heijs, n.d.). The average of this is 110 kg/hour.

Pyrus communis (Chinese pear): The picking rate of a Chinese pear is similar to the picking rate of pear. For that reason the estimate is a picking rate of 110 kg/hour.

Ribes divaricatum (black gooseberry): This berry is similar to black currant. Ribes nigra (black currant) has a picking rate of approximately 9 kg/hour. The estimate is a picking rate of 9 kg/hour.

Ribes 'Josta' (jostaberry): This berry is similar to black currant. Ribes nigra (black currant) has a picking rate of approximately 9 kg/hour. The estimate is a picking rate of 9 kg/hour.

Ribes nigra (black currant): The picking rate of black currant is 6 to 12 kg/hour (Heijs, n.d.). The average of this is 9 kg/hour.

Ribes rubrum (red currant): The picking rate of red currant is 6 to 12 kg/hour (Heijs, n.d.). The average of this is 9 kg/hour.

Ribes uva-crispa (gooseberry): Within this species there are varieties with and without thorns. The picking rate of gooseberry without thorns is 5-8 kg/hour. The average of this is 6,5 kg/hour. The picking rate of gooseberry with thorns is between 3-4 kg/hour. The average of this is 3,5 kg/hour. For all gooseberries the picking rate averages to 5 kg/hour. (Heijs, n.d.)

Rubus fruticosus (blackberry): Blackberry has a picking rate of 5,5 kg/hour (Heijs, n.d.).

Rubus hibrids (tayberry): This is a cross between raspberry and blackberry (Garmundo, n.d.). The picking rate of Rubus ideaus (framboos) is 3,5 kg/hour. The picking rate of Rubus fructicosus is 5 kg/hour. The average of this is 4,25 kg/hour.

Rubus ideaus (raspberry): Within this species there are two sets of varieties: the summer-fruiting and autumn-fruiting raspberry. The summer-fruiting raspberry has a picking rate of 4 kg/hour. The picking rate of autrumn-fruiting raspberry is 3 kg/hour. The average of this is 3,5 kg/hour (Heijs, n.d.).

Rubus loganobaccus (loganberry): The loganberry is a cross between raspberry and blackberry (Directplant, n.d.). The picking rate of Rubus ideaus (framboos) is 3,5 kg/hour. The picking rate of Rubus fructicosus is 5 kg/hour. This averages to 4,25 kg/hour.

Sorbus aucuparia (mountain ash): The fruit of this plant is similar to red currant. The picking rate of Ribes rubrum (red currant) is 9 kg/hour. The estimate is that this is approximately the picking rate for mountain ash.

Sorbus domestica (service tree): The fruit of this plant is similar to red currant. The picking rate of Ribes rubrum (red currant) is 9 kg/hour. The estimate is that this is approximately the picking rate for service tree.

Sorbus torminalis (service tree): The fruit of this plant is similar to red currant. The picking rate of Ribes rubrum (red currant) is 9 kg/hour. The estimate is that this is approximately the picking rate for service tree.

Vaccinium corymbosum (blueberry): The 'masterdocument oogstgegevens voedselbos plantgoed' gives two different picking rates. The picking rate for mature plants is 6 kg/hour. The picking rate for young plants is 4 kg/hour. After 10 years the plant is fully grown. If the picking rate for the first 10 years is 4 kg/hour and the next 10 years the picking rate is 6 kg/hour, the average picking rate is 5 kg/hour (Heijs, n.d.).

Vaccinium macrocarpon (cranberry): Cranberry has a picking rate of 16 kg/hour (Heijs, n.d.).

Viburnum lentago (sheepberry): The fruit of this plant is similar to blueberry. The picking rate of Vaccinium corymbosum (blueberry) is 5 kg/hour. The estimate is that this is approximately the picking rate for sheepberry.