

Aneta Dacko, Mariusz Dacko

Methodology for the Valuation of Perennial Crop Plantations in the Context of the Plant Life Cycle: A Case Study of Highbush Blueberries

Abstract

Aim of the work: The aim of the study was to systematise the methodology for valuing perennial crop plantations, taking into account the biological life cycle of the plant.

Research method: Based on an analysis of the legal regulations in Poland and a review of the relevant literature, a critical assessment was conducted of the methods commonly applied in valuation practice, including the cost of replacement and liquidation approaches, the mixed approach, and the Skierniewice method. The theoretical considerations were verified through a case study of a highbush blueberry plantation (*Vaccinium corymbosum* L.).

Key results: It should be noted that applying the cost-based approach to a plantation in its full production phase would lead to a significant underestimation of its market value, which at this stage is primarily determined by its income-generating potential and prevailing market conditions rather than by the sum of historical investment outlays. Following a critical review of the available methods, it was concluded that, under Polish legal conditions, the most comprehensive tool for valuing perennial plantations, already from the first year of their operation and ensuring consistency with the requirements of the Real Estate Management Act, remains the Skierniewice method. However, attention was drawn to the sensitivity of this method to the potential consequences of subjective assessments of plantation quality parameters, as well as to the need for caution when applying price indices during transitional periods preceding updates of normative tables.

Aneta Dacko, PhD Eng., University of Agriculture in Krakow, Faculty of Environmental Engineering and Geodesy, Department of Agricultural Surveying, Cadastre and Photogrammetry, 253a Balicka St., 30-198 Krakow, Poland, e-mail: aneta.dacko@urk.edu.pl, ORCID: 0000-0003-1470-5442; **Mariusz Dacko, PhD Eng., URK Professor**, University of Agriculture in Krakow, Faculty of Agriculture and Economics, Department of Economics and Food Management, 21 Mickiewicza Ave., 31-120 Krakow, Poland, e-mail: mariusz.dacko@urk.edu.pl, ORCID: 0000-0001-8424-4720.



This work is licensed under the Creative Commons Attribution 4.0 International.
[Creative Commons CC BY 4.0.](https://creativecommons.org/licenses/by/4.0/)

Main conclusions: In conclusion, the necessity of an interdisciplinary approach to valuation was emphasised, combining the analytical expertise of a property valuer with specialised agrotechnical knowledge.

Keywords: real estate valuation, perennial crop plantations, Skierniewice method, plantation value.

1. Introduction

Perennial crop plantations, primarily comprising fruit orchards, fruit shrub plantings, and ornamental plant crops, constitute a significant component of the assets of agricultural holdings and horticultural enterprises. These shape the structure of land use, influence the agricultural landscape, and determine long-term management strategies (Cymerman, 2013). As dynamic biological assets, they are subject to processes of development and ageing, which results in the fluctuation of their economic value over time and necessitates the application of valuation methods that differ from those appropriate for traditional fixed assets.

In Polish valuation practice, plantations are subject to valuation in numerous contexts, including, among others, real-estate transactions, debt-recovery proceedings, compensation proceedings, expropriation for public investments, and the securing of credit claims. The legal basis for these procedures is set out in the Real Estate Management Act (Act, 1997, Art. 135(6)) and in the Regulation on Real Estate Valuation, whose provisions (Regulation, 2023, §§ 25–28) define the rules for applying the cost-of-replacement method, and which also govern the valuation of liquidation costs (§ 19) and the valuation of agricultural real estate with plantings (§ 58). Detailed guidelines in this regard are also set out in the National Specialised Valuation Standard (KSWS, 2015).

Despite the existing legal framework, the process of estimating value remains a challenge due to biological variability, technological diversity, and the temporal character of plantation development. The choice of an appropriate methodology therefore requires an individualised approach, closely correlated with the stage of the plantation's life cycle (Zmarlicki, 2017). Young plantings, plantations in the full fruiting phase, and those in the terminal phase (requiring liquidation) represent distinct economic situations and justify the application of different valuation methods.

The aim of this article is to systematise the methods used in the valuation of perennial crop plantations in Poland and to present their theoretical and methodological foundations. Particular attention is devoted to linking valuation approaches with the biological life cycle of plants. The analysis covers the

cost-of-replacement method, the mixed (cost-income) approach, and the liquidation-cost method, as well as the formalised standard applied in fruit growing, the Skierniewice method (Zmarlicki, 2024; Zmarlicki, Brzozowski, 1998).

Although the subject of perennial plantations appears in the literature scarce. The issue is usually discussed fragmentarily, or as an element of broader studies on agricultural or non-urbanised land (Bud-Gusaim, 1997; Cymerman et al., 2024; Schilbach, 2001). This article fills this research gap by presenting an organised review of plantation valuation methodology under Polish conditions.

2. Literature review

The issue of valuing perennial crop plantations is present in the Polish literature on real estate valuation, horticultural economics, and agricultural law, although comprehensive methodological studies in this area remain scarce (Cymerman, 2013; Cymerman et al., 2024; Zmarlicki, 2017; 2024). The absence of a representative market for plantation transactions, combined with strong heterogeneity in species, variety, technology (planting systems), and age, limits the applicability of the comparative approach. Consequently, valuation practice relies mainly on cost-based, mixed, or normative concepts (estimation tables). Research in agricultural accounting focuses primarily on biological assets with a short production cycle, such as work in progress, and on the cost structure within the FADN system (Minut-Kaszyńska, 2018). This underscores the shortage of dedicated analyses for perennial plantations with a long life cycle. In broader studies on the valuation of agricultural real estate, plantations are usually treated as component parts of the land property, and less often as autonomous objects of valuation (Bud-Gusaim, 1997; Cymerman, 2022; Schilbach, 2001). The key methodological contribution in this field was developed by Zmarlicki and co-workers (Zmarlicki, 2002; 2007; 2011; 2017; Zmarlicki, Brzozowski, 1996; 1998; Zmarlicki, Zwierz, 1987), which laid the foundations for the contemporary, standardised Skierniewice method (Zmarlicki, 2024). This system integrates normative current plant values (W_b), values of lost benefits (W_{uk}), and numerous coefficients, including habitat quality classification and fruit-price indices, updated to reflect technological and market changes. An important thread in the literature is the necessity of conducting a reliable inventory of the plantation as the foundation of a credible valuation (Cymerman, 2022). The precise determination of species, variety, developmental phase, planting density, habitat conditions, and phytosanitary condition is essential for selecting the appropriate estimation parameters. This requirement is reflected in legal provisions (Regulation, 2023, § 58; Act, 1997, Art. 154–158), which impose

an obligation to precisely identify the component parts of real estate. Additional professional guidelines are contained in the KSWs (2015), which emphasises establishing the species composition, age, condition, and production function of the plantation during the site inspection. The issue of plantation valuation is also closely linked to research on the estimation of agricultural damage. The literature emphasises the role of lost benefits (*lucrum cessans*) in determining the amount of compensation, which is consistent with legal provisions (Act, 1964, Art. 361; Act, 1997, Art. 128(1)) implementing the principle of full compensation. Valuation practice in cases of ecological damage or changes in land use is also influenced by environmental and nature-protection regulations. Both normative documents and legal regulations at the national and EU level determine the choice of approach applied in the valuation. For the cost of replacement and liquidation methods, the provisions of the Regulation on Real Estate Valuation (Regulation, 2023, § 19, §§ 25–28) are of key importance. The literature review leads to the conclusion that, during the production phase of the plantation, the most suitable basis for valuation is provided by cost-income approaches and specialised normative studies, in particular the Skierniewice method, owing to their ability to integrate the costs of establishing the plantation, its biological characteristics, and its income-generating potential.

3. Methodology

The study adopted a research approach based on a critical analysis of the literature in the field of property valuation, agricultural and horticultural economics, and on an analysis of the applicable legal regulations.

The source material comprised peer-reviewed scientific articles, specialised monographs, professional standards for property valuers, and industry handbooks concerning the estimation of damage in perennial crops. A detailed analysis was conducted of the legal framework governing plantation valuation in Poland, in particular the provisions of the Real Estate Management Act and the Regulation of the Council of Ministers on Real Estate Valuation. These documents defined the normative basis for applying the cost, mixed, and liquidation approaches, allowing a distinction to be drawn between elements of valuation that arise directly from statutory delegation and those that have developed through good professional practice.

Supplementary research material was provided by publications of the Institute of Horticulture in Skierniewice, containing the methodological framework and normative tables applied in the so-called Skierniewice method. These sources enabled a comparative assessment of the approaches analysed and the identification

of practical problems, such as the inventory of plantings, the identification of plant age, and the assessment of their phytosanitary condition.

The material gathered was used to systematise the methods applicable to the valuation of perennial crop plantations. As a supplementary research method, expert consultation (an unstructured interview) was employed with the owner of a commercial highbush blueberry plantation, managed at an advanced agrotechnical level. This made it possible to verify the adopted assumptions model and to confront the theoretical analysis with the production and cost realities of contemporary fruit growing.

4. Results

4.1. The plantation life cycle as a determinant of method choice

The fundamental methodological premise in the valuation of a plantation is recognising it as a biological asset with an economic character that varies over time. Life-cycle analysis makes it possible to distinguish phases in which different bases of value predominate: the cost basis (related to outlays) or the income basis (related to benefits).

As Bud-Gusaim (2005) indicates, the full life cycle of a plantation, from the investment decision to its liquidation, is multiphase in character and comprises stages that differ in the intensity of outlays, the level of risk, and the capacity to generate economic benefits. These phases determine the variable market and production value of the plantation: from the high-cost period of establishment and non-fruiting growth, through increasing and full fruiting, to the terminal stage concluded by the liquidation of the planting.

A similar, though more synthetic, presentation of the stages of plantation development is given by Cymerman et al. (2024), who emphasise the necessity of adapting valuation methods to the specific production and botanical characteristics of perennial plants. These authors distinguish three fundamental periods in the functioning of a plantation: the investment period, the yielding period, and the liquidation period.

The investment period covers the time from the establishment of the plantation to the point at which the revenues obtained from the first harvests exceed the current operating costs; its length varies by species and depends on habitat conditions. This is followed by the yielding period, whose time may range from several to several dozen years, depending on the type of crop. The cycle is closed by the liquidation period, covering the removal of the plants and the preparation of the land for further use. This period is significant from the point of view of identifying the final costs and the liquidation value.

Taking both concepts together makes it possible to treat the three periods distinguished by Cymerman and co-authors (2024) as an economic simplification of the more detailed, five-phase model of plantation development proposed by Bud-Gusaim (2005). Such an approach creates a coherent analytical framework for the valuation of perennial crops, making it possible to link the biological life cycle of the plantings with the appropriate choice of methods and bases of valuation at each stage of their functioning.

4.2. Case study: valuation of a highbush blueberry plantation (*Vaccinium corymbosum* L.)

Verification of the theoretical relationships described above was carried out on the basis of a case study of a highbush blueberry plantation. The subject of the analysis was a model object with an area of 1 ha, established from certified nursery stock and managed at a high agrotechnical level, with an assumed thirty-year life cycle ($T_c = 30$) and a yielding period of 28 years ($T = 28$).

It should be emphasised that the purpose of this subsection is not to present monetary valuation results for a specific object, but rather to offer a critical discussion of the methodological and practical conditions of the estimation process. The observations and conclusions presented constitute a synthesis of the literature analysis and of the expert consultations conducted with the owner of a commercial blueberry plantation, which made it possible to confront the theoretical assumptions with production realities.

4.2.1. Cost-of-replacement method

The cost-of-replacement method is applied to young plantations that are in the investment phase or have not yet entered the fruiting period, when the plantings do not yet generate income streams and their economic value reflects the outlays necessary to bring the crop to its current state. The essence of this method is to determine the total cost of reproducing a plantation of identical characteristics, comprising: species, variety, age, spacing, training system, and accompanying infrastructure. The structure of these costs usually includes:

- site preparation (mechanical cultivation, starter fertilisation, soil pH adjustment);
- purchase of nursery stock;
- planting and maintenance costs in the first years of cultivation;
- technical infrastructure, including support structures and irrigation systems;
- ongoing plant protection, fertilisation, and formative treatments (pruning).

The general formula for calculating value using the cost-of-replacement method takes the form:

$$W_{odt} = \sum_{i=1}^n K_i, \quad (1)$$

where:

W_{odt} – the replacement value of the plantation,

K_i – the value of expenditures associated with successive cost categories,

i – the expenditure category,

n – the number of categories adopted.

In the case of a highbush blueberry plantation, the application of the cost approach requires particular attention and a critical stance towards the generalised knowledge available in the literature. First, when making investment decisions, farmers rationalise the costs of the necessary work (for example, by purchasing sawdust from a nearby sawmill, establishing the plantation on naturally acidified soil, or optimising the costs of soil acidification, if this proves necessary). Second, the process of establishing and early operation of a blueberry plantation is characterised by high technological and biological complexity and considerable heterogeneity of outlays. Already at the stage of analysing the initial costs, at least six fundamental cost categories (K_1 – K_6) can be distinguished, differing both in their economic character and in the function they perform in the plantation's life cycle. It is worth noting that some of the costs discussed are obligatory, while others may, but need not, occur.

The first category (K_1) comprises soil preparation costs, covering work related to levelling the terrain, weed clearance, and, above all, adjusting the soil pH to the level required by highbush blueberry (approximately pH 3.5–4.5). They will also include the design and construction of cultivation strips through furrow ploughing. Even at this stage, a significant methodological problem of the cost approach becomes apparent: the boundary for the replacement cost of the plantation is not unambiguous. Valuation requires a decision as to whether the actual method of soil preparation should be reconstructed, or the currently recommended one (it is worth noting, for instance, that blueberry plantations are also established in containers). In practice, this leads to considerable differences in the estimated level of costs K_1 , the sum of which may yield a different economic value for the plantation.

The second cost category (K_2) concerns the purchase and application of mulching material (organic matter, e.g., coniferous sawdust). Under conditions of intensive blueberry cultivation, the scale of these costs is significant; for a plantation with an area of 1 ha, this may mean the need to apply several hundred cubic metres

of sawdust. These costs are markedly local in character, heavily dependent on the availability of the raw material, its price, and the cultivation technology adopted. In the cost approach, they should therefore be considered while taking into account the habitat and organisational conditions of the holding.

The most capital-intensive cost item when establishing a blueberry crop will usually be the purchase of nursery stock and its planting (K_3). For a 1 ha highbush blueberry plantation, one must reckon with the need to purchase several thousand seedlings, and these seedlings may already differ significantly from the outset in age, root-system quality, and yielding potential, as well as in their source of origin (usually the place of purchase), and hence also in price. From the valuation perspective, it is of key importance that the cost of the biological material is not a simple determinant of the plantation's future productivity or its economic durability, since both of these issues depend on the farmer's knowledge and experience and on the maintenance treatments that will be undertaken in subsequent years of the plantation's life cycle. The cost approach disregards this biological heterogeneity, reducing it to a homogeneous category of investment outlays.

Another important category comprises the costs of purchasing and installing the irrigation system together with fertigation (K_4). Typical technological solutions include at least two drip lines per row of plants, as well as filters, fittings, pumps, and control automation. The scale of these costs increases considerably where the holding does not have its own water intake, which may generate additional investment and operating costs (in addition to electricity costs and installation maintenance costs, significant costs of purchasing water will then also arise). From the valuation standpoint, here the problem arises of a blurred boundary between the plantation as a biological asset and the technical infrastructure that conditions its functioning but is not always functionally identical to it (for example, in order to rationalise costs, the irrigation system may have been designed to also serve another, neighbouring crop).

The fifth cost category (K_5) covers the construction of the plantation's perimeter fencing. Even in a budget variant, the purchase of a considerable quantity of materials becomes necessary (hundreds of metres of forest mesh and tensioning wire, hundreds of posts, gate components). Each case will, however, be individual in character, depending on the shape of the plot and the location of the plantation, which may constitute a separate plot or part of an already fenced holding. Here, too, a situation may arise in which the fencing of the plantation being valued partly constitutes an element of the neighbouring crop. The fencing performs a protective function, not directly affecting the biological production potential of the shrubs, but conditioning the possibility of maintaining them and protecting them against external interference, especially during fruiting. The cost approach

does not differentiate between costs of a productive, protective, or preventive nature, treating them all as elements of replacement value. Similarly, here it does not distinguish between necessary costs (the purchase and planting of the crop) and possible, but not always necessary, costs, to which the fencing precisely belongs. In the case of a crop established within the boundaries of an already fenced holding, the plantation's fencing may not be needed at all, or may be needed only in part.

The list of initial costs is closed by starter maintenance in the year the plantation is established (K_0), which includes, among other things, weed control, formative pruning, mowing of the inter-row spaces, and monitoring of plant health status. These treatments are a precondition for the plantation entering the production phase.

The total sum of unit costs incurred in the first year of a highbush blueberry plantation's operation can reach a level characteristic of large-scale agricultural investments, with its magnitude depending to the greatest extent on the costs of nursery stock, mulch, and bringing the soil to the required pH. Irrigation systems and fencing are also of considerable importance in cost calculations. It must be emphasised, however, that the scale of the costs incurred does not in itself determine the economic value of the plantation, since the cost approach does not take biological and market risk into account.

In subsequent years of the plantation's life cycle, further, economically justified costs arise, related to the purchase and installation of hail-protection covers, periodic replenishment of the mulch, pruning of the shrubs, or ongoing maintenance of the inter-row spaces. The dynamics of these costs further highlight the limitations of the cost approach, which lacks the tools to consistently link the costs incurred in establishing the plantation and maintaining it through successive development phases with its changing economic value. In sum, the replacement value of a plantation may differ significantly from its market value, which is determined primarily by its profitability.

It should also be mentioned that the value of the plantation determined under the cost approach in the year of its establishment may, at this stage, still disregard wear. In subsequent years, however, this becomes a significant aspect of the valuation. It is therefore taken into account in the form of depreciation in the mixed approach and in the Skierniewice valuation concept, both of which are appropriate for valuing plantations in later phases of the life cycle.

4.2.2. Mixed (cost-income) approach

The mixed approach, integrating cost and income components, is widely applied in valuation practice.

Under this approach, the value of the plantation is defined as the aggregate of two components:

- the non-depreciated portion of the establishment costs (the replacement value adjusted for wear);
- the value of lost benefits (*lucrum cessans*) projected from the valuation date to the end of the plantation's period of economic usefulness.

According to Cymerman (2025) and Schilbach (2001), this value is expressed as:

$$W_p = K(1 - \frac{t}{T}) + D_n, \quad (2)$$

where:

W_p – the value of the plantation,

K – the total costs of establishing the plantation,

t – the number of years the plantation has been in use up to the valuation date,

T – the total yielding period,

D_n – the present value of lost benefits.

The mixed approach, combining elements of the cost and income approaches, constitutes one of the more frequently applied solutions in the valuation of perennial plantations in the phases of increasing yield and full production, particularly in compensation proceedings. Its application results from the need to capture two fundamental sources of value: the accumulated capital invested in the plantation (taking its wear into account) and the plantation's income potential, expressed through lost benefits. At the same time, this method introduces process dilemmas into the valuation characteristic of both the cost approach and the income approach, which calls for particular interpretative caution.

The first component of the mixed approach, understood as the non-depreciated part of the costs of establishing the plantation and maintaining it up to the point of the first harvest, $K(1 - \frac{t}{T})$, reflects the degree of wear of the capital invested in the plantation (K), comprising both the biological component (seedlings) and the technical component (mulch, the irrigation and fertigation system, and fencing). As the period of the plantation's use elapses, this value decreases, which is expressed by the component $K \cdot \frac{t}{T}$, interpreted as the economic depreciation of capital from the start of yielding to the valuation date. This depreciation is linear in character and relates to the total yielding period of the plantation (T) (Cymerman et al., 2024).

Let us analyse an example in which the blueberry plantation begins yielding in the second year of use, while the valuation is carried out in the fifth year. This means that, up to the valuation date, the plantation had remained in the yielding phase for three years ($t = 3$). The total life cycle of the plantation is $T_c = 30$ years,

and the yielding period is $T = 28$ years. In such a formulation, the value of the plantation can be written as:

$$W_p = K_{1-2} \left(1 - \frac{3}{28}\right) + D_{N6-28}. \quad (3)$$

This calculation takes into account three depreciation charges on the capital invested in establishing and maintaining the plantation in the years preceding the first harvest, which constitutes the first component of the formula, namely $K_{1-2} \left(1 - \frac{3}{28}\right)$. It also covers the value of net lost benefits (the difference between the value of the potential harvest and the anticipated costs of maintaining and operating the plantation) that could have been obtained from the valuation date to the end of the yielding period.

The second component of the formula, D_{N6-28} , refers to future values and, as such, requires their discounting to the valuation date. The application of a discount rate in the mixed approach, however, gives rise to further methodological dilemmas in the valuation of perennial plantations. In the case of real estate valuation using the income approach with the technique of discounting income streams, the discount rate is set as the rate of return required by purchasers of similar properties, taking investment risk into account. The starting point is market analysis and the determination of the relationship between the income from properties and the costs of their acquisition. In the case of valuing perennial plantations, one can indeed speak of income from the plantation, but it is probably only in exceptional situations that such plantations become the subject of market transactions. Determining the discount rate in a manner analogous to that used for residential or commercial premises is, in practice, limited or impossible on a local scale.

There may be two solutions in such a situation. First, one can look for data on rates of return for the most closely comparable assets, for example by analysing lease rents and the market prices of plots used as orchards. However, this too will most probably be rare on a local scale. The ultimate solution may therefore be to use information on the yield of long-term treasury bonds as a reference point (the base rate) and to increase it by a premium for the specific risk of investing in a perennial plantation (i.e., yield and price risk, technological and organisational risk). Undoubtedly, a precise analytical attribution of the premium to individual risk factors would be very difficult; the valuer should therefore explain by how much, and why, the adopted rate is higher than the base rate. The risk premium could probably be justified by interviews with at least several local growers.

One must, however, be aware that the consequences of adopting a particular discount rate are very significant. A discount rate that is too high would lead to the marginalisation of the income component by overpricing the risk of not receiving income from the plantation, a risk that increases with the passage of

time in accordance with the discounting formula. Conversely, too low a rate could excessively inflate the value of the benefits lost in subsequent years of the plantation's anticipated life cycle. Such a lost benefit, although it remains a matter of an uncertain future, would, as the discount rate falls, become increasingly close to the present value of the net income actually achieved by the plantation at the moment of valuation.

An additional methodological problem is how to account for the decline in yields in the final phase of the yielding period, resulting from the ageing of the plants and their biological wear. This decline should be captured through the gradual reduction of the projected yields within the D_n component.

4.2.3. Liquidation-cost method

In accordance with the provision contained in the regulations (Regulation, 2023, § 19), the value of the liquidated component parts of the land (perennial crop plantations) constitutes the difference between the costs of the physical removal of the plantings and the value of the materials recovered in the course of dismantling.

$$W_{lik} = \sum_{i=1}^n K_i - \sum_{i=1}^n WM_i, \quad (4)$$

where:

W_{lik} – the value of the liquidated component parts,

K_i – the costs of the individual liquidation works (grubbing, removal of trellises, biomass shredding, land reclamation),

WM_i – the value of the recovered materials (firewood, steel elements, parts of the irrigation and fertigation system, etc.),

i – the stage of plantation liquidation,

n – the number of stages.

The liquidation-cost method is applied in the final phase of a perennial plantation's life cycle, when its production capacity has become fundamentally exhausted and the further maintenance of the crop is no longer economically justified. In contrast to valuation based on replacement costs or the calculation of lost benefits, this method assumes that the plantation has lost its usefulness as a productive asset, and the primary object of assessment becomes the economic consequences of terminating its use.

At this stage, the value of the plantation no longer derives either from future income or from historically incurred outlays, but from the balance of costs and any benefits associated with its removal. The liquidation method therefore focuses on the costs necessary to restore the land to a condition allowing its further use, with these costs being reduced by the value of the recovered materials. The value of the plantation determined in this way may be negative (when the costs of the

liquidation works exceed the value of the recovered materials), which constitutes a fully rational economic outcome.

From a methodological point of view, the correct determination of the costs of the liquidation works is of key importance. These usually include the removal of the plants (grubbing of the above-ground parts and root systems), the dismantling of technical infrastructure (irrigation and fertigation systems, support structures, fencing), the management or disposal of biomass, and land reclamation (including deacidification). In the case of blueberries, these are costs whose magnitude depends on the cultivation technology used, habitat conditions, and soil properties, which substantially limits the possibility of their standardisation.

Recovered values, such as wood, fencing elements, or parts of technical installations, are in practice rarely of significant economic importance and will therefore not offset the liquidation costs. Failing to take them into account would, however, lead to an overstatement of the plantation's negative value; they should therefore be identified and included in the valuation, even if their impact on the final result is limited.

This method provides a clear and practical basis for determining value in situations where the plantation has lost its usefulness and the key objective becomes restoring the land for further use. Considering the liquidation costs of a plantation is tantamount to assuming that the scenario of its continued operation is no longer economically rational. The liquidation cost method thus finds its justification in the valuation of perennial plantations in the final phase of their life cycle, allowing a realistic assessment of their value through the lens of the necessary costs and the possibility of offsetting them with recovered materials.

4.2.4. *Skierniewice method*

The Skierniewice method constitutes the only fully standardised system for valuing fruit-growing plantations in Poland. Its methodological construction is closely correlated with the compensation principles expressed in the Real Estate Management Act (Act, 1997, Art. 128–135), and in particular it implements the norm of Art. 135(6). This provision defines the value of the plantation as the sum of the costs of its establishment and maintenance up to the time of the first harvest, increased by the value of lost benefits. In the current version of the method (Zmarlicki, 2024), this paradigm is realised through the aggregation of the current value of the plants (W_b) and the value of lost benefits (W_{uk}), with both variables determined on the basis of normative cost and income tables.

The current-value parameter (W_b) is based on tables of investment costs developed by the Institute of Horticulture in Skierniewice, which reflect the accumulated outlays of the full investment cycle, from site preparation through to

the attainment of production capacity. The lost-benefits component (W_{uk}), in turn, constitutes the equivalent of the income not obtained during the period necessary to bring a new plantation to the full fruiting phase.

A key element of the methodology is the system of correction coefficients, taking into account habitat quality classification (W_{bwb}) and variety-rootstock selection (W_{bwuk}). Their correct application requires field verification (inventory) covering an assessment of site suitability (habitat and soil conditions), the phytosanitary condition of the plantings (health-status assessment), and cultivation technology (the production suitability of the variety and the rootstock used). The model also includes a fruit price correction index (W_{zco}), whose function is to offset the impact of short-term price fluctuations by referring the valuation to multi-year average prices. It must, however, be stressed that in current valuation practice this index (W_{zco}) should be omitted. According to the schedule of methodological work, its value will be established in 2026 and will apply during the transitional period up to 2028, for which the preparation and publication of new, updated normative tables have been planned.

The normative formula (Zmarlicki, 2024) takes the form:

$$W_{rs} = W_b \cdot W_{bwb} + W_{uk} \cdot W_{bwuk} \cdot W_{zco}, \quad (5)$$

where:

W_{rs} – the value of the fruit-growing plant,

W_b – the current value of plant X at age Y, read from the tables,

W_{uk} – the value of lost benefits from plant X at age Y, read from the tables,

W_{bwb} – the quality-classification index for the current value, determined on the basis of a site inspection (the average of the assessment of the characteristics determining the plant's current value, i.e., the site, habitat and soil conditions, and the health-status assessment index),

W_{bwuk} – the quality-classification index for the value of lost benefits, determined on the basis of a site inspection,

W_{zco} – the fruit-price change index.

In the valuation of a blueberry plantation, the application of this method appears to be the simplest solution from a procedural point of view. It amounts to substituting into the formula the values of the indices read from the normative tables and then multiplying them by the number of plants. The valuer's role is in this case limited to assessing the quality of the plantation's characteristics, aggregated into three indices:

- the site and habitat-soil conditions,
- the health status of the plants,
- the production suitability of the variety and rootstock.

At the same time, the universality and simplicity of this method raise doubts as to its precision, in particular regarding the disregard of the individual specificity of a given plantation. Establishing the correct value can be problematic, especially in a situation where the valuation is carried out by a valuer lacking specialised knowledge of the production technology of the given plant species.

The range of variability of the indices is, moreover, very wide, running from 0.20 to 1.35 for the current value and from 0.20 to 1.30 for the value of lost benefits. Adopting the maximum rates results in a more than sixfold (approximately 6.5-fold) increase in the value of a single plant compared with a valuation based on the same base categories W_b and W_{uk} at the minimum index levels. This underscores the crucial importance of their correct determination. For a person without practical experience in managing a blueberry plantation, assessing the plantation's characteristics can be particularly difficult, all the more so because these indices are based on qualitative scales: a four-point scale for the value W_b (very good, good, poor, bad) and a five-point scale for the value W_{uk} .

An additional limitation of the method is the absence of an unambiguous description of the assessment criteria adopted, for example a precise definition of which habitat-soil conditions correspond to a rating of 'good'. Moreover, it may be problematic to determine the value of a blueberry plantation aged over 18 years, which corresponds to the last entry included in the normative table presented by Zmarlicki (2024). Yet in the course of the expert consultations carried out with the owner of a commercial blueberry plantation, information was obtained indicating that the actual life cycle of this type of plantation can reach as much as 30 years. This discrepancy raises significant doubts as to the possibility of adequately reflecting the value of older plantations using the currently applicable normative tables.

Consequently, the application of this method in the valuation of a blueberry plantation requires not only interpretative caution but also supplementation with expert analysis and an individual assessment of the plantation's biological and production condition, in order to limit the risk of significant distortions in the estimated value.

5. Conclusion

Confronted with the realities of the highbush blueberry plantation case study, the theoretical analysis conducted leads to the fundamental conclusion that, in the valuation of biological assets, there is no universal algorithm appropriate for every stage of their development. The economic value of a plantation evolves over time, moving from a cost-based value in the investment phase, through a mixed value, to a negative liquidation value. Consequently, the uncritical application

of the cost of replacement method to plantations in full fruiting would result in a gross underestimation of their market value, since it would disregard premiums that are crucial for the investor: for time, for biological risk, and for stabilised yielding potential.

This phenomenon is observed particularly clearly in the case of intensive berry crops, where a dichotomy exists between the outlays incurred and the actual market value. High infrastructural costs, including irrigation systems or specific substrate preparation, do not translate linearly into the final value of the asset. During the production phase, this value is determined primarily by price conditions on the fruit market and current yield per hectare, which justifies the primacy of income-based and mixed approaches over cost-based ones.

Under Polish legal conditions, the optimal tool, especially in compensation proceedings, remains the Skierniewice method, which ensures consistency with legal requirements (Act, 1997, Art. 135(6)). It must be stressed, however, that its operational simplicity constitutes a significant methodological trap. The model's high sensitivity to the values of the correction coefficients means that the valuer's subjective assessment can generate extreme discrepancies in the final results. This risk is compounded by the necessity of relying on historical data; during the transitional period up to 2028, preceding the publication of the new tables by the Institute of Horticulture, valuers are obliged to exercise particular caution when applying price indices, which may fail to keep pace with market dynamics and breeding progress.

Ultimately, the credibility of a plantation valuation depends on the interdisciplinary competence of the valuer. This process requires going beyond the role of a financial analyst and possessing up-to-date agrotechnical knowledge adapted to local conditions. The correct identification of varieties, the assessment of phytosanitary condition, or the quality classification of the habitat all require specialised industry knowledge. In cases of a high degree of complexity or a high value of the object of valuation, an indispensable element of the valuer's toolkit should be the exchange of information with local growers and cooperation with horticultural experts, which would help minimise the risk of significant errors in estimating the value of perennial plantations.

Bibliography

Act. (1964). Ustawa z dnia 23 kwietnia 1964 r. – Kodeks cywilny (Dz.U. 1964 nr 16 poz. 93; t.j. Dz.U. 2025 poz. 1071, 1172, 1508; 2026 poz. 184, 507) [Act of 23 April 1964, Civil Code (Journal of Laws 1964, No. 16, item 93; consolidated text: Journal of Laws 2025, items 1071, 1172, 1508; 2026, items 184, 507)] (in Polish).

- Act. (1997). Ustawa z dnia 21 sierpnia 1997 r. o gospodarce nieruchomościami (Dz.U. 1997 nr 115 poz. 741; t.j. Dz.U. 2026 poz. 399) [Act of 21 August 1997 on Real Estate Management (Journal of Laws 1997, No. 115, item 741; consolidated text: Journal of Laws 2026, item 399)] (in Polish).
- Bud-Gusaim, J. (1997). *Wycena gospodarstw rolniczych oraz ich zasobów majątkowych* [Valuation of agricultural holdings and their property resources] (in Polish). Wydawnictwo SGGW.
- Bud-Gusaim, J. (2005). *Taksacja rolnicza* [Agricultural valuation] (in Polish). Wydawnictwo SGGW.
- Cymerman, R. (Ed.). (2013). *Podstawy rolnictwa i wycena nieruchomości rolnych* [Fundamentals of agriculture and the valuation of agricultural real estate] (in Polish) (3rd ed.). Educaterra.
- Cymerman, R. (Ed.). (2022). *Podstawy rolnictwa i wycena nieruchomości rolnych* [Fundamentals of agriculture and the valuation of agricultural real estate] (in Polish) (5th ed.). Educaterra.
- Cymerman, R., Kowalczyk, C., Kurowska, K., Podciborski, T., Zygmunt, R. (2024). *Podstawy gospodarki i wycena nieruchomości niezurbanizowanych: rolnych, leśnych i wodnych* [Fundamentals of management and the valuation of non-urbanised real estate: agricultural, forest, and water properties] (in Polish). Wydawnictwo Naukowe Tygiel.
- KSWS (National Specialised Valuation Standard). (2015). *Wycena nieruchomości rolnych* [Valuation of agricultural real estate] (in Polish). <https://pfsm.pl/aktualnosci/item/14-standardy-do-pobrania>
- Minut-Kaszyńska, I. (2018). *Metody wyceny produkcji roślinnej w toku* [Methods of valuing plant production in progress] (in Polish). Kujawsko-Pomorski Ośrodek Doradztwa Rolniczego w Minikowie.
- Regulation. (2023). Rozporządzenie Ministra Rozwoju i Technologii z dnia 5 września 2023 r. w sprawie wyceny nieruchomości (Dz.U. 2023 poz. 1832) [Regulation of the Minister of Development and Technology of 5 September 2023 on real estate valuation (Journal of Laws 2023, item 1832)] (in Polish).
- Schilbach, J. (2001). *Charakterystyka nieruchomości rolnych oraz zasady ich wyceny* [Characteristics of agricultural real estate and the principles of its valuation] (in Polish). Akademia Rolnicza im. Hugona Kołłątaja w Krakowie.
- Zmarlicki, K. (2002). *Określenie wartości roślin sadowniczych (na plantacjach towarowych) i upraw ogrodniczych (w ogrodach działkowych i przydomowych) przy wywłaszczaniu nieruchomości* [Determining the value of fruit-growing plants (on commercial plantations) and horticultural crops (in allotment and home gardens) in real estate expropriation] (in Polish). Polska Federacja Stowarzyszeń Rzeczoznawców Majątkowych.
- Zmarlicki, K. (2007). *Szacowanie wartości roślin sadowniczych na plantacjach towarowych oraz upraw ogrodniczych w ogrodach działkowych i przydomowych przy ustalaniu odszkodowań za wywłaszczenie* [Estimating the value of fruit-growing plants on commercial plantations and horticultural crops in allotment and home gardens when determining compensation for expropriation] (in Polish). Polska Federacja Stowarzyszeń Rzeczoznawców Majątkowych.

- Zmarlicki, K. (2011). *Określanie wartości plantacji kultur wieloletnich* [Determining the value of perennial crop plantations] (in Polish). Polska Federacja Stowarzyszeń Rzeczoznawców Majątkowych.
- Zmarlicki, K. (2017). *Szacowanie wartości ogrodnichich plantacji kultur wieloletnich* [Estimating the value of horticultural perennial crop plantations] (in Polish). Polska Federacja Stowarzyszeń Rzeczoznawców Majątkowych.
- Zmarlicki, K. (2024). *Szacowanie wartości ogrodnichich plantacji kultur wieloletnich* [Estimating the value of horticultural perennial crop plantations] (in Polish). InHort Instytut Ogrodnictwa.
- Zmarlicki, K., Brzozowski, P. (1996). *Metoda wyceny upraw ogrodnichich w warunkach ogrodów działkowych i ogrodów przydomowych* [A method for valuing horticultural crops under allotment garden and home garden conditions] (in Polish). Krajowa Rada PZD.
- Zmarlicki, K., Brzozowski, P. (1998). *Kosztowo-dochodowa metoda wyceny wartości odszkodowań za utracone rośliny sadownicze* [A cost-income method for valuing compensation for lost fruit-growing plants] (in Polish). Pracownia Wydawnictw Instytutu Sadownictwa i Kwiaciarstwa.
- Zmarlicki, K., Zwierz, W. (1987). *Metoda kosztowo-dochodowa wyceny wartości odszkodowań za utracone rośliny sadownicze i ozdobne w Pracowniczych Ogródkach Działkowych* [A cost-income method for valuing compensation for lost fruit-growing and ornamental plants in Employee Allotment Gardens] (in Polish). Krajowa Rada PZD.