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Sustainability of linden flower production in the development of forest villages: A case study in Yenice Forest Areas-Türkiye

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Abstract

Linden (Tilia tomentosa Moench) spreads in natural forests in Turkey. Linden flower production is done by forest villagers through dense/heavy pruning from natural forests. The sustainability of the natural structure is seriously endangered. In this study, A face-to-face survey method was applied to forest villagers collecting linden flowers in the research area. With the data obtained, the economic contributions of linden flower picking from natural forests to the forest villagers and the production and marketing processes were analyzed. Two production models were created to ensure sustainability in the natural linden forests in the research area. The economic analyses of the investment for these production models were carried out. According to economic analysis, B/C = 3.71, IRR = 5.94992% of the first management model, and the payback period was determined as 19 years and 2.5 months. For the second model, it was 3.79, 5.7736%, and 19 years and 10.7 months, respectively.

Key words: linden flowers, forest village, economic analysis, *Tilia tomentosa* Moench.

1. INTRODUCTION

Forests constitute approximately 29% of Turkey's surface are(Anonym, 2020a). All production, work, and transactions in forest areas are carried out within the General Directorate of Forestry (GDoF). There are 20 thousand forest villages and a population of approximately 7 million forest villagers within or adjacent to forest areas. In other words, one out of every three villagers in rural areas of Turkey is a forest villager (Coşgun, 2021). For this reason, all works carried out in forest areas are closely related to forest villagers. All kinds of activities of forest villagers in forest areas directly affect forest areas.

The forestry organization of Turkey was realized in the form of General Directorates affiliated with the Ministry of Agriculture and Forestry. To General Directorate of Forestry; "forest resources; taking into account its ecological, economic and socio-cultural benefits, to manage in ecosystem integrity with plant and animal existence, to plan it in a participatory and multi-purpose manner, to protect against unlawful interventions, natural disasters, fires, to fight with various pests and to have it made, forestry To carry out and develop quarantine services, to increase forest areas and services related to forests, to develop and rehabilitate forests, to provide silvicultural maintenance and rejuvenation" has been given.(URL-1 n.d.). GDoF studies all kinds

of wood and Non-Wood Forest Products Production (NWFP) to be realized from forest areas. For this reason, they are organized as 30 Regional Directorates of Forestry (RDoF)and their affiliated branch offices, 31 Nursery Directorates, 276 Forestry Enterprises Directorates, and Forestry Enterprises Chiefs in these directorates throughout the country (URL-1 n.d.).

The "Forest Law carries out all kinds of activities to be carried out in forest areas" numbered 6831, which was accepted in 1956 and is still valid. The Communique on Non-Wood Forest Products No. 302, created according to the forest law, also regulates the utilization of forest areas for NWFP production. This legal regulation necessitates planning the production and utilization of the NWFP. Communiqué No. 302 states that using NWFPs can be done with legal permissions.

The increasing and widespread use of NWFP in the world and Turkey causes its value to increase. Based on this increase, the development of benefiting from NWFP is an influential factor. The economic values of NWFP are also increasing due to medicinal/aromatic and ethnobotanical benefits (Altunel, 2011; Coşgun and Coşgun, 2021; Faydacıoğlu and Sürücüoğlu, 2011; Göktaş and Gıdık, 2019; Göldaş et al., 2010; Stoyanova and Stoyanov, 2013; Yavuz and Erdoğan, 2019).

It is seen that there are various studies on the production and marketing conditions of NWFP (Ayo and Isaac, 2006; Bozkıran and Giray, 2014; Ertuğrul et al., 2019; Güler, 2018; Şafak and Okan, 2004; Yaman and Akyıldız, 2008). Studies in the world and our country reveal that NWFP positively affects the incomes of the local people. It is seen that NWFP has a role and economic contribution to the development processes of rural poor communities (Ahmed et al., 2016; Babalola, 2015; Chupezi. et al., 2009; Kumar, 2015; Nath and Inoue, 2014; Šišák, 2006; Taha et al., 2015). The widespread use of NWFP, its production, marketing, economic contributions to the rural areas, and the planning and sustainability of this utilization have become a matter of discussion (Ok. et al., 2012; Ok. and Koç, 2018; Ok and Tengiz, 2018). Linden flower production and standards in Turkey, especially in recent years, are the subject of certification; It has been determined that NWFP affects its production as well as its marketing and sales (Yıldırım, 2012; Tuttu et al., 2017) .

Studies have been made and are being carried out for various plant and animal species that make up the NWFP. When all these studies are examined, it is seen that the studies on benefiting from the linden flower are limited. The contribution of linden flower production to the economic life of the forest villagers and the fact that no study has been carried out on the subject of sustainable "Linden Flower Enterprises (LFE)" constitutes the importance and original value of this study.

According to GDoF data in Turkey, Linden Flower production (*Tilia tomentosa* Moench) is carried out in 6 RDoF (URL-2 n.d.) (Table 1). Two Regional Directorates of Forestries (RDoF) are located in the Western Black Sea Region (Bolu and Zonguldak) (Figure 1).

Selection criteria of the research area;

Among the two regional directorates in the Western Black Sea Region, the highest area and amount of linden flower collecting is in the Zonguldak Regional Directorate of Forestry (ZRDoF),

Linden flower production is carried out in 4 Forestry Enterprises Directorates (Bartın, Ulus, Yenice, and Zonguldak). Within these Enterprise's Directorates, the region where linden flower production is carried out in the highest area and amount is Yenice Forestry Management Directorate.

The forest villagers in the forest villages located in the forest areas of the Yenice Forest Enterprise must earn other incomes than wood raw material production labor income because the wood raw material production from the forest areas in the region in the early 2000s increased from 120 thousand m^3 annually and reached 320 thousand m^3 by 2021. This mode of production is not seen as sustainable production. Yenice forest areas are also crucial in terms of biological diversity. One of Europe's 100 hottest regions, Kavaklı and Çitdere Nature Reserves, are also located in this region. Forest areas of high importance in biodiversity and studies for

wood raw material production that have reached high levels take place together in Yenice forests. Wood raw material production income for the forest villagers who live intertwined with forest areas depending on Yenice Forest Management is at profound levels. However, this is seen as an unsustainable income. Production restrictions in producing raw wood materials in the coming years will cause this society to create significant pressures. At the same time, this situation will endanger the sustainability of biodiversity in the region. For this reason, alternative income sources should be created so that forest villagers can have a sustainable income in the future. Linden flower enterprises, the subject of NWFP production, are an essential potential alternative income source for the region.

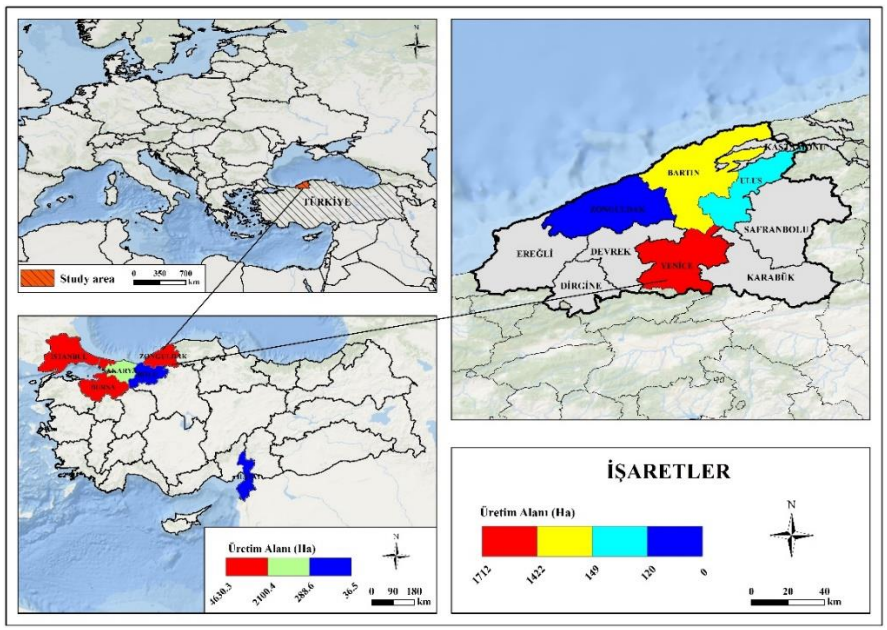

Figure 1: Working Area

The study has two main aims.

OBJECTIVE 1: Yenice forest management directorate is to determine the contribution of linden flower collecting to the income of forest villagers in natural forest areas and to determine the operation of marketing processes.

OBJECTIVE 2: Demonstrating the profitability with economic analysis of the investment to be made for the linden flower enterprises, which is a non-wood forest product is one of the alternative income sources,

Forest villagers in the region to know the economic dimensions of obtaining a sustainable income source by collecting linden flowers; It is essential because it will reduce the livelihood expectation of forest villagers from wood raw material production labor and reduce wood raw material production pressure on forests.

In addition, with the realization of the second purpose, a sustainable production method will be provided by reducing the damage caused by linden flower production, which has reached unsustainable dimensions and is obtained by wild pruning.

Research data; It has been obtained by working with forest villagers who collect linden flowers in the collection and drying of flowers in the areas where linden naturally grows. In addition, face-to-face surveys were conducted with forest villagers ordering linden flowers. In addition, face-to-face surveys were conducted with forest villagers collecting linden flowers. In this context, in the linden flower business; data were tried to be obtained on average production amount per tree, average income, fresh leaf/dry leaf ratio, average sales price,

sales price expectation, average working time per person, production amount, annual revenue, marketing method, market channels, and marketing.

The forest villagers, who produce flowers by collecting linden flowers from the NWFP, reach the end consumer after participating at most minuscule two intermediaries in the marketing chain. As a result of these stages, there is a price difference of at least 150% between the price of the first producer who collects the linden flower and the price it reaches to the final consumer. To increase the income of the forest villagers, who have a deficient level of economic gain from this type of business, it is necessary to establish marketing channels that will directly reach the end consumer in the production-consumption chain. For the entire flower collection process to be sustainable, it must be ensured that legal procedures are strictly followed. Using new pruning equipment for production should be encouraged, and highly heavy pruning should be abandoned. Social or economic credit supports of the Forestry Rural Affairs Department should be activated for technical pruning education for the forest villagers who will operate linden flowers.; Those who do not have specialized pruning equipment should not be allowed to collect linden flowers by pruning on linden trees from forests. The economic analysis of the linden flower enterprise**,** which will be made by establishing linden gardens, and the IRR (Internal rate of return) and other analysis values have created positive indicators. It has been determined that the investment to be made will be profitable.

2- MATERIALS and METHOD

2.1. Data Collection Method

The material of the study was obtained in two ways. The first was screening national and international scientific studies on the production of linden flower (*Tilia tomentosa* Moench) and non-wood forest products. The second data group is original field data. These data were obtained in two ways. The first group of actual field data; is the data obtained from examining the production studies carried out in the field and the forest villagers collecting linden flowers from the forest areas of Yenice Forestry Enterprise Directorate. In this context, by participating in the production works in the field, it was determined how the exhibition was made and how the production amounts and transportation and drying works were carried out. Other original field data is obtained from the focus group meetings and face-to-face surveys held with forest villagers who collected linden flowers from the forest areas of Yenice Forestry Enterprise Directorate in the summer of 2019.

In the focus group meeting held with the participation of forest village mukhtar in the organization of Yenice district governorship, it was determined that villagers collected linden flowers in 13 forest villages within 33 forest villages. In addition to 13 forest villages affiliated to Yenice Forestry Enterprise, It has been determined that forest villagers (families) in a total of 15 forest villages, including two forest villages adjacent to these areas but affiliated to Karabük Forestry Enterprise Directorate, collect linden flowers.

In each village where linden flower collecting takes place, it is foreseen to conduct a face-to-face survey with all the collectors (entire field sampling method). In forest areas, to obtain non-wood forest products, legal permission must be obtained according to the Communiqué on Non-Wood Forest Products No: 302 published following Forest Law no: 6831. However, since only two forest villagers applied for permission to collect linden flowers in the local forest villages and because the forest villagers in the region did not legally collect linden flowers, a complete face-to-face survey could not be carried out. For this reason, it is planned to survey five linden flower picker family businesses (13 x 5=65) who want to answer the survey from each village. As a result of the studies, more subjects were reached, and a face-to-face survey was conducted with 72 forest villagers that collected linden flowers.

2.2. Data Evaluation Methods

Primary data was evaluated for the data obtained by the face-to-face survey method. In the second data evaluation, economic analyses were made to show the possible financial contributions of benefiting from the

linden flower business as an alternative income to establish a linden garden through linden afforestation. Thus, it is aimed to determine the economic dimension of the non-wood forest products management and the level of their contribution to the income of the forest villagers by ensuring that the forest villagers earn a sustainable income.

2.2.1. Evaluation of survey data

In this study, linden flower collection works were carried out together with forest villagers who collect linden flowers from natural forests by joining them. For this reason, some measurement values remained within the scope of the survey data.

From the data obtained, Variables such as education, age, gender, production amount, and annual income of forest villagers collecting linden flowers were determined.

Data such as annual average income, expenses, marketing methods, and problems obtained by forest villagers by collecting linden flowers are the variables examined. Statistical relationships between these variables were determined by Chi-Square analysis.

2.2.2. Economic Analysis Data and Evaluations

Land use of forest villagers who collect linden flowers from natural forest areas is an unsustainable position. For this reason, an alternative sustainable production model for forest villagers to produce linden flowers by wild pruning from linden trees in natural forest areas and whether this model is economical or not is presented

For the Linden flower enterprise planned as a model, It is envisaged to plant 100 linden saplings in a 1 ha area with a distance of 10 m X 10 m. In this planning, the forestation unit cost data of GDoF for 2020 were used (Anonym 2019a).

The unit prices of the cost to be made have been determined by considering all the processes required for afforestation, starting from the preparation of the field for planting seedlings in the GDoF Afforestation Unit Cost Analysis. In the calculation of unit costs, the costs of maintenance work for the first three years, weeding with the worker around the saplings, hoeing, terrace repairing application, it was deemed necessary to maintain it as a standard until the 20th year when the crown closure was formed.

For the linden flower business, there is no national or international yield study that reveals the developmental course of the flowering status of the linden tree according to its age. Similarly, no study shows a yield relationship between the crown and flowering according to linden species. In the creation of data on income and expenses related to the collection of linden flowers; Face-to-face survey data with forest villagers in the study area, and opinions obtained from focus group studies using semi-structured questionnaires conducted with Forest guards who had worked in Yenice Forestry Enterprise Directorate for a long time were used.

The data used in the realization of the Economic Analysis are outlined below.

1. Management time of linden trees for linden flower production,

2. The time for the linden tree to become an adult individual,

3. The beginning time for linden trees to start flowering (A satisfying level),

4. The amount of flower production obtained from the beginning of flowering of linden trees to the optimum flowering time,

5. Annual linden flower production, which can be obtained from the time of reaching the optimum flower yield to the end of the administration period, in an area planned for the study,

6. The ratio of fresh leaf to dry leaf in linden flower production,

7. The wood raw material price of the linden tree at the end of the administration period (the average sales price realized in the auction sales of the Zonguldak Regional Directorate of Forestry Operations Marketing Branch Directorate in 2020 (Anonym 2020b).

Net income is obtained as the difference between the total expenses incurred and the revenues earned. From the first year of the plantation plant to the 20th year, the culture and maintenance expenses of the area were added analysis. Since the 20th year and every five years, sales have been made with the average sales price of the product amount. Labor, fuel, tool, and equipment costs are considered expenses for each production period. Net Present Value, Benefit Cost Ratio, Internal Rate of Return Ratio, and Payback Period were determined within the economic analysis of the linden flower business. These analyses were created for two different linden flower enterprise models.

Linden flower Enterprise Model I: It is the field operation with an understanding based on periodic income generation until the age of 80 by cutting the crown of all linden trees that have reached the age of 20 once every five years and harvesting their flowers. This model includes the distribution of income and expenses that regular payments reveal during the administration period. Although this management option is calculated for 80 years, the number of years revenue is generated less. Net present value, Benefit Cost Ratio, Internal Rate of Return, and Payback Period were found using 4%, 5%, and 6% discount rates to calculate the internal rate of return based on the net incomes obtained. Net present value, Benefit-Expense Ratio, Internal Rate of Return, and Payback Period were calculated based on the net gains obtained.

Linden Flower Enterprise Model II: The Income and expenses that will be created from the plantation field are obtained by pruning one-fifth of the linden trees that have reached the age of 20 every year. In this model, the number of years of income has increased, and the income and expense levels have also changed. Net present value, Benefit-Expense Ratio, Internal Rate of Return, and Payback Period were calculated based on the net incomes obtained.

Net revenues for each year are discounted to present value with the cost ratio. The data obtained in this way, by applying different discount rates, the rate at which Present Net Value is obtained as positive and negative (internal rate of return) has been determined. The econometric models (Net Present Value, Internal Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit/Cost (B/C) criteria) used for economic analysis are as follows (Daşdemir and Şahin, 2002).

$$NPV = \sum_{t=0}^{n} F_t\ \alpha_t - M_t\ \alpha_t \qquad (1)$$

F_t: cash inflows in year t,
M_t: cash outflows in year t
p: bank rate (interest rate),
t: a time that cash flows are obtained,
n: Project duration,
α: $1/(1+p)^t$ = discount/interest rate factor relative to p and t

$$IRR = \sum_{t=0}^{n} \frac{F_t}{(1+i)^t} - \sum_{t=0}^{n} \frac{M_t}{(1+i)^t} = 0 \qquad (2)$$

$$B/C = \frac{\sum_{t=0}^{n} F_t\ \alpha_t}{\sum_{t=0}^{n} M_t\ \alpha_t} \qquad (3)$$

3- DISCUSSION

3.1 Linden Flower Collecting Planning, Production Area, and Collection Amounts

According to GDoF data in Turkey, linden flower (*Tilia tomentosa* Moench) collecting, and flower production takes place in 6 GDoFs (URL-2 n.d.) (Table: 1). ZRDoF ranks third among other RDoFs of the area with production quantities where flower production can be carried out by collecting linden flowers.

At the ZRDoF, Linden flower (*Tilia tomentosa* Moench) production by pruning is carried out in 4 Forest Enterprise Directorates (Bartın, Ulus, Yenice, and Zonguldak) (Table 2). Flower production is carried out in 6 Forest Enterprise Directorates in Bartın Forestry Enterprise Directorate. In 3 Forest Enterprise Chiefs affiliated to Ulus Forestry Enterprise Directorate, 5 Forest Enterprise Chiefs under Yenice Forest Enterprise Directorate, and 3 Forest Enterprise Chiefs under Zonguldak Forestry Enterprise Directorate; Linden flowers (*Tilia tomentosa* Moench) collect in a total of 17 Forest Enterprise Chiefs and flower production continues (Table 2). It is seen that the average linden flower production capacity in the ZRDoF for the years 2022-2024 is 7,66 kg ha^{-1} (Table 2). There is an average annual production capacity of 8,38 kg ha^{-1} in the five Forest Enterprise Chiefs of Yenice Forestry Enterprise Directorate (URL-2 n.d.).

Table 1: Distribution of Linden (*Tilia tomentosa* Moench) Flower Area and Production Amounts as NWFP in Regional Forestry Directorates in Turkey

Regional Directorate of Forestry	2022 Year		2023 Year		2024 Year	
	Production Area (ha)	Amount to be Produced (kg)	Production Area (ha)	Amount to be Produced (kg)	Production Area (ha)	Amount to be Produced (kg)
Bolu	**36,5**	**776,2**	**36,5**	**776,2**	**36,5**	**776,2**
Bursa	4630,31	100.658,16	4.630,31	100.658,16	4630,31	100.658,16
Hatay	288,63	5.974,72	288,63	5.974,72	288,63	5.974,72
İstanbul	3.696,33	50.375,65	3.696,33	50.375,65	3.696,33	50.375,65
Sakarya	2.100,44	39.669,53	2.211,20	48.522,17	2.100,44	39.669,53
Zonguldak	**3.403,49**	**25.819,55**	**3.267,93**	**25.352,50**	**3.403,49**	**25.819,55**
Total	14.155,7	223.273,81	14.130,9	23.1659,4	14.155,7	223.273,81

Table 2: Production Amount and Area Distribution of Forestry Enterprise Directorates (2022-2024)

Zonguldak Regional Directorate of Forestry Forestry Enterprise Directorates	2022 Year		2023 Year		2024 Year	
	Production Area (ha)	Amount to be Produced (kg)	Production Area (ha)	Amount to be Produced (kg)	Production Area (ha)	Amount to be Produced (kg)
Bartın	1.422,13	7.526,84	1.422,13	7.526,84	1.422,13	7.526,84
Ulus	149,07	1.158,05	13,51	691,00	149,07	1.158,05
Yenice	1.712,25	14.354,57	1.712,25	14.354,57	1.712,25	14.354,57
Zonguldak	120,04	2.780,09	120,04	2.780,09	120,04	2.780,09
Total	3.403,49	25.819,55	3.267,93	25.352,50	3.403,49	25.819,55

Source: (URL-2 n.d.).

Production plans have been made for the three Forestry Enterprise Chiefs of Kayadibi, Karakaya, and Kavaklı, affiliated with Yenice Forestry Enterprise Directorate. A Linden flower(*Tilia tomentosa* Moench) Harvest Plan has been prepared for the Kayadibi Forest Enterprise Chief (Anonym, 2011). This study planned that producing fresh-leaved linden flowers from a 40 ha area would be 14,712,40 kg/year. "Utilization Plan laden (Tilia ssp.)

(2018-2030)" was prepared for Karakaya Forestry Enterprise Directorate (Anonym, 2019b). In the planning study, It has been determined that annual production of 6.589.132 kg per year can be made from an area of 679.30 ha. To ensure sustainable production in this plan, "The production of linden flowers and leaves will be done by climbing the trees by hand or cutting them with small branch shears without damaging the trees. Branch cutting will not be allowed." included. The "Benefit Plan" for the Kavaklı Forestry Enterprise Directorate was carried out for 2018-2030. In the planning, production of 5,432 kg/year from an area of approximately 660 ha is included (Anonym 2014, 2019c). The data in the plans are not consistent with each other. Despite this, it is planned that a total of 27 thousand kg/year of linden flowers can be produced annually from the 1,380 ha forest area in the region. Considering the market price, an annual economic value of approximately 6.5-7 million TL/year is produced.

It is stated that it is possible to identify silvery linden, one of the 4 naturally grown linden taxa in Turkey, only from its flowers and bracts. Linden flowers are formed in the form of cymosis/racemosis/panicle. This formation: The positioning of the flower boards in the form of clusters on the side branches around the main axis (Simosis / Racemosis / panicle), that is, in the form of flower development in the form of side branches while the main axis continues to grow. The number of flowers on the Simoz flower board varies between 4-10-13; but usually has 3 branches and 9 flowers (Sarıkaya and Doğdu, 2021). The drooping flowers open at the end of June and the beginning of July.

The peduncle and cymbal peduncle are covered with dense, soft short-woolly trichomes. Its flowers are hermaphrodite (male and female flower parts are in the same flower, bisexual flower/hermaphrodite), very symmetrical, deep bowl form and sharp honey scented. The sepals (sepal) are 5 pieces, each ovoid and pointed, greenish-yellow in color. The outer surface is grayish-white-star- trichomes.The inner surface is dense, long, soft trichomes at the base. Stellate type of indumentum are mostly 8-armed throughout the plant. Petals are also 5 pieces. Each of them is in oblanceolate form. The tip is toothed and yellow. Between the petals and the stamens there are 5 non-productive petal like stamens (staminodes); which run slightly shorter than it, with thick stems and spatulate. The number of stamens (male organs) is 45-48-55, and their length is shorter than the petals. Their pollen is tricolporate, that is, with 3 holes and 3 slits. (Yaltırık, 1967; Browicz, 1968; Rehder, 1977; Demir, 2003; Pigott, 2012; Oral, 2018; Weryszko-Chmielewska et al., 2019).

Bract (4-5-11.5 x 1-2 cm in size, rounded and narrow at the base, narrow and long elliptical or oblong, sessile or 1.5 cm stalked. Covered with short- lanate, the floret stem is united at least one-third to one-third of the brachte's length. The bract is usually shorter than the flower board (Sarıkaya and Doğdu, 2021). The bract's side (anterior surface) bearing the flower board is light green, glabrous, or with sparse white satellites. The outer (rear) surface is dull, dense, white-star short - woolly hairy (Yaltırık, 1967; Browicz, 1968; Demir, 2003; Pigott, 2012; Oral, 2018). The bract functions as wings and enables the ripening fruit board to fly.

Linden flower is widely used in pharmacy and folk medicine for its therapeutic and calming properties. The flavonoids, mucilage components and essential oils contained in the linden flower are the leading medicinal ingredients.In the content of linden flower, it contains tannin, sugar, various acids, vitamin C and carotene as well as a useful glycoside called drug (Anşin and Özkan, 2006; Toker et al., 2004).

Flower linden production in Turkey varies between 40-80 tons, and flowering leaf linden production ranges between 100-150 tons. From 135 tons of linden collected across the country in 2018, forest villagers earned an income of 10.8 million liras. In 2019, 15 million TL income was obtained from 150 tons of linden (Bacca, 2020).

Linden flowers are located on the shoot of the last year, as in some other species (such as Walnut, etc.). For this reason, pruning only the last year shoots may be sufficient. Apples, cherries, cherries etc. In some fruit species, such as the flower, the flower is located on the previous shoot. Pruning on these species will prevent

flower formation and decrease fruit yield. However, this does not apply to the linden flower. Pruning should be done by taking this situation into account.

3.2 Socio-Economic Situation of Forest Villagers Collecting Linden Flowers

3.2.1. Demographic structure

The education level of the forest villagers, who produce linden flowers and enter the sample, is literate and has primary school education, 85%. The fact that the education level of the forest villager households producing linden flowers is relatively low restricts education and awareness-raising efforts to ensure sustainable use instead of wild pruning. In the investigation area, 83% of forest villagers who operate linden flowers from forest areas in terms of the workable workforce are 64 and below (Ateş 2019). The region's labor force has the potential to generate income by establishing linden orchards. 78% of them have any social security. From this point of view, it is seen that there is no dependency on the linden flower business to make a living. For this reason, prohibiting wild pruning and limiting the use of forests for sustainable linden flower production will not create significant pressure. The fact that retirement ranks first (35%) in the ranking of basic livelihoods also strengthens this judgment (Ateş, 2019).

3.2.2. Production and Self Consumption

The average fresh linden flower production per capita is 10.67 kg/day, the average production amount per tree is 10.15 kg/day, the average wet linden flower production time per tree is 3.07 hours/day, and the average daily working time for linden flower production is It has been determined as approximately 8.5 hours/day. A person can produce an average of about three trees per day (Ateş, 2019).

The Average wet-dry weight change was determined as 38.61%, dry production amount was determined as 29,42 kg/year. On the other hand, it has been observed that the average amount allocated for self-consumption from production is approximately 2.0 kg/season. The slope of the land and the height of the trees where linden flowers can be collected constitute the most critical production problem of linden flower picking (Ateş, 2019).

The collection time of the linden flower is also considered important for quality. It is emphasized that the flowers should be collected within the first four days after the ripening time to avoid losing their essential oil content (Korkusuz and Dirik 2011). However, about 28% of the forest villagers who produce in the natural forest area stated that they collect the flowers in 1-10 days, 40% in 11-20 days, and 31% in 21-30 days. When the collection times of the flowers are evaluated, it is seen that there will be significant quality losses in the production of linden flowers in the region.

3.2.3. Marketing

The process of reducing the high humidity (70-85%) of medicinal and aromatic plants after harvest to the appropriate humidity level (10-15%) for safe storage can be achieved by quality drying (Polatcı. and Tarkan, 2009). Depending on whether the drying process is carried out in direct sun or shade, quality differences arise in the component contents of the product. In natural sun drying processes, sun rays also have adverse effects, such as causing color changes and essential oil losses (Rocha et al., 2011; Janyai and Tung,2001). It is necessary to ensure that the linden flowers collected in the research area are dried in shaded environments away from the sun to lose the essential oil and other components they contain. The rate of those who dry the collected flowers in a sunny climate is 31%, while those who dry them in a shaded environment are 69%. Drying causes significant losses in the content quality of flowers. It is considered necessary for businesses that will establish a linden garden and operate linden flowers to dry the products in shady environments to provide

a good marketing opportunity. The average packaging time is 13.67 minutes, and the most preferred storage method is sacking, which is 87.5%.

While the dried linden flowers are offered for sale as sales packaging, Sacks are used at 81.9% and bags at the rate of 11.1%. After the collected linden flowers are dried, they are marketed as cash. The rate of marketing to local wholesalers is 76.4%. The average market price was determined as $8.46/kg. The expectation of market price was defined as 13.84 $/kg on average. The price formed in the market was 64% lower than expected. The average annual income obtained from the production of linden flowers in the forest villagers producing linden flowers is $233.21. It has been determined that the average 23.47% of the sales price of the forest villagers in the production of linden flowers consists of the costs. A positive and statistical relationship has emerged between the production/collection amounts of linden flowers from the forest and the income of the enterprises/families.

Various studies conducted in forest villages have revealed forest villagers' monthly average income levels. The monthly average income in the forest villages of İçel was $ 571(Özkurt 1998). In the forest villages of the Western Black Sea Region, the average monthly income of the families benefiting from forest and village relations department loans for Heating Stoves, sheathing of buildings, and GES support are $ 487, $ 490, and $ 453, respectively. The average monthly income for the forest villages of Gündoğmuş District of Antalya Province in the Western Mediterranean Region is $ 241.6 (Coşgun, 20128; Uzun and Yılmaz, 2008). The average monthly payment of forest villagers collecting NWFPs in the Istanbul region is $ 432.5 (Sezgin et al., 2022; URL-3 n.d.). Within the scope of NWFP, the monthly income of forest villagers engaged in beekeeping in forest villages from beekeeping is $ 84.8 (Coşgun, 2017). The average income earned by family enterprises that collect linden flowers as NWFPs from research areas is the income obtained from work done in a month or even less. Compared to beekeeping, it is a highly profitable business. Beekeeping requires a career spanning almost the entire year. However, as NWFP, collecting linden flowers involves 15-20 days in June and July.

3.3. Economic Analysis of Linden Flower Enterprise by Establishing a Linden Garden

The benefit-cost ratio was calculated by accepting 3%, the current interest rate in forestry. In the first enterprise model, the benefit-cost ratio was found to be B/C = 3.71; for the second enterprise model, this ratio was found to be B/C = 3.79. Net Present Value for the first management style was 46.459.44, and for the second enterprise, the type was 47.722.79.

One of the essential criteria in the analysis of investment projects is to know how many years the investment will pay back the principal, interest (cost) and how many years it will work profitably for the investor. In other words, the analyst must know the time risk of the project (Okka, 2006). The number of years (b) that determines how long the capital of the investment and the total interest will be paid back; 19 years and 2.5 months for the first form of enterprise and 19 years and 10.7 months for the second form of enterprise. The total management period for the linden flower business is 80 years (a). The profitability period shows how long the project will work profitably; It is obtained as the difference between the management period (a) and the number of years (b), which determines how long it will take to recover the capital and total interest of the investment made. In this case, The profitable working time of the linden enterprise is (a - b). In other words, the first enterprise type is 80 years - 19 years and 2.5 months. Such a linden flower enterprise will work profitably for 60 years and 1.93 months.

Two management models were planned for the linden garden enterprise for linden flower collecting/production, and IRR (Internal Rate of Return) analyzes were carried out. In the first management model, the IRR was calculated as 5.94992%. In the second management model, IRR was found to be 5.7736%. This profitability rate was higher than 3%, the small interest rate accepted for forestry investments. Therefore, forestry can be considered a good management form compared to the average. In the economic analysis made by taking into account the natural stand conditions for the red pine afforestation areas; For 33 years of

management period; IRR of 3.70% in afforestation area + bad site class areas, + 45 years of management period in natural stand + bad site class areas, IPR is 3.62% and in the 27-year management period and afforestation + good site class areas, the IRR was found to be 7.47% (Özel et al., 2017).

In the study on red pine afforestation in the Bartın region, the Internal Rate of Return analysis was found to be 4.28% for afforestation areas where the management period is 33 years, which is carried out in poor site class areas and with labor power (Daşdemir and Şahin, 2002).

For red pine afforestation for 40 years without any production in the Antalya region, IRR was obtained as 4.48% (Erkan et al., 2002).

In the red pine afforestation made in Şanlıurfa, for 33 years of management period + IRR for bad site class areas was calculated as 1.46%, and 45 years for management period for natural stand + bad site class area was calculated as 2.19 (Daşdemir et al., 2019). As a result of their economic analysis using the yield table values prepared for red pine afforestation made with traditional methods, the IRR was calculated as 4.48% for poorly site class areas and 7.64% for good site class areas (Erkan, et al., 2002)

5-CONCLUSION

As in the world, the Covid19 epidemic in Turkey has seriously questioned the immune system's development processes, especially in people. The immune system can be healthy, usually by consuming naturally produced foods. For this reason, utilizing organic foods has become necessary in recent years, not a fashion. NWFP also draws attention with its organic nutritional qualities. Nutrition with natural products and their nutrients has become very important in this process.

The organic structure of NWFP has started to mean higher income for the rural people who collect and produce them and put them on the market. However, the process from the production or collection of NWFP to the market after it is also examined. On the other hand, the way of production of these products from their natural environments is also carefully monitored. In particular, it is highly emphasized on the issue of output or collecting sustainably.

In Turkey, the sustainability of the stages of collecting NWFP from nature, either directly presenting these products to the market or turning them into food items and presenting them to the market, is now extremely important. With this production and marketing method, primarily rural areas and forest villagers come first.

Forest villagers constitute the last segment of society in terms of living standards in Turkey (Çağlar, 1983). To provide additional income for the livelihoods of forest villagers, the sustainability of NWFPs produced/collected from natural environments and the marketing conditions of these products also require improvement.

Wood raw material production has reached maximum levels in the Yenice Forestry Enterprise Directorate areas, where the forest villages subject to the study are located. The wood raw material production labor income of the forest villagers in this region is also significant. However, wood raw material production in the region has to be limited soon. Because today's production rate will cause irreparable ecosystem degradation in forest areas if restrictive measures are not taken. Living wood raw material production constraints mean income losses and social pressure for forest villagers. To reduce these social pressures, it is necessary to create alternative sustainable income sources and to reveal the dimensions of income contributions obtained from investments that can be made for different income approaches.

Some local forest villagers can earn significant income from linden flower picking in a short period of the year. However, the collection/production of linden flowers from the local forests is not sustainable. The forest villagers cut the branches of the whole tree complete with a wild pruning method and then collect these branches by separating them from the flowers. Yenice Forestry Enterprise Directorate cannot prevent this

unsustainable method of obtaining products from natural forest areas. Production in this way is an illegal form of utilization. The study also carried out the economic analysis of linden flower management as an investment subject that will reduce the effects of this wild utilization on forests, compensate for future income losses, and be very profitable.

Research studies have revealed that the collection and marketing of linden flowers positively contribute to the household income of the local people. For this purpose, two different scenarios were produced. For both systems, the investment to be made for the linden flower business to be built on one hectare of land turned out to be quite economical. However, it is seen that the irresponsible and unsustainable utilization of the region can be changed by establishing small and medium-sized linden orchards. The accepted term of administration for linden is 80 years. It has been revealed that the return of the capital and total interest of the investment is provided in 19 years and from 2.5 months according to the first scenario and in 19 years and from 10.7 months for the second scenario.

In the study, the forest villagers, as NWFP, cannot evaluate the linden flower collecting and marketing processes well. Considering the marketing channels of the products obtained, marketing to businesses that sell products directly to the consumer will result in higher income. Investigations have shown a 64% difference between the revenue earned and the expected price. There is a difference of approximately 130% between the price of linden flowers received by the forest villager, who is the first producer, and the price obtained by the final consumer, to the detriment of the forest villager. Drying processes must be healthy to expand the region's linden flower business and generate high income. Improving the drying processes through marketing channels will increase the revenue obtained; thus, the linden flower business will become widespread.

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