

Sustainable Management of Non-Wood Forest Products - Technical Guidelines

13 May 2021

Table of Contents

[List of Acronyms 3](#_Toc71833520)

[Introduction 4](#_Toc71833521)

[1. Pine honey 5](#_Toc71833522)

[2. Bay Leaf 7](#_Toc71833523)

[3. Chestnut 9](#_Toc71833524)

[4. Resin 13](#_Toc71833525)

[5. Truffles 16](#_Toc71833526)

# List of Acronyms

Communiqué of NWFPs Communiqué on Inventory and Planning of NWFPs and Production and Sales Principles

DNWFPS Department of Non-Wood Forest Products and Services of GDF

FAO Food and Agriculture Organization of the United Nations

GDF General Directorate of Forestry of Turkey

ISO International Organization for Standardization

LoA Letter of Agreement

MoAF Ministry of Agriculture and Forestry of Turkey

NGO Non-Governmental Organization

NWFP Non-Wood Forest Product

OMO Chamber of Forest Engineers of Turkey

TAB Turkish Association of Beekeepers

TAGEM General Directorate of Agricultural Research and Policies

TSE Turkish Standard Institutions

# Introduction

On December 20, 2019, a Letter of Agreement-LoA on "Provision of technical guidelines on sustainable management of non-wood forest products (NWFPs) and the status reports on specific selected products " was signed between the Chambers of Forest Engineers (OMO) and the Food and Agriculture Organization of the United Nations (FAO).

Within the scope of this LoA, firstly the "NWFPs Assessment Report" followed by the "NWFPs Policy Report" was prepared.

Following these general reports, detailed reports were prepared for pine honey, bay leaf, chestnut, resin and truffle mushroom. The issues, and determinations expressed in these reports prepared, through the examination and interviews conducted in the field, update meeting attended by the representatives of the relevant institutions and a national workshop attended by all stakeholders including universities, non-governmental organizations (NGOs), producers, mukhtars[[1]](#footnote-1), and public institutions, primarily the General Directorate of Forestry (GDF) was shared with all parties.

Following these studies, "sustainable technical guides" were prepared in which the information and findings obtained were appropriately included.

In the preparation of these guides, in addition to the Department of Non-Wood Forest Products and Services (DNWFPS) of GDF, cooperation was made with the following academicians, and representatives of NGOs.

|  |  |
| --- | --- |
| Product Name | Contributors |
| Pine honey | Prof. Dr. Mustafa Avcı - Applied Sciences University of Isparta Forestry Faculty  Ziya Şahin - Turkish Association of Beekeepers |
| Bay | Sadettin Güler - Forest Engineer (Msc.)  Western Mediterranean Forestry Research Institute of GDF  Wood and Non-Wood Forest Products Research Chief Engineering |
| Chestnut | Prof. Dr. Ümit Serdar- Ondokuz Mayıs University Faculty of Agriculture  Dr. Kıymet Senan Savaş-  Bursa Provincial Directorate of Agriculture and Forestry of MoAF  Plant Production and Phytosanitary Department |
| Resin | Prof. Dr. Ilhan Deniz-  Karadeniz Technical University Faculty of Forestry |
| Truffle Mushroom | Prof. Dr. Hasan Hüseyin Dogan- Selçuk University Faculty of Science Biology Department  Niyazi Uluçoban - Promotion and Research Association of Truffle Mushroom |
| In general | Prof. Dr. Hüseyin Fakir- Applied Sciences University of Isparta Forestry Faculty |

# Pine honey

Pine honey is a unique honey produced by bees, not from flower pollen, but from honeydew which is produced by an insect namely “the giant pine scale” (*Marchalina hellenica* ) which lives in the body of some pine tree species. Most of the world's pine honey (about 90%) is produced in the South-West region of Turkey, particularly in Muğla province because of the suitable climatic conditions and relative humidity for *Marchalina hellenica* and its natural host, *Pinus brutia*. (FAO, 2020)

As of 2019, 66 305 hectares of the forest area has been reserved for "pine honey production" by GDF. Between 15-30 thousand tons of pine honey is produced annually. The average price of pine honey to when it reaches the end consumer is around 5-8 USD/kg. As of 2019, its contribution to the national economy has been calculated as 200 million USD.

The main lines of "Pine Honey Technical Guide" are as follows:

1. Ensuring the health and sustainability of *Marchalina hellenica*,
2. Determination and management of forests where pine honey is produced.

The main factor in pine honey production is the spread of *Marchalina hellenica*. Without this insect, pine honey production is not possible. For this reason, it is necessary to protect the existence and sustainability of this insect first.

*Marchalina hellenica* generally spreads in red pine forests in the coastal area from Antalya to Istanbul. It spreads in forests facing the sea and receiving sea moisture from sea level to an altitude of 1 000 meters above sea level.

The most important factor in the biology and activity of *Marchalina hellenica* is "extreme summer temperature and drought". In 2020, the extreme heat and drought seen in Muğla, along with the country in general, caused large-scale deaths of *Marchalina hellenica*. It is difficult to determine how much damage the insect has suffered. However, compared to 2019, pine honey produced in 2020 decreased by 90-95%.

In addition to its direct effect, extreme heat and drought trigger forest fires, which damages pine honey production areas. Not many measures can be taken against extreme heat and drought but reduction and management of forest fires can be improved. Furthermore, studies should be initiated to assess the possibilities to shift the production to higher attitudes, based on the biology of the insect.

The second important factor after the drought is wood production in areas where the insect spreads. Since there is a significant need for wood supply the wood based forest sector in Turkey is extremely huge and wood production has the management priority by GDF. Forestry education is generally based on wood production. Especially in pine honey production areas, this approach can be harmful in some cases for *Marchalina hellenica*.

To prevent the damage caused by wood production, wood production activities in forests should be completed in March-April, when the insect is not active, and therefore honey production is not carried out.

Under normal conditions, *Marchalina hellenica* lays eggs in March-April, the nymphs that hatch start to grow from May; and start to secrete from tree trunk and branches as of June. The insect's most active time is between August and November. In general, beekeepers come to the red pine forests from mid-August to early September under normal conditions and although it varies depending on the location, pine honey is produced until November-December.

Silvicultural maintenance of forests where insects are found stands out as an important issue. Under normal conditions, there are more insects in forests that receive more light and have better ventilation. Therefore silvicultural activities should aim for allowing more light into the forest where pine honey is produced. Maintenance of forests reduces the risk of fire and spreading, while also supporting the presence of *Marchalina hellenica* and honey production.

One of the issues that beekeepers are against to is the cutting of red pine trees at an early age for wood production. With the regulations made by the GDF in recent years, the cutting (administration period) of the red pine trees where the insect is located has been increased from 60 to 100-120 years old, and this regulation has been welcomed by the beekeepers[[2]](#footnote-2).

It would be beneficial to develop a management model for forests devoted to pine honey production. Such a model should include recommendations on followings: how to arrange the hives, the determination of the number of hives to be placed in the unit area, fire and silvicultural measures, creating water supply for bees, increasing the humidity of the forest with artificial ponds to be used easily in forest fires, facilitating access to these areas, creating mobile accommodation facilities for beekeepers, which measures to take to encourage marketing, planning and executing activities such as mining, agriculture and tourism in a holistic manner.

When we look at pine honey production as a whole, starting from the forests to the end consumer, a picture emerges as follows.

1. Pine honey is a special type of honey made by bees from the secretion of *Marchalina hellenica* which lives in red pine forests
2. On behalf of the state, forests are managed by GDF. GDF is also exercises the owner rights over the insects. The beekeepers as the owners of bees and the GDF have to coordinate their activities for the optimal production.
3. There are no problems with the sale of pine honey. Price is formed according to free-market conditions and all honey produced can be sold easily. A significant portion of honey is pine honey that is exported by Turkey.
4. For pine honey, which has a different structure than flower honeys, a separate standard should be developed by Turkish Standard Institutions (TSE) and International Organization for Standardization (ISO), and it should be subject to different customs and trade procedures.
5. As the production areas are under control, it is very easy to determine from which forest area, by which beekeepers the pine honey is produced, however labeling system is not in place. Therefore a model should be developed for the labelling by GDF with other stakeholders such as TAB, TSE and marketing firms. Such cooperation will also increase export opportunities.
6. Civil society’s knowledge about pine honey and its health / nutritional values is limited. Special promotional campaigns should be organized for awareness raising.

# Bay Leaf

Bay leaf is obtained from the bay tree (*Laurus nobilis L*.), which is a bushy species found naturally in forests in the form of trees and shrubs. The branches of the laurel, which have reached a certain maturity, or generally the whole trunk is cut, brought to the facilities by the villagers or intermediaries, where the leaves, are separated from the branches, dried and packaged.

Bay leaves are usually collected between August and September. Disease-free and undamaged leaves, which comply with the standards regarding their sizes, are packaged according to their sizes and presented to domestic and foreign markets. After the leaves are separated, the remaining branches are broken into pieces and pressed into pellets and used as fuel. "Laurel oil" is produced by distillation method from leaves that are not of sufficient size or damaged.

According to data from the GDF in Turkey by the end of 2019, there were a total of 180 400 hectares of bay tree fields.

In the Aegean and Mediterranean Regions where the *Laurus nobilis* found,it spreads usually with other Maquis plant species such as *Phillyrea latifolia, Quercus cocciferae, Smilax aspera, Olea europaea, Pinus brutia, Pistacia terebinthus* etc. *Laurus nobilis* covers around 15-35%, in some places 50-70% in the maquis vegetation.

In general, *Laurus nobilis* is found naturally in areas close to the sea or in areas with high air humidity, with no geographical barriers to the sea. It spreads on the south sides of the Mediterranean and Aegean Regions, and on the north sides of the Black Sea region. Forest Regional Directorates with the highest number of laurels are listed as Zonguldak, Mersin, Kahramanmaraş, Antalya, Bursa and İzmir.

Bay leaf production in 2019 was 32 600 tons in total, and about half of this production was exported. As of 2019, the contribution of all other products obtained from laurel, including unprocessed bay leaves, to the national economy was calculated as 264 million USD. Direct export income was around 38 million USD.

"Laurel Leaf Technical Guide" should have the main lines as follows

1. Ensuring the health and sustainability of laurel forests and trees,
2. Determination and management of bay leaf production areas,
3. Harvesting/Production, processing, and marketing of bay leaves.

Bay leaf harvesting is basically based on collecting from laurel areas located within the state forests owned and managed by GDF. The most important risk for laurel and laurel areas is that it’s potential ecological and economic value is not fully understood. In some areas in the Mediterranean Region which are suitable for *Laurus nobilis*, red pine is planted for wood production.

In fact, more expenses are made for afforestation with red pine and silvicultural maintenance of these forests compared to the costs of laurel planting and maintenance. After many years, a single revenue is obtained with wood production. In contrast, planting and maintenance of laurel is easier and cheaper. The product is harvested more frequently. Laurel does not interfere with other forest products and services; it is resistant to fire. Despite these advantages, due to the lack of sufficient scientific information and statistics, red pine afforestation can be made even in areas ecologically and economically suitable for the laurel.

Another threat is the afforestation of burned bay areas with red pine instead of leaving them to the natural process of regeneration, the soil is cultivated with dozers and other construction equipment to prepare for plantings. Burned forests areas are tried to be afforested in the same year due to public pressure , and in some cases, there could be a risk that burned forests may become “temporary quarries” due to excessive soil cultivation.

It is of great importance to rehabilitate the laurel areas, which have suffered structural deterioration and the leaf yield decreased due to biotic and abiotic reasons, by using appropriate rehabilitation techniques.

Considering the contribution of laurel to biodiversity, it would be beneficial not to make all existing laurel areas subject to production, but to preserve some areas as “bay gene conservation centers” where laurel is part of the natural plant species mixture and where laurel individuals are healthy. In addition, the flowers of laurel trees are preferred by bees and are known to contribute to honey production.

Areas, where bay leaf production will be made, are determined by GDF and land-based "utilization plans" are prepared for these areas. The following points were determined in the field investigations and interviews, and it would be beneficial to implement the production guidelines in a way to respond to these findings.

1. It is suggested to map the bay leaf production areas on a Geographic Information System (GIS) basis and to be included under the name of "Bay Leaf Production Area" in the other sectoral plans, especially in Forest Management Plans, and the maps will be available for authorized people to access them easily and in a standardized way. In this way, all areas can be monitored from a single source, harvest and harvest planning will be made taking into account national and international developments, and as a result, producers and processors will be able to get more regular and higher income.
2. The principles, and procedures regarding the production of bay leaves have been determined by GDF. Local rules are also determined during the preparation of the Utilization Plans. However, it seems a little difficult to say that the implementations in the field are carried out in accordance with these plans.
3. Before the bay leaf harvest begins, hands-on training should be given to field workers. The most important factor in bay leaf pricing is if the leaf is well-preserved and that it is collected and packaged in accordance with the standards. However, due to insufficient training of workers, there are problems in practice and serious losses may occur.
4. There are no professional teams of workers involved in bay leaf production. The cutting of laurel branches is generally done by the forest villagers in the region and each villager works in the areas near her/his village. However, laurel shoots in an area can grow only within two to three years after cutting and become ready for cutting again.
5. To ensure continuity in the production and employment, the laurel plantations can be divided into three parcels, and the production can be made on a rotational basis. Nevertheless, workers who can do the job can change, become unable to work or migrate to other places by getting older. On the other hand, considering the migration tendency of the rural population, it is predicted that there will be problems with the workforce in the future. Emphasis should be given to the employment of more professional teams and mechanization in laurel production.
6. In the areas of harvesting the ability of the plant to shoot should not be dulled. In clearcutting, a low-cut close to the root neck should be applied, the cut surface should be smooth and inclined.
7. The branches with leaves that are cut are brought to the facilities on the same day or within a couple of days, where the branches are dried in a suitable environment and the leaves are whipped with automatic machines, and separated from the branches. If these branches are kept in the field, and natural drying is required, it will be appropriate to keep them is in shady places, and not to be exposed to rain. If possible, drying should be done in porches that are covered, with open sides, with wooden floors and elevated from the ground.
8. It is predicted that there will be no problems in the sale of laurel leaves in national and international markets, which are produced and packaged in accordance with its technique and standard. In addition, it is observed that the demand for bay leaves is increasing due to the COVID-19 outbreak.
9. Although the production of bay leaves is mostly carried out in forests belonging to the State and under the control of GDF, the number of personnel trained in the field of laurel in GDF is insufficient.
10. GDF should play a more effective, regulatory and determining role between the bay leaf buyers and processors and the villagers that produce it.
11. Bay leaf production is generally carried out in August-September. This time interval is the period when the leaf sizes and the amount and quality of the essential oil in it are at the best level. However, this period also coincides with the fire season. Foresters especially in the Mediterranean and Aegean regions devote the summer months to combating forest fires.
12. In the forestry sector, laurel and other non-wood forest products are traditionally perceived as secondary products, giving more priority to wood production. To improve this situation, comprehensive public information and awareness-raising work should be carried out, starting with the training in forest faculties.

# Chestnut

Chestnuts (*Castanea sativa*) is one of the natural forest trees of Turkey. According to GDF data chestnut forests cover262 045 hectares in Turkey. Chestnut fruit is produced in 74 897 hectares of these state-owned chestnut forests. The remaining areas are reserved for traditional forestry activities.

In addition to the chestnuts in the state-owned forests, chestnut orchards/gardens are also established by the private sector. Chestnut fruit is mainly produced in gardens belonging to the private sector. In 2019 the total chestnut production in Turkey amounted to 72 655 tons, 33% of this production was harvested from state-owned forests and 67% from privately owned chestnut orchards.

While the chestnut trees in the state forests are mostly in the Black Sea region, the chestnut groves belonging to the private sector is concentrated in the Aegean region. In addition to the fruit and timber of chestnut trees, chestnut flowers are an important resource for beekeeping. In particular, the state-owned chestnut forests in the Black Sea region contribute greatly to chestnut honey production.

Turkey's total chestnut production in the year of 2000 was 68 652 tons, a total of 116 million USD contribution to the national economy, the export revenue was approximately 7 million USD. In 2019, total production increased to 72 655 tons and exports to 14 225 tons. Direct export income of 2019 was approximately 36 million USD.

The most important market in chestnut exports is Italy by far. Imports have also been started in recent years. Imports are almost 100% made from China.

"Chestnut Technical Guide" should include the main lines as follows

1. Preserving the health of chestnut forests and trees and ensuring their sustainability,
2. Determination and management of forest areas where chestnut fruit is produced,
3. Management of chestnut orchards established by the private sector, and their integration with the production in state forests,
4. Production, processing, and marketing of chestnut fruit.

Both forests and chestnut orchards are faced with serious diseases and pests. These diseases and pests and the measures to be taken are shown in the table with short descriptions.

|  |  |  |  |
| --- | --- | --- | --- |
| Diseases and Pests | Latin names of the agents | Where it damaged | Suggestions |
| Chestnut blight (canker) | *Cryphonectria parasitica (Murr.)* | Trunk and branches | * Biological control can be done by using hypovirulent variants in forests. * Resistant varieties can be used in gardens. * Application of fertilizers to increase the viability of the trees can be useful. |
| Root rot | *Phytophthora spp.* | Roots | * New chestnut groves can be established with resistant varieties . * seedlings grafted on selected rootstocks can be used. * Appropriate use of fertilizers may help to strengthen the trees against the root rot. |
| Fruit rot | *Penicilllium* spp.  *Ciboria batschiana (*syn. Sclerotinia pseudotuberosa)  *Gnomoniopsis* spp. |  | * Harvested fruits can be kept in water for 3-9 days and then dried for 1 day and stored in cold (0-1 ° C). * Hot water can be applied to harvested fruits (30 minutes at 50 ° C or 15 minutes at 55 ° C or 5 minutes at 60 ° C) |
| Chestnut gall wasp | *Dryocosmus kuriphilus* | Buds | * *Torymus sinensis* can be used as biological control. * Resistant varieties can be used in new gardens. |
| Chestnut moths weevils | *Cydia splendana* (Hbn)  *Curculio elephas* (Gyllenhal)  *Pammene fasciana* | Burs and nuts | * Pheromone or feed traps can be used for monitoring and catching the weevils. * Chemical spraying with approved methods/materials can be done in “underground natural storage” places. * Chemical control can be used in home gardens with approved methods/materials. * The harvested fruits can be kept in water at 45-60 ° C for 30-45 minutes to kill the insect's eggs and larvae. * Eggs and larvae of the insect can be killed by keeping the harvested fruits in water for a few (3-9) days. |
| Ambrosia beetle | *Xyleborus dispar* (F.) | Trunk and branches | * Traps by placing an ethyl alcohol solution in a plastic bottle can be used. |
| Tree redworm  Goat moth | *Cossus* (L.) | Trunk and branches  Trunk and Branches | * Pheromone (scent) traps and capsules can be used to catch adults of pests. * Mycorrhizal etc. that will strengthen the immune system of the trees. fertilizers can be used. |

The following points were determined in the field surveys and interviews, and it would be beneficial to implement the guides in a way to respond to these findings.

1. In the management of state and private sector chestnut forests, first, the health and sustainability of the trees should be ensured. In this regard, first of all, "sustainable forest management criteria and indicators" should be followed. The capacity of an unhealthy tree or an unhealthy stand to produce any product, including fruit, is drastically reduced.
2. An important part of the chestnut forest in Turkey is degraded forest. As part of traditional forestry activity, the rehabilitation works for getting more productive forest for wood are ongoing. Although this approach is beneficial regarding wood production, it should be taken into account that for fruit production more open space and good sunlight is required. Care should be taken to protect trees with high fruit yield and quality in the rehabilitation of existing chestnut fields.
3. Regarding the silviculture of chestnut forests, scientific studies should be conducted on whether it is necessary to apply different substances (resin, tar, etc.) to the cutting places against chestnut cancer, and if necessary, which substance should be used in what dosage.
4. In practice, chestnuts in forests and chestnuts in orchards appear to be subject to different rules. While forests are under the control of GDF, chestnuts in agricultural areas are under the control of the General Directorate of Plant Production of MoAF. This situation causes some confusion. On the other hand, General Directorate of Food and Control of MoAF is also active at various stages. Even though these General Directorates are within the same ministry, more coordinated cooperation is needed.
5. Although the chestnuts in agricultural areas are under the responsibility of agriculture authorities, these are generally areas that are far from settlements and closer to forests. In fact, they have similar ecosystems with chestnut groves in forests. Diseases and pests in forests also affect individuals in agricultural areas. To control the spread of diseases between the forest and agricultural areas GDF could deal with chestnut trees in agricultural areas and organize reports and statistics jointly, and to consider trees in a region in integrity.
6. Root-rot-resistant rootstocks should be used in the production of chestnut saplings. Research should be done on the clonal reproduction of these rootstocks. If rootstocks resistant to root-rot are used as seed rootstocks, it has been suggested to obtain seeds by growing them in an isolated place outside the forest areas in order to make the individuals more resistant to root-rot.
7. The chestnuts in the state forests are predominantly in the Black Sea region and there is no intensive fruit production yet. The main factor in the low fruit production and utilization is that the fruits of existing individuals are very small compared to private plantation. In cooperation with the MoAF and Universities, a situation assessment should be made, forest areas that can be grafted should be determined and a graftingprogram should be implemented based on scientific data. On the other hand, there is a need for genetic improvement. However, there are some concerns (disease-pest entry and genetic contamination etc.) about the grafting studies in forest areas.
8. Pruning, grafting and disinfection of grafting equipment should be carried out by the people or organizations/companies that have a certificate. In grafting studies, special attention should be paid to the issue of not grafting valuable trees, which are considered as monuments. The maintenance of monumental trees should be done by professional teams under GDF control.
9. It is assumed that increasing temperatures due to climate change will affect the Black Sea region more intensely and it may become more suitable for chestnut fruit production. Preparations for this aim should start immediately.
10. Ecological aspirations of hazelnut, one of the main products / plants of the Black Sea Region, are very similar to chestnuts. Compared to hazelnuts, chestnuts can be sold more expensive. The area which is not suitable for hazelnut agriculture, could be converted to chestnut cultivation. This issue is especially important for upland and slope lands where hazelnut yield is low. In addition, it may be considered to give priority to the vaccination of wild chestnut trees in hazelnut orchards in the Black Sea and Marmara Region.
11. A portion of the chestnut harvested in Turkey are exported. However, the lack of harvester associations seems an important problem to defend their rights and raise their voices. Cooperatives that will regulate harvesting and ensure that harvesters come together should be encouraged.
12. Beside the fruits, chestnut is an important plant species regarding biodiversity and culture. Nevertheless, there is no non-governmental organization representing with different stakeholders who are dealing with chestnuts. An association / platform structuring with representatives from the university-public-private sector (producer, trader, exporter, etc.) would be extremely beneficial.
13. Since production is predominantly subject to climatic conditions, yield forecast and harvest adjustment cannot be made. Storing chestnut fruits in suitable conditions will be an important factor concerning price stability.
14. In the current practice, "degraded forest areas" are allocated to citizens, mainly to forest villagers within the framework of income generating species afforestation program. Since the areas where chestnuts are found, especially in the Black Sea Region, are included in the management plans as "productive forest", their allocation is not possible. This situation decreases the demand for afforestation. In addition, the fact that GDF gives priority to "forest villagers" in accordance with the Forest Law and other relevant legislation plays a preventive role for companies working professionally. Considering the food security and food supply under COVID-19 conditions, not only forest villagers, but also professionally working companies should be allowed to apply for private afforestation and supported. The public should be informed about the allocation of forest areas for chestnut fruit production and the demand should be increased.
15. Public-university-private sector cooperation is not enough. There is a need for a joint action plan and work schedule covering all units of the MoAF, rather than work and action plans belonging only to the general directorates. There are many academicians working individually on chestnuts in universities. Institutionally, Ondokuz Mayıs University (Ali Nihat Gökyiğit Chestnut Research Station), Uludağ University, Adnan Menderes University are working on chestnuts.
16. Beside universities, there are research institutes dealing with chestnut researches operating under the General Directorate of Agricultural Research and Policies (TAGEM) and GDF of MoAF

|  |  |
| --- | --- |
| General Directorates | Research Institute |
| TAGEM | Atatürk Horticultural Central Research Institute/Yalova |
| TAGEM | Fig Research Institute-/Aydın |
| TAGEM | Black Sea Agricultural Research Institute/Samsun |
| GDF | Western Black Sea Forest Research Institute/Bolu |
| GDF | Eastern Black Sea Forestry Research Institute/Trabzon |
| GDF | Aegean Forestry Research Institute/İzmir |
| GDF | Marmara Forestry Research Institute/İstanbul |

# Resin

Resin is harvested mainly from *Pinus brutia* and *Pinus pinaster*. In addition to these two trees, a little amount of resin is collected from *Pinus nigra* roots. Although it is technically possible to collect resin from *Pinus pinea*, it is not used for the time being as more income is obtained from stone pine harvesting. The total potential area suitable for resin production is around 100 000 hectares in Turkey.

Resin harvesting, which started in the 1950s, reached the highest level around 7 000 tons per year in 1971, then decreased with the introduction of imported artificial resins, and since the 1990s, the annual average was around 100 tons. Currently, Turkey’s resin demand is largely met through imports. In 2019, around 11 000 tons of resin was imported annually and around 20 million USD was paid in return.

Recent trends to use natural materials instead of synthetic materials has increased the demand for natural products harvested from natural resources.

In this context, the first circular numbered 302 on Communiqué on Inventory and Planning of NWFPs and Production and Sales Principles (Communiqué of NWFPs) was published in 2016 and the works and procedures regarding the production/harvesting and sale of resin from the state forests were determined. Then, the "Resin Action Plan-2017/2021" was put into practice.

Within the framework of this action plan, it is aimed to increase the resin production, which was around 290 tons by 2019, to 5 000 tons per year until 2023.

Currently natural resin is obtained from three different sources:

* 1. Pine Resin (Gum Resin): Pine resin is produced in a similar way to pine resin rubber, which is collected by a labor-intensive work by wounding the trunks of planted, living pine trees with different methods.
  2. Sulphate Resin: It is obtained as a by-product in the production of pulp from resin pine chips by sulphate (kraft) method.
  3. Wood Extraction Resin: It is obtained by chipping and extracting with a capital-intensive technology from resinous pine bottom logs and roots that have waited in the soil for a long time after cutting.

In line with above-mentioned explanation, a “Resin Technical Guide, should have the following specifications.

1. Determination and management of forests suitable for resin production,
2. Making the resin production method duly,
3. Processing and marketing.

The following recommendations have been made for resin production and sales within the framework of Communiqué of NWFPs, Resin Action Plan and the recommendations of academics.

1. Resins are produced from wounds opened on pine tree trunks in accordance with its professional technique.
2. Red pine (*Pinus brutia)* forests are the most suitable forests for resin production due to the topography and climate conditions in their distribution areas. Likewise, the production of paper wood for the paper industry, where resin products are obtained as by-products, is mostly made from these forests.
3. Although they do not spread naturally in Turkey, coastal pine trees (*Pinus pinaster)*, which have been subjected to afforestation for industrial plantation purposes since the ‘70s, have potential regarding raw resin production.
4. Within the scope of the “Resin Action Plan”, GDF supports the production of flowing resin by the private sector, allocates suitable forest lands for resin production if requested, and encourages the production of new products with highly added value from raw resin.
5. Forests are mainly used for wood production in Turkey. However, especially red pine trees should be subjected to resin production before final cutting. The resin production made in accordance with the adequate technique does not negatively affect the growth of the height and diameter of the tree.
6. The areas to be subject to resin production should be determined by the committees in which the technical staff of the forest administration and planning, silviculture, non-wood products and services branch directorates will also participate. Uncontrolled bushes and grasses found under trees in forests both negatively affects the growth of the tree and makes resin production/harvesting difficult furthermore those are also increasing the risk of fire. Therefore, cleaning is a priority measure to be taken.
7. In terms of the habitat suitable for resin production, it is appropriate to separate at least 5 ha for each harvesting site. After the trees reach a diameter of 25-30 cm, resin can be harvested more efficiently.
8. It is recommended that the slope of the land where resin production takes place should not exceed 30%, as it causes difficult working conditions and transportation, although it does not affect the resin production of trees. More resin can be harvested in areas up to 400 meters above sea level and facing the sea.
9. The way to follow in order to meet the market demand in a short time and to ensure a quality and efficient market supply is to make the existing forests suitable for resin production. It is possible to increase the raw resin yield per tree and reduce labor costs by making silvicultural care practices and the creation of infrastructures that facilitate labor.
10. Within the scope of this activity, silviculture interventions such as reducing the forest canopy by removing the individuals with uneven stems, cleaning the intermediate and substrate that prevent the sun and heating of the tree trunks, pruning the lower branches, performing maintenance interventions to improve the crown of the trees left in the field can be implemented.
11. The most important issue in resin production and harvesting is the trained and experienced workforce. Maintenance techniques and resin production techniques of forests intended for resin production should be transferred to the members cooperatives established by forest villagers and the related groups through training. With this envisaged activity, the training of the workforce to work in the resin production areas should be provided through the training of resource managers. It should be ensured that the company workers who are planned to work in the field and the authorities who will supervise them receive "Resin Production Training" and "Certificate".
12. It is necessary to have cooperation and collaboration between public, workers, villagers, university and industry.

# Truffles

Truffle mushroom, which is one of the important non-wood forest products and also named as "black diamond", grows in forests with tree roots under the ground and creates a mycorrhizal association.

Truffles are the most valuable mycorrhizal fungi found in most forest ecosystems in the Northern Hemisphere, from subtropical to boreal regions. While it has more than 180 species recognized around the world, about 10 of them are considered commercially for their important and distinctive species-specific aromas. Besides their ecological importance, truffles have a high economic impact and provide significant income for residents of rural (forested) regions and many underdeveloped areas in central, southern and south-Eastern Europe. Environmental changes, high human impact on forest ecosystems, and intensification of forest management approaches reduce truffle production significantly.

Truffles biology and information about them have started to gain value in Turkey in the last decade, and *Tuber aestivum* and *Tuber borchii* hunting has become very popular recently. However, unrestricted and unconscious truffle harvesting causes ecological and economical losses.

Technological and organizational innovations such as research of ecological conditions, monitoring of mature truffles in nature, optimization of truffle gardens in agriculture and forestry systems, long-term storage facilities and uses of truffles, food sector and tourism has the potential to trigger development in the production and sale.

Truffle species form mycorrhiza with the roots of some trees and shrubs and contribute to the forest ecosystem by living a symbiotic life. They naturally grow in a variety of habitats. Truffle species makes ectomycorrhiza with *Populus, Ostrya, Salix, Cistus, Fagus, Quercus, Corylus, Tilia, Carpinus, Castanea* and *Pinus* species.

The "Truffle Forest Action Plan" was prepared and implemented by GDF in 2014. In August 2020, the "Truffle Garden (Truffle) Plant Project Feasibility Report and Investor Guide" was published. Then, in September 2020, Circular No. 7319 on "Truffle Harvesting and Sales Procedures and Principles" was published.

Circular No. 7319 consists of the main text and two supplements. These are i) Macroscopic and Microscopic Characteristics of the Commercial Species (6 pages) and ii) Preliminary Study Report Composition of the Afforestation Application Project for Truffle Production Purpose. (14 pages).

In line with above-mentioned explanation, a “Truffle Technical Guide, should have the following specifications.

1. Detection, recording and harvesting of truffles that occur naturally in forests ,
2. Establishment of truffle gardens.

Identification of truffle forests in Turkey is very new, it has started since 2014. Especially degraded oak forests are suitable areas for truffles. It is estimated that 1-2 000 tons truffles grow per year in Turkey. However, as of the end of 2019, only 40 tons of truffles was harvested. The contribution of this 40-ton production to the economy was calculated 32 million USD. It appears that there is a potential of 1 billion USD if at least 1 000 tons of truffle harvested.

Existing truffles in forests are mostly detected with the help of trained dogs. It was estimated that, as of 2019, there were around 150 dogs trained for truffle. One dog can be purchased and sold with around 2 000 USD.

In Turkey people are allowed to collect the following types of truffles from state-owned forest.

1. *Tuber magnatum*Pico. Italian white truffle,
2. *Tuber melanosporum*Vitt. Winter black truffle,
3. *Tuber brumale*Vitt. Winter truffle,
4. *Tuber aestivum*Vitt. (Syn. Tuber uncinatum Chat.) Summer black truffle,
5. *Tuber borchii*Vitt. Whitish truffle mushrooms,
6. *Tuber maculatum*Vitt. Spotted Truffle,
7. *Tuber macrosporum*Vitt. Smooth surfaced black truffle,
8. *Tuber mesentericum*Vitt. Summer truffles.

While collecting truffles in forests, the following rules must be followed.

* Maximum number of hunters/collectors should be determined to search and collect truffles in existing forests to ensure the sustainability of the truffle.
* Truffle hunters should be certified and undergo training that will ensure that health of truffles and health of the ecosystem are protected.
* Official records must be made of the mushrooms collected. In this way, seasonal and annual data can be easily followed and protection strategies of truffle species can be prepared easily.
* The species collected must be found under appropriate transport and storage conditions. During the collection, approximately 20% of harvested truffle is lost due to transportation under improper conditions.

The rules to be followed to increase and protect the truffles in forests are as follows.

* It is necessary to determine the natural truffle production areas and consider the truffles in modern forestry studies and silvicultural studies.
* The production potential of each truffle area should be determined and it should be announced how many truffles will be collected from the same region on an annual basis. This will ensure that truffle collection is sustainable.
* Planting saplings inoculated with truffle species that will adapt to the region and soil conditions should be encouraged in the planting of trees in newly afforested areas and planting areas. In this way, the saplings will grow faster and healthier, and natural truffle areas will increase.

In addition to the truffles naturally found in forests, artificially created truffle gardens have begun to be established. The following issues is recommended in the establishment and management of truffle gardens.

* Forest or non-forest areas that can be truffle gardens should be determined and recorded; their work should be checked annually. Thanks to the recording of the success rates of the works, useful information will be obtained in the development of future production policies
* Efforts should be made to assist and inform the related people in the selection of truffle types suitable for the soil structure and vegetation of the registered areas.
* Methods should be developed to encourage the production of seedlings with truffle species grafted suitable for the region.
* The truffle commercial market is in the hands of European countries. In particular, sales prices are determined by countries such as Italy and Bulgaria. Necessary measures should be taken in advance to avoid possible market and sales problems considering the truffles collected from forests and produced in gardens reach the target level,

1. Mukhtar or muhtar refers to village and neighborhood headmen in Turkey. In each village, muhtar is the highest elected authority of the village. Muhtars and their village councils are elected during local elections for five years. However, political parties are not permitted to stand candidates for these posts [↑](#footnote-ref-1)
2. In terms of wood production, the annual increment of red pine starts to decrease after 50-60 years of age of trees. Therefore, in the current practice, red pine trees over 60 years old are cut down for wood production. In forests that have suitable ecological conditions and show rapid growth, the age of cutting goes down to 30. But in forests where pine honey is produced, the cutting age of trees for wood production has started to be 100 or 120, instead of 60. [↑](#footnote-ref-2)