Technical guide
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Cultivation of organic bush berries

FiBL
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High market demand for organic bush berries in Europe and growing interest among Kosovar merchandisers and producers in high-bush blueberries have initiated the creation of this technical guide. The guide aims at non-organic berry producers in the Balkan region interested in converting their production to organic, at organic farmers seeking to expand their knowledge in berry production, as well as at farmers considering getting into organic berry production.

It provides up-to-date technical information on the production of high-quality organic bush berries, covering topics such as orchard pre-establishment planning, fertilisation, and preventive pest and disease management.

The guide has been elaborated in the frame of the SIRED project to support interested producers in the transition to organic production.

Content

In this publication, the following symbols are used to indicate information that refers to individual fruit species:

- Summer raspberries
- Autumn raspberries
- Blackberries
- Redcurrants
- Blackcurrants
- Gooseberries
- Blueberries

Opportunities and challenges of organic berry production

Growing international market

Markets for organic products have been growing steadily in many European countries, and market growth is projected to continue. Because of supply shortages, importers and retailers are more willing to accept new exporters from new sourcing regions to secure and diversify their supply chains.

Kosovo is a traditional producer of berries and is known by international buyers for the quality and consistency of its production. While conventional crop volumes continue to grow yearly in the country, especially for raspberries, strawberries, and blueberries, interest for certified organic production is increasing too among farmers, as organic products tend to fetch higher producer prices than equivalent conventional fruits. For marketing of berries, growers in Kosovo can benefit from the support of a well-organised sector and a broadly branched deep-freezing infrastructure that is fully suitable to develop an organic supply chain.

Although the European organic market has stabilised in recent years, some raw materials are still sourced a long way from Europe. For example, 660 tons of frozen organic raspberries were imported in the EU in 2022, mainly from China. At a time when consumers are placing more emphasis than ever on food systems sustainability, long-distance sourcing is becoming less and less popular. Given the situation in Ukraine and the desire of importers to avoid overseas sourcing when possible, Kosovo has a real card to play, offering a similar pedoclimatic context to its Balkan neighbours and enjoying a positive 'organic' image internationally (Table 1).

Table 1: Volume of organic bush berries imported to the European Union in 2022

Main exporting countries	Imported volumes	Main importing countries
Ukraine	3100 tons	Germany, Poland, Netherland
Serbia	2500 tons	Germany, Poland, Netherland
Bosnia I Herzegovina	390 tons	Sweden, Germany

Eastern European countries are the main exporters of fresh and frozen bush berries to the organic market in the European Union.

Kosovo offers favourable natural conditions for the production of organic bush berries. However, careful assessment of the opportunities and risks is essential for a successful operation.

Minor production challenges

From an agronomic point of view, the conditions in Kosovo are relatively favourable for berry production, as pest and disease pressure decreases with increasing altitude, and the agricultural landscape is near-natural. Conventional berry growers in Kosovo in general do not encounter major plant protection problems and therefore use little pesticides.

As with conventional products, the organic market is mainly oriented towards frozen products, which makes it easier for producers to convert to organic farming, as they do not have to change varieties and techniques significantly.

Manageable conversion constraints

For marketing of organic berries, production must comply with the requirements of the organic standard that is aimed at. Depending on whether the products are destined for the European or the Swiss organic market, the regulations differ slightly.

The organic market can be entered after a conversion period during which producers face higher expenses without receiving a premium. For individual small producers, the certification fees may be too high. By forming producer groups and implementing an Internal Control System (ICS), certification costs can be shared.

Planning before planting

Basic preliminary questions

Creating a bush berry orchard is work-intensive and expensive. Therefore, it is advisable to clarify any concerns and do extensive planning beforehand. The three core questions to be answered before entering this sector are the following:

Are bush berries suitable for my farm?
The work-intensive cultivation of berries is not suited for everyone. Even subtleties can make the difference between success or failure. The cultivation of berries requires expert knowledge and sensitivity.

In order to produce high-quality berries profitably, the location must be suitable for the cultivation of the desired berry species (see information on the following pages). Furthermore, it must be clarified whether operational peak times can be handled with the available staff.

Is there a demand for organic bush berries, and what are the marketing conditions?
Thorough information about marketing aspects is essential. This includes information on products in demand, customers, sales conditions, producer prices, etc.

All types of bush berries do best in full sun, airy locations, but protected from strong winds and late frosts. A carefully selected site can effectively reduce pest and disease pressure. The immediate surroundings, the slope and the level of the water table are all important factors to consider.

In case of close location of the orchard to local markets, good availability of workforce and personal interest, direct sales can be an option. However, due to the still little domestic demand for organic berries, the deep-frost market is certainly the best entry point for producers willing to engage in organic production.

Which intensity level should be aimed at?
Due to the growing quality demands of buyers, the professional cultivation of berries is becoming increasingly cost-intensive (e. g. necessary weather protection for high quality raspberries for the fresh market). Consequently, there is more pressure to achieve high yields on a regular basis.

Extensive berry cultivation without weather protection is better suited for direct sales, deep-frost market or further processing.

Selection of a suitable location

The main raspberry production area in Kosovo is situated in the Podujevo municipality in the Pristina region. With an average annual rainfall of 700 mm, much sunshine and relatively good protection from severe temperatures, the region offers good conditions for the cultivation of bush berries. However, farmers at higher altitudes up to 1200 m appear to have fewer problems with some pests.

Exposure

- Sunny and airy locations that are protected from strong winds and late frost are most suited for bush berries.
- For optimal sun exposure, the rows must be aligned in north-south direction.
- Alignment of the rows with the main wind direction will result in faster drying of the plants and consequently in less disease infections.
- Guaranteed supply of water in terms of quantity and quality is essential.
- A distance of at least 100 m to forests and hedges reduces infestation by the raspberry beetle, raspberry blossom borer and *Drosophila suzukii*, as they offer shelter to the pests.

Soil Quality

Berry crops prefer medium to light, water-permeable soils with a slightly acidic pH (depending on the berry species). Planting in compacted, stagnant or alternating soils must be avoided. Cultivation on dams can improve the depth and soil structure, especially in moderately suitable soils.

Raspberries have high demands in soil quality. In unfavourable soils, low yields, and shoot and root diseases are likely to result.

- Raspberries require medium-heavy to light, permeable soils.
- Compacted or water-logged soils are not suitable.
- Cultivation on compost-enriched dykes minimises root disease problems and is currently the standard cultivation method on medium-heavy to light soils.

- The plants of blackberries, redcurrants, gooseberries, and blackcurrants have somewhat lower demands in soil quality.

- Blueberry plants require light, acidic soils that are rich in organic matter and have a pH of approximately 4 (H_2O method). Such soils are rare in Kosovo. Instead, blueberries can be cultivated in special row systems (see page 17).

Altitude

Depending on the exposure, an increase in altitude of 100 m can result in a delay of harvest of 3 to 5 days. In higher altitudes, the fruits might only ripen partially, depending on the crop and the variety.

- Cultivation up to approx. 1400 m a.s.l. (applies especially to floricane-fruiting raspberry cultivars for commercial cultivation).
- Primocane varieties should not be cultivated above 800 m a.s.l. to ensure a sufficiently long production phase.

- Cultivation up to 1000 m a.s.l., depending on exposure conditions.

Box 1: Spade diagnosis for soil evaluation

The spade diagnosis is a valuable tool to determine the suitability of the soil conditions for planting.

How to proceed

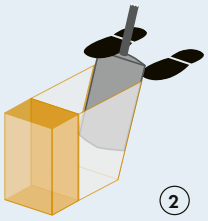
(1) Choose a location that is representative of the entire field. If available, select a location with a tap-rooted plant that can serve as an indicator for soil compaction.

(2) Take a long drainage spade, if available. Prepare a hole about one spade deep and 20 cm long. Avoid damaging the side that will later be stabbed for the soil brick.

(3) Cut the soil tile on both sides.

(4) Poke the spade vertically into the soil at a distance of about 10 cm from the hole. Separate the soil brick from the rest of the soil volume by pushing the spade slightly forward with the shoulder.

(5) Use the spade like a lever and carefully lift the sample out of the hole. Stabilise the brick with your hand or place a second spade in front of the soil brick and let it tip over onto it.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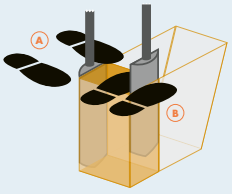

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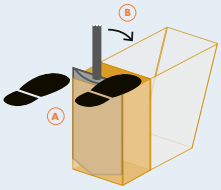

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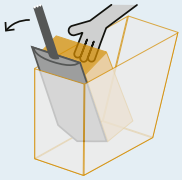
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What to look out for?

- Rusty spots and black manganese concretions indicate aeration problems. Such soils are unsuitable for blueberry cultivation without dykes!

Top: Are the edges of the aggregates in the topsoil rather round and crumbly (left) or sharp (right)? Sharp edges indicate that soil has suffered from compaction, or is biologically not very active.

Right: Have the roots grown naturally downwards, or have they encountered obstacles? Is the length appropriate for the season? Too short roots can be an indicator for an area that is asphyxiated or saturated with water for part of the year.

Preparatory crops

Previous crops have an effect on bush berries. Besides the transmission of soil-borne diseases, problem weeds must be avoided, as they are extremely difficult to control in organic bush berries.

- Cultivation of bush berries directly after a natural meadow generally results in increased weed growth and infestations by wireworms *(Elateridae)*.
- Raspberries should never follow raspberry or other *Rubus* species.
- Ideal previous crops are cereals or artificial grassland with alfalfa or clover.
- After an existing bush berry plantation, a break of at least 12 months with an annual green manure crop must be respected.
- Strawberries are host for many pests and diseases that also affect bush berries. Therefore, planting of bush berries after strawberries must absolutely be avoided.

Soil preparation

- At soil preparation, the soil should not be too wet, dry, or frozen.
- Large amounts of non-decomposed manure, green plant material, or straw should not be added to the soil since they may inhibit growth.
- In case of soil compaction, tilling depth should reach 3 to 5 cm below the compacted layer. Spading machines or rototillers help prevent an uneven soil surface.
- In heavy soil, forming dams before the winter will promote a good soil structure and ensure better control of the weeds.
- On light soils, the beds must be prepared at least 3 weeks before planting.
- As the soil is prepared for a cropping period of 8 to 10 years, deep subsoiling at 35 to 40 cm is recommended, at least under the future planting rows. By fostering aeration and natural drainage, this operation will greatly reduce the risk of *Phytophthora* in the long term.

Basic fertilisation

Basic fertilisation is carried out before tillage and bed formation. This allows the incorporation of the fertiliser into the soil.

- The application of organic fertiliser must be based on soil analyses.
- As a general recommendation, 25 and 35 m^3 of composted manure or 15 to 20 m^3 of mature compost per hectare can be applied.
- After planting, annual application of organic fertiliser onto the rows is recommended to maintain a sufficiently high humus content.

See pages 18 to 21 for additional information on plant nutrition and organic fertilisation.

Since profitability depends partly on the lifespan of the plantation, particular attention must be paid to soil preparation and planting. For a healthy and strong root development, tillage and incorporation of organic matter in the ridges must be carried out well ahead of planting.

Variety selection

In organic production, the main criteria for variety selection are:

- High quality of the fruits (fruit size, taste, shelf life after harvest)
- High pest and disease resistance
- High yield reliability
- Pickability (concentrated fruit maturity)
- Late-maturing varieties are most prone to attacks of *Drosophila suzukii*. As the pest was first detected in Kosovo in 2023, it will need to be closely monitored in the coming years.
- At altitudes above 700 m a.s.l., late-maturing varieties often do not ripen completely.

> For more information on recommended varieties, consult the variety lists at shop.fibl.org:
> - 1037: raspberries, blackberries and other Rubus species (in German and French only)
> - 1036: blueberries (in German and French only)

Planting material

As for other crops, organic berry production requires the use of planting material that was produced organically (unless an exemption is granted by the certification body that planting material from conventional production can be used). To assess the availability of organic planting material, the database www.organicxseeds.com is used in some European countries. In the last years, an increasing number of producers in Europe has been offering organic planting material of a growing range of varieties with improved quality that is suitable for organic production. In Kosovo, however, there are still no producers of organic planting material. Therefore, farmers establish new orchards using conventional planting material, and enter conversion after the plants have taken root.

For the purchase of specific varieties, quality, quantity, and delivery time, orders need to be placed early. This is especially important for long-cane plants, but also for large quantities and trendy varieties.

Strong and disease-free planting material is crucial for a successful new crop. As bush berry planting material takes several years to grow, it may be advisable to visit the producer of the planting material **the year before planting** to visually inspect the plants.

Nowadays, mainly green plants in multi-pot plates are used as planting material. Bare-rooted plants have become less important. The robustness of the varieties, especially against diseases, plays a major role in organic production of bush berries.

In the nursery, the following features can be controlled:

- **Leaf colour and shape:** The planting material should have bright green leaves without spots, discolouration, or signs of damage. Yellowish or wilting leaves may indicate nutrient deficiencies or diseases.
- **Growing conditions:** Consider the growing conditions of the planting material, including soil quality, drainage, and sunlight exposure. Wet, compacted soils are a favourable factor for the development of *Phytophthora*.
- **Watering and fertilisation:** The planting material should be properly watered and fertilised.

At delivery, planting material with bare roots can be inspected for three features:

- **Root health:** The roots of the planting material should be white and firm. Planting material with brown or mushy roots should not be used.
- **Stem strength:** The stems should be solid and sturdy. Weak or floppy stems may indicate poor growth or disease.
- **Plant size:** The plants should be at least 15 cm tall and have a well-developed root system.

To prevent the introduction of pests in the orchard, random samples of dubious plant material may be sent for testing (applies mainly to raspberries with suspected Phytophthora root rot).

Creating a nature-like environment for natural self-regulation of pests

According to the ideal conception of organic farming, plant protection problems are reduced to a minimum if the conditions for completely self-stabilising systems are created. In reality, even in well-established organic orchards, individual pests or diseases can occasionally get out of hand. Since in organic production effective plant protection products are limited, measures and strategies to promote self-regulating forces are of central importance.

The more an organic farm resembles a diverse, natural environment, the better large populations of natural predators and parasitoids of pests can develop, as they find suitable habitats and food sources. Even within orchards natural diversity can be promoted. Due to their perennial character and

Sown flower strips ideally provide continuous food supply and shelter to generalist natural enemies.

Figure 1: Semi-natural elements and complementary measures conducive to natural enemies

A diverse, semi-natural habitat in and around the berry orchard builds the foundation for the control of insects and mites in organic farming. Habitats with host and food plants of natural predators favour a natural control of harmful species.

their diversified structure, orchards are potentially attractive for both pollinators and natural enemies of crop pests.

Extensively managed meadows

Extensively managed meadows are not fertilised, and are cut once or twice a year only. Not applying any fertiliser promotes plant diversity and pollen and nectar supply for (wild) bees, butterflies, and other insects such as flower-visiting beneficial insects. As the first cut is done late (in early summer), grasshoppers, field hares and ground-nesting bird species can reproduce successfully, and flowering plants can multiply through seeds.

Perennial flower strips

Perennial strips of selected flowering plants sown in the driveways and next to the orchard have proven to be an effective measure to encourage beneficial insects. In addition to offering food and shelter to parasitic insects and predatory mites, flower strips offer undisturbed ground zones that promote beneficial arthropods such as ground beetles and spiders which feed on pest larvae on the soil surface.

Multi-year trials with flower strips have shown that they are particularly effective in keeping aphid populations in check and can thus reduce the use of bioinsecticides. The composition and the management of these semi-natural habitats are of great importance for their effectiveness. Flower strips should be composed of a mixture of perennial species that are adapted to the needs of many beneficial insects, provide early and continuous nectar and pollen, and do not promote pests. Alternated mowing of the flower strips allows for continuous flowering during the season.

Low hedges

Low hedges at the edge of orchards encourage flower-visiting beneficial insects and songbirds and serve as drift and wind protection. Many bird species use the bushes for shelter and nesting. They are also important habitats for many beneficial organisms, such as *Ichneumon* wasps (parasitoids), *Syrphidae* flies, *Chrysopidae* flies, predatory mites and wild bees *(Apoidea)*.

With the early flowering of plants in hedgerows, such as white willow, blackthorn *(Prunus spinosa)* and other field plants, *Syrphidae* and *Chrysopidae* flies – important enemies of aphids *(Aphidina)* and red spider mites *(Tetranychidae)*, can develop significant populations already at the beginning of the season and thus contribute to keeping phytophagous pests below the optimal damage threshold.

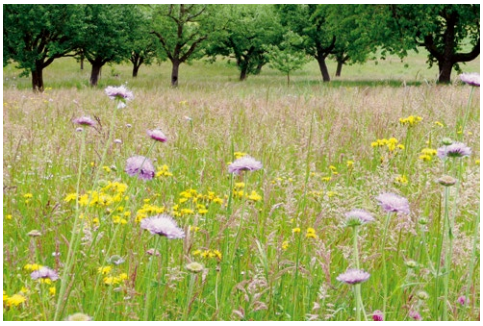
Ruderal areas

The pioneer areas on nutrient-poor rubble heaps or gravel and crushed stone surfaces encourage the formation of sparse, species-rich sites.

The areas should be sunny all year round and well drained. Areas that are difficult to work mechanically and/or have shallow soils, and thus are unsuitable for agricultural use, are well suited.

Stones and wood piles

Well-lit, sunlit thickets of branches and wood are used by hedgehogs, sharp-shinned lizards, weevils, and numerous invertebrates such as root-knotted plovers. These piles can be placed in places where they do not impede work. Stone piles are also valuable landscape elements.



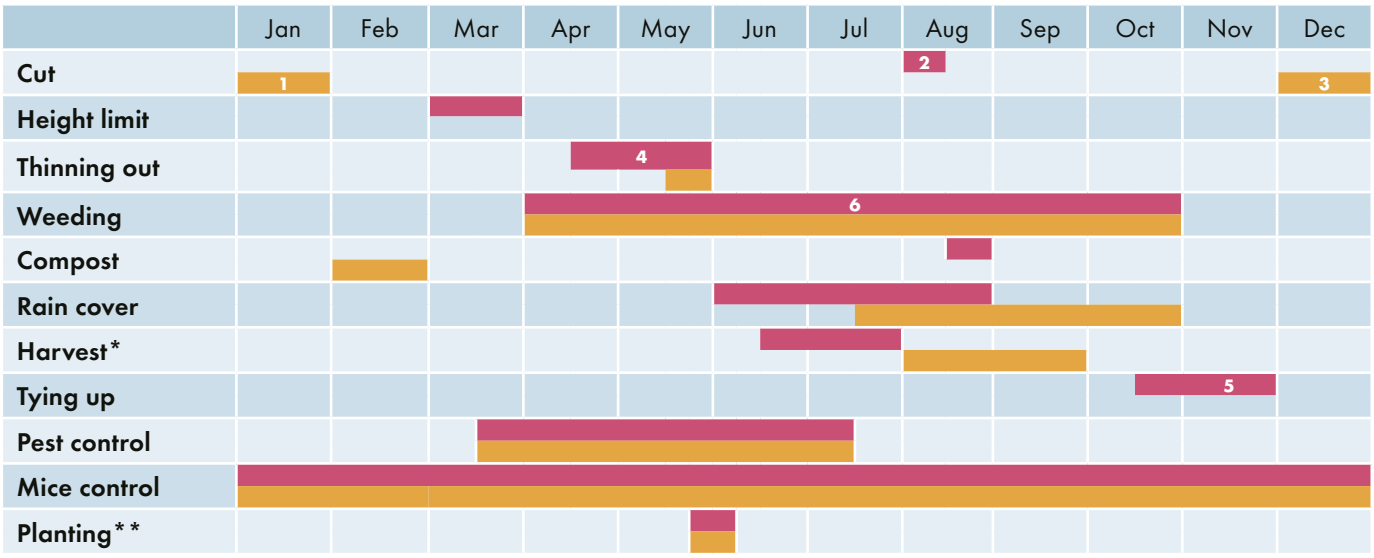
Conversion of fertilised grassland into species-rich meadows takes several years. To impoverish the soil, the cut material must be removed.

Ruderal areas within or in proximity of plantations promote many species of beneficial insects and predatory spiders.

Stone heaps provide shelter for warmth-loving beneficial wildlife. They are especially useful when placed in proximity of an orchard.

Raspberries: overview of cultivation measures and cropping systems

Cultivation calendar



Summer raspberries
Autumn raspberries

* First fruit after 1 year, full yield after 2 years
** Seed stock: Green plants (potted, not lignified)

See pages 20 and 21 for information on fertilisation times.

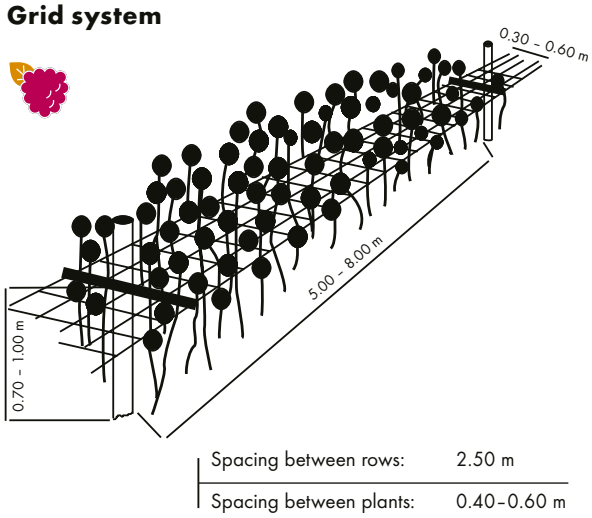
1 Reducing the number of new canes and shrub thickness to 12–20 canes per metre.
2 Cutting off mature canes and removing them from the orchard.
3 Cutting off all shoots (e. g. by using a power scythe) and removing them from the orchard.
4 Thinning out young canes to a total of 10–14 per bush (at medium cane thickness) once they are 15 cm and 50 cm in height. If there are too many young canes each year, tear them off – otherwise cut them off. Prune young canes to approx. 10 cm in length until the beginning of June if your berry variety is growing heavily, or if it does not have a lot of canes.

5 Hedgerow cultivation: Tie up the young canes. In the case of pole-based cultivation: Tie the young canes very loosely to the poles if required. Tie the canes permanently and firmly to the poles once the leaves fall off and/or after the canes are lignified.

6 For weeding of the planting rows, carefully use the cultivator hoe for the bed's margins, as raspberries have shallow root systems. In early spring, the finger weeder can be used, too.
6 Mulch the driveways alternatively to keep the wild flowers in bloom throughout the year.

Training systems

Grid system



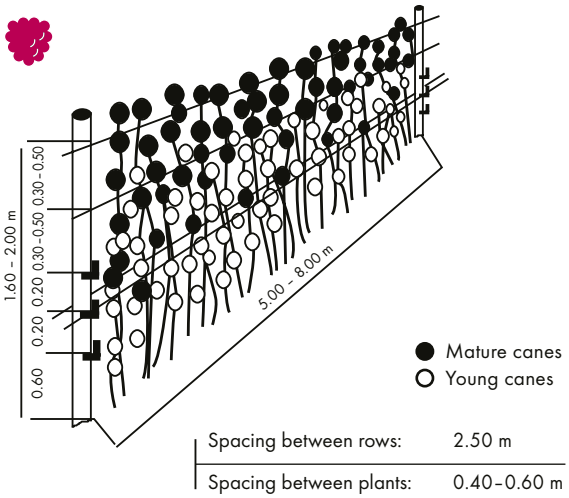
Advantage

- Simplest, proven system

Tips

- The fewer canes per metre (ideally 12–20 canes), the sooner the harvest and the bigger the fruit.
- If required, tie up canes with additional strings (from pole to pole). You might actually be able to substitute the entire grid with this method.

Hedge



Advantage

- Proven system

Disadvantage

- Attaching of canes is not time-efficient.

Tips

- The new canes can be pulled through the wire more easily if the lower pair of wires is not mounted firmly.
- Attach fruit-bearing canes with decomposable binding material (suitable for binding pliers) or with multi-use plastic binders.

Long cane culture – a novel method

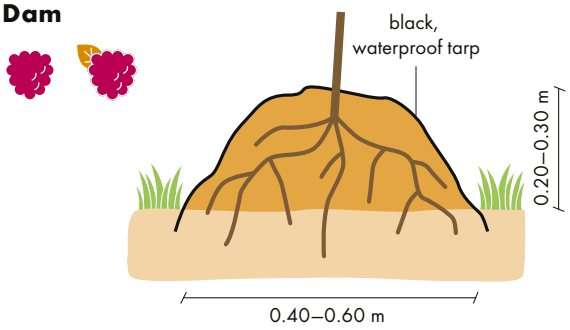
The long cane culture relies on the planting of fully-grown canes that can produce fruits within weeks of planting. The method enables a timely production. In case of staggered planting, continuous market supply from early summer to autumn is possible. In organic cultivation, long-cane crops are only possible as soil crops without pots.

In the year before harvest: In spring, green plants are planted into fertile soil. During the growing season, 2 canes of 1.80 m are grown per plant. When plant growth is completed, the plants are stored at –2 °C.

In the year of harvest: In spring, the plants – covered with flower buds – are taken out of the cooler and planted in the field. After 65 to 80 days the fruits can be harvested.

Shrub row system

Dam



Advantage

- Reduced infestation through dying off of roots *(Phytophthora fragariae)*

How to establish this system?

- Spread 60 liters of ripe and non-steamed plant-based compost per meter onto the future plant row.
- Create the dam (with a special device or a furrow plough).
- Install a drip irrigation system on the dam.
- Cover the dam with a black, waterproof tarp (facilitates the start phase, limits weed growth, and keeps the root area dry (*Phytophthora* prophylaxis).
- Planting: Drill additional holes into the tarp if there are not enough new shoots on the plants.

Yearly maintenance of the dam:

- Spread out 10–30 litres of compost per metre each year (depending on soil analysis results).
- If the tarp on the dam is no longer intact, remove the non-degradable tarp and hoe it flatly to the left and right of the dam (prevents the growth of weeds on the sides).

In light soils, the plants can also be cultivated on flat ground instead on dams under the prerequisite that *Phytophthora*-tolerant varieties are used. In Kosovo, the following raspberry varieties are mainly used:

Primocane varieties:

- **Polka:** three-month harvesting period from late July to October
- **Delniwa:** for fresh marketing and processing, excellent sweet taste during the entire harvest season until frosts
- **Mapema:** beginning of harvest comparable to Polka

Floricane varieties:

- **Meeker:** productive variety, a little more frost-sensitive than Willamette
- **Willamette:** dark red fruits that ripen in mid-summer

Blackberries: overview of cultivation measures and cropping systems

Cultivation calendar

Full Harvest Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cut		1			2							
Rain cover												
Harvest*												
Frost cover											3	
Pest control												
Mice control												
Planting**												

Blackberries

* First fruit after 1 year, full yield after 2 years

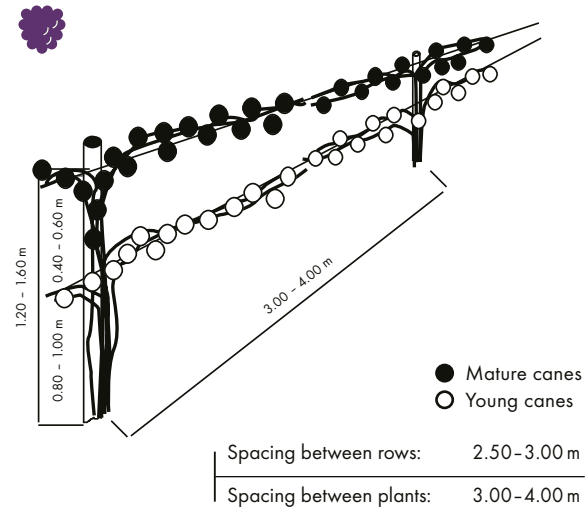
** Seed stock: potted plants

See pages 20 and 21 for information on fertilisation times.

1. Cut mature shoots and excessive lateral shoots and remove them from the plantation. If the plantation is located in an area susceptible to frost, carry out the cutting work in March.
2. If there are not enough young shoots or if they are too thick, pinch them at a height of approx. 20 cm.
   Cut back any lateral shoots not required for the shrub's structure to a length of 20 cm before the harvest.
3. Cover varieties susceptible to frost by placing jute sacks over them or place canes on the ground.

Training systems

Horizontal system

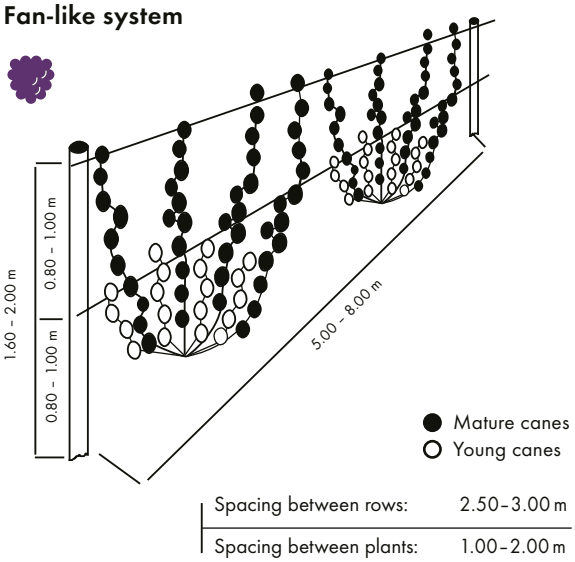


Advantages
- Creating this system is cost-effective.
- As an anti-icing measure, canes can be easily taken down in winter.

Disadvantages
- Moderate yield efficiency
- Moderate size of berries

Tips
- Only suitable for plants with tendril movement
- Leave 6–8 mature canes per shrub.

Fan-like system

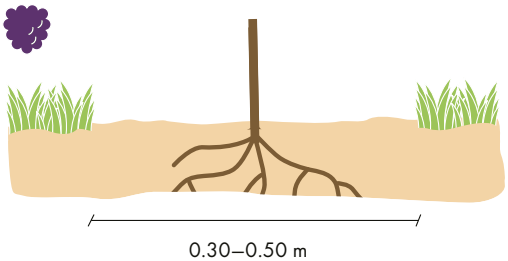


Advantages
- High yield efficiency
- Large size of berries

Tips
- Suitable for upright varieties
- Leave 4–6 mature canes per shrub.

Shrub row systems

Hoeing

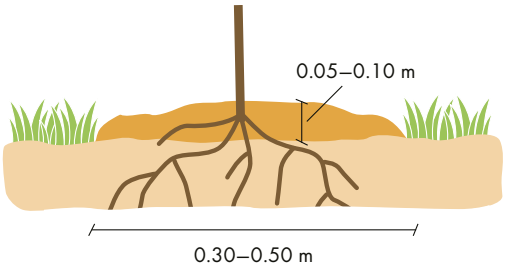


Advantages
- Fertiliser can be added to the bush rows without any problems.
- Hoeing allows for a proper regulation of nitrogen mineralisation.
- Unobstructed mice control is possible.

Disadvantages
- Labour-intensive (high fuel consumption, danger of soil compaction)
- Acquiring a hoeing machine with scanning arm technology is only viable on large cultivations or in the case of interplant usage.

Tips
- Hoeing machines with scanning arm: Be cautious with seedlings and young shoots. Pad the scanning arm or protect the stems from being hit (e. g. by using polyethylene pipes).
- If shoots grow sufficiently, allow area to grow over in the second half of the year.

Mulch system



Advantages
- Soil humidity is preserved (can also be a disadvantage).

Disadvantages
- Fertilisation might be more difficult if the mulch material is not the actual fertiliser.
- Unbalanced nutrient accumulation (phosphorus and potassium) in the bush rows.

Tips
- Use mulch material specifically customised to the nutritional requirements of the crop (soil analysis), precipitation and soil conditions: manure, compost, wheat straw, Chinese silvergrass or bark chips. Mulch cover containing bark chips ensures best conservation of soil humidity.

Redcurrents, gooseberries, blackcurrants: overview of cultivation measures and cropping systems

Cultivation calendar

Full Harvest Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cut					1 3							2 4
Rain cover												
Harvest*												
Pest control												
Mice control												
Planting**												

Redcurrents, gooseberries
Blackcurrants

* First fruit after 1,5 year, full harvest after 2,5 years
** Seed stock: bare-root plants (with 1–3 strong shoots)

See pages 20 and 21 for information on fertilisation times.

Slightly twist upright lateral shoots that are too thick (increases the fertility).

1 Cut back lateral shoots that have been harvested once as well as lateral shoots that are not needed or too thick to a length of 2 cm; pay attention to the specific properties of certain varieties.

2 Depending on the aging process of the main canes, replace the main canes with young canes growing from the cane base every couple of years.
Remove all spurs.
Remove any cut plant material from the orchard if *Colletotrichum* (see page 30) is a problem. Otherwise, chaff and/or mulch the material for fast decomposition.

3 Remove all canes growing from the base except for 3 to 4 strong, upright canes required for the bush structure.

4 Trim all main canes that have been harvested twice to 40 cm long butts.

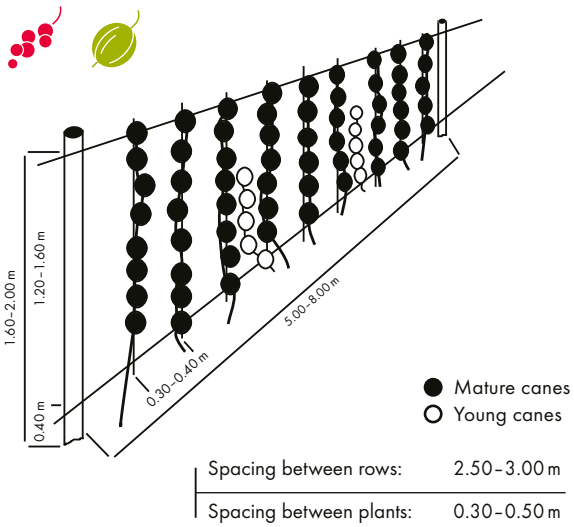
Work to do during the development phase:

Reduce the number of canes to 1 (in the case of a spindle) or 2 (in the case of a 2-branched hedge).
Remove all lateral shoots up to 50 cm above the ground and snap off any competing shoots (possibly pinching).

Continually tie the main canes to the wire.
Remove flowers in the first vegetation period.

Training systems

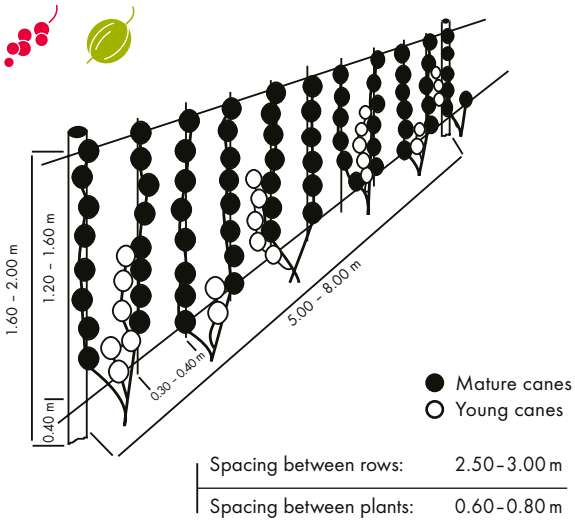
Spindle



Advantages
- Higher picking efficiency than with bush cultivation
- Height of foliage wall is reached faster than when using the two-branched hedge system.

Disadvantages
- Higher seed stock costs than two-branched hedge cultivation system.

Two-branched hedge



Advantage

- Higher picking efficiency than bush cultivation

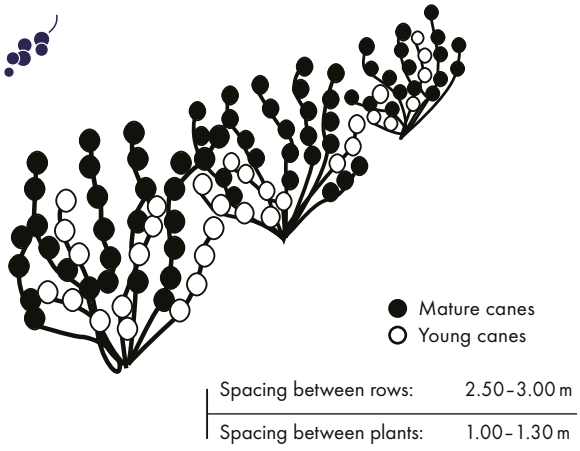
Disadvantage

- Higher construction-related costs than bush cultivation

Tips

- Suitable for high growth plant species and varieties
- Pull up a young cane at each third to fourth fruit-bearing cane; as soon as the young cane starts bearing fruit, remove the old cane.

Bush



Advantage

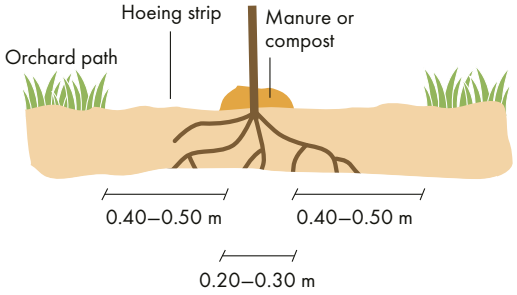
- Heavier growth of canes compared to spindle and two-branched hedges

Tip

- Plant deeply to achieve sufficient growth of canes.

Shrub row system

Sandwich system



Advantages

- The advantages of the hoeing method are combined with the advantages of the mulch system.
- The use of cost-efficient hoeing machines without scanning arm is possible.
- Higher operating speed than the hoeing method

Hoeing

See page 13.

Mulch system

See page 13.

Blueberries:
overview of cultivation measures and cropping systems

Cultivation calendar

Full Harvest Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cut	1											1
Harvest*												
Pest control												
Mice control												
Planting**												

Blueberries

* First fruit after 1,5 to 2,5 years, full harvest after 4,5 to 6,5 years

** Seed stock: 2 year-old container plants (with 1–3 strong, non-lignified shoots)

See pages 20 and 21 for information on fertilisation times.

1 To obtain larger fruit sizes (and increased picking efficiency) as well as sufficiently strong vegetative growth, remove superfluous elements such as one-time fruit-bearing cane tips, barked-up canes, canes bending to the ground during the ripening phase and surplus flower buds (upper shoot area).
Remove pruned plant material from the orchard to prevent disease transmission (*Colletotrichum*, see page 30).

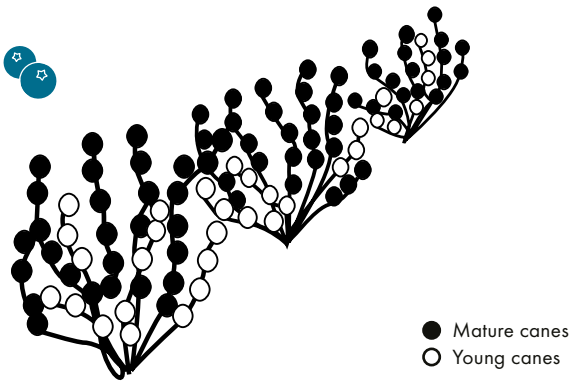
Work to do during the development phase (after approx. 2 years):
To increase the vegetative growth:

1 Remove weak or horizontal shoots and prune all flower buds (upper section of one-year-old shoots). Time: December to February.

Apply nitrogen fertiliser depending on growth and foliage conditions (see pages 20 and 21).

Training system

Bush



Spacing between rows:	2.50–3.00 m
Spacing between plants:	1.00–1.50 m

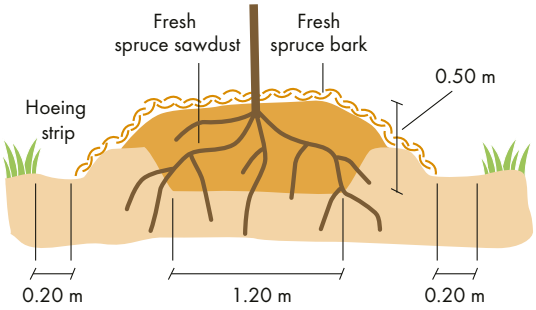
Tips

- Heavy winter pruning has a positive impact on the vegetative growth and fruit size.
- The pruning of developing young canes stimulates branching and reduces longitudinal growth (which is rarely desirable).

Shrub row system

‘Fricker’ system

Without turf* – Ditch & Dyke – Sulphur – Bark – Grassed over orchard path



Advantages of ‘Fricker’ system

- Creating root conditions suitable for blueberries without having to use peat and plastic tarps
- Grassing over of orchard path is possible.

The Swiss Bio Suisse regulations prohibit the use of peat in blueberry cultivations. It is also prohibited to entirely separate the root area (e. g. by using a plastic tarp) from the natural, already-existing soil (e. g. as cultures in sacks).

How to establish this system?

1. Free area from root weeds, in particular couch grass (*Agropyron* sp.) and mice.
2. Create a 20–30 cm deep ditch using a double-share plough; dig once to the left and once to the right (goal: ditch of approximately 1.20 m in width).
3. Shovel out any soil that fell back into the ditch if necessary.
4. Fill ditch will fresh spruce sawdust (no sawdust from deciduous trees or chaff from shrubs!) to create a slightly cambered bed (see illustration above). The sawdust should be soaked with rainwater before the planting in September. Required sawdust for 1000 m^2: approx. 200 m^3.
5. To decrease pH levels, apply 60 g of elemental sulphur evenly onto each metre of sawdust and work it in lightly approximately 4 weeks before planting.
6. Cover the sawdust with a 5 cm thick layer of spruce bark (without soil parts!). Required bark for 1000 m^2: approx. 20 m^3.
7. Sow the seeds on the orchard path (in spring).

The ‘colourful’ option

- Sow the seeds of wild flowers best suited for your location. Choose a mixture that contains no subterranean runners which might be difficult to remove e. g. coltsfoot/coughwort *(Tussilago farfara)*.

Advantages compared to the ‘green’ version:

- Improves the biological diversity, e. g. increased number of beneficial, flower-visiting animals.
- Increases the willingness of buyers to buy high-bush blueberries.
- The cut plant material can be used as fodder.

Disadvantages compared to the ‘green’ option:

- Requires more work (removal of cut plant material, increased danger of weeds growing in a bush row).

The ‘green’ option

- Spreading mulch mixture.

How to manage the system?

Bush rows

- Starting with the summer following the creation of the rows, measure the pH level (of the sawdust cover only!) each year at the same time. If the pH value is too high (see page 9), apply 20–40 g of elemental sulphur per metre.

Caution: It will take a couple of weeks for the pH level decrease to take effect. Do not apply additional sulphur as this could result in a drastic pH level decrease and harm your plants.

- Depending on the decomposition level of the sawdust, apply fresh spruce sawdust (approx. 10 cm tick layers) after a couple of years and cover the layers with spruce bark.

Orchard path

- Create a hoeing strip (20 cm in width) between the orchard path vegetation and the sawdust (prevents weeds from crossing over into the bush row).

‘Colourful’ version

- Trim twice a year and remove cut plant material (in agricultural zones, first cut from June 15th onwards).

‘Green’ version

- Mulch regularly.

Plant nutrition

Good soil fertility as a foundation

A healthy and fertile soil forms the basis for the nutrition of berry crops. As a result, the preservation and enhancement of natural soil fertility through appropriate cultural measures is of central importance in organic farming. Measures that negatively affect soil fertility, such as the application of mineral fertilisers and the use of synthetic chemical pesticides and herbicides, are prohibited. Likewise, soil cultivation must be carried out gently and with restraint. The effects on soil life and soil structure must be taken into account in every measure. Deep ploughing is to be avoided, as is any tillage of the soil when it is wet.

In organic berry cultivation, soil organic management is practised in a targeted manner. In the long term, the supply and build-up of organic matter must at least replace the decomposition losses. Nutrient losses due to too intensive cultivation and unnecessary energy expenditure are to be avoided. In addition, the discharge of nutrients into groundwater and surface waters and the risk of erosion must be minimised.

A biologically active soil is a prerequisite for nutrient mineralisation from the organic matter of the soil or from supplied organic fertilisers. Likewise, a well-structured, microbially active soil serves to break down pathogens such as root diseases and can thus decisively reduce disease pressure.

Nutrient supply to the crops should primarily take place via the soil through mineralisation of soil reserves and nutrients from the organic matter. This ideally results in a supply of nitrogen and other nutrients in a appropriate, balanced and timely manner. Fertilisers can only compensate for poor soil conditions to a limited extent.

No soil-independent production

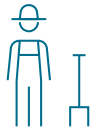
Soil-independent forms of production (hors-sol production, hydroponics, nutrient film technology or similar methods) as well as systems with complete or majority separation of the root zone from the grown soil (e. g. by plastic films, fleeces, pots or containers) are generally prohibited in organic agriculture. Therefore, trough or pure substrate cultures are not possible in organic berry cultivation. The plants must be cultivated in the grown soil in connection with subsoil and bedrock. The possibility of barrier-free root penetration into the living soil must be fully guaranteed. Exceptions are granted for the production of planting material.

The use of biocompatible peat-free substrates with spruce bark and sawdust to lower the pH value of blueberries are permitted. In order to improve the growth success and the soil structure, a biocompatible substrate may be used as a supplement or admixture before planting. However, the root zone and the topsoil must not be separated by films, fleeces or other materials. Details on the definition of soil-dependent production, the use of substrates and the use of new cultivation methods for organic farming are being worked out by Bio Suisse.

Four steps to an optimal nutrient supply

Step 1: Adjust cultivation methods for optimum nutrient efficiency

- Adjust the bush row cultivation to the nutritional conditions of the berry plants. This will allow available nutrients to be used more efficiently.
- Use healthy, vigorous planting material only to make better use of available nutrients.
- As nutrients are more accessible to plants in gently cultivated and well-structured soils, only cultivate the soil under optimum conditions, use gentle hoeing machines and/or cutters instead of PTO-powered units, and use light machinery with low pressure tires.



Step 2: Perform soil analyses

Fertilisation according to plant needs is based on soil analysis (method: reserve nutrients EDTA), and taking into account the type and vigour of the previous crop. To ensure comparability of results, it is preferable to always choose the same certified laboratory. In Kosovo, the reference laboratory for soil analyses is the Kosovo Institute of Agriculture (KIA) in Peja.

When should the soil samples be taken?

- In fruit-bearing orchards, soil samples should be taken every 5 years in autumn.
- In new orchards, soil samples should be taken the year before planting before sowing the preceding crop – or before preparing the planting bed (in order to adjust nutrient balance in due time).
- N_{min} samples are taken immediately before fertilisation.

How to collect soil samples?

- Use a soil sampler to obtain at least 20 soil samples per lot unit of the soil zones containing berry roots. Also take samples from the bush row and the orchard path edges and, depending on the distribution of roots, also from the orchard path.
- Sample depth: 0–30 cm, without turf
- In plots with very different soil conditions, one sample per soil type is necessary (do not take a composite sample).
- In blueberries, only take samples from the strip of sawdust. Even the smallest trace of natural, pre-existing soil (e. g. if the sample was taken from too far down) can significantly falsify the analysis results (especially the pH value).

Which analysis programs to choose?

Minimum option:

- pH (H_2O), humus content, nutrient reserves of P_2O_5, K_2O, Ca, Mg

Optimum option (especially recommended if you intend on performing new plantings or if there are nutritional disturbances)**:**

- pH (H_2O), humus content, nutritional reserves and highly soluble nutrients from P_2O_5, K_2O, Ca, Mg
- N_{min} if an oversupply or undersupply of N is suspected. Only have the pH (H_2O) value measured. Nutrient analyses are not really useful at the moment since an interpretation of the results will be difficult due to the new training system.
- In blueberries, to ensure that the contracted soil laboratory is able to calculate the amounts of nutrients to be applied, you need to provide the name of the berry variety and potential yield.

Step 3: Visual inspection

Valuable conclusions about the nutrient requirements of the bushes can be drawn by visually inspecting their condition (colour and size of foliage as well as shoot growth). This procedure is particularly important to evaluate nitrogen and trace element requirements. All other nutrient deficiencies are generally detected through soil analyses.

The nitrogen supply needs to be increased under the following conditions:

- Heavy fruit bearing
- Insufficient shoot growth
- If the leaves change colour from dark green to light green or yellow and/or if the leaf size is below average.

Even if there are signs of a nitrogen deficiency, application of fertiliser is not always required:

- Because the nitrogen supply can be improved by simply hoeing the bush row.
- In the case of drought, watering might have a bigger impact.
- When the soil is reaching low temperature and increased moisture levels, this can result in temporary deficiencies even though the overall nitrogen level might actually be high.

Step 4: Applying fertilisers as required

How much fertiliser?

Nitrogen (N):

- **Take previous observations and experience into account (see step 3).** It might be useful to perform a soil analysis assessing N_{min} levels before applying any fertiliser.
- With regular inputs of compost or manure, limit mineral nitrogen fertilisers to reduce the risk of root dieback.
- **Required N supply** (N_{min} concentration in the soil plus fertiliser):
  Rasperries: 60 kg per ha/year
  Blackberries: 55 kg per ha/year
  Redcurrents: 85 kg per ha/year
  Blackcurrents: 70 kg per ha/year
  Gooseberries: 60 kg per ha/year
- **Caution:** Excessive nitrogen levels will lead to heavy vegetative growth, increased pest infestation, a decrease in yield as a result of long internodes and fruit quality as well as increased expenditure and groundwater pollution. Increased N applications also delay flowering in favour of vegetative growth, which delays harvesting.

P_2O_5, K_2O, Ca, Mg, and trace elements (if required):

- Apply fertiliser according to the nutrient requirements calculated by the laboratory.
- For raspberries, the total nutrient requirement can also be managed considering the yield potential (see table 2).

Table 2: Nutrient requirements of raspberries based on yield potential

Yield (kg/m²)	Nutrient required (kg/ha)			
	N	P_2O_5	K_2O	Mg
1.0	30	15	40	10
1.5	45	25	60	15
2.0	60	35	80	15
2.5	75	50	100	20

Nitrogen:

- Take previous observations and experience into account (see step 3 above).
- During the initial two years, the amount of required N is increased due to the unfavourable C : N ratio in the sawdust; it amounts to approx. 60 kg per ha and year.
- During the yield phase, approximately 30 to 60 kg of N are required per hectare and year.

P_2O_5, K_2O, Ca, Mg and trace elements (if requir.)**:**

- Based on previous experience, these nutrients are largely available to plants due to the decomposition of the sawdust and/or bark.
- As a reference, for a yield level of 1.5 kg/m², the crop will require 20 kg of Phosphorus, 65 kg of potassium and 15 kg of magnesium.
- Blueberries need acidic soils. They are sensitive to excess lime, potash deficiency, and unbalanced micronutrient content such as zinc or boron. Use fertilisers in sulfate form with an acid reaction such as potassium sulfate or magnesium sulfate.

Where to apply the fertiliser?

- Nitrogen-containing fertilisers are usually applied to the bush row area only in order to prevent excessive vegetative growth on the orchard path.
- All other fertilisers can be applied to the entire sampled area.

When to apply the fertiliser?

N-containing commercial fertilisers:

- From the time the first shoots appear until May (possibly June), depending on the condition of the plants and the time it takes for the fertiliser to take effect.
- In blueberries, organic N-containing liquid fertiliser should be added in 2 or 3 applications per year during the development phase.

Compost, manure and liquid manure:

- See table below.

All other fertilisers:

- From February to the middle of March (when the shrubs have no foliage).
- Not on frozen or heavily drenched soils.

Which fertiliser?

Examples of inputs that can be applied in organic production according to the specific nutrient level or soil characteristics to improve:

Organic matter: Choose a fertiliser with a high organic matter content such as compost, farm manure, or organic mulch material, particularly if the humus content is below 2.5 %.

Nitrogen (N): organic commercial fertilisers, farm manure, compost. Take the content of other nutrients into account, too.

Phosphorus (P_2O_5): compost, farm manure, natural P-fertiliser like rock phosphate (to be incorporated in the soil)

Potash (K_2O): compost, farm manure, organic mulch material, multi-nutrient fertiliser, rock powder rich in K (e. g. Potash sulphate, Patentkali (Potash magnesia), and Magnesia kainite)

Calcium (Ca): compost, different lime fertilisers like calcium carbonate. Monitor the impact on the pH level.

Magnesium (Mg): compost, farm manure, organic mulch material, rock powder and algae products (monitor the impact on the pH level)

Note: Raspberries react sensitively to a lack of magnesium. Deficiency symptoms are first visible on old leaves, on the leaves at the base of the young shoots (laterals), and on the fruit stalks. In such situations, an administration of magnesium sulphate in June with a liquid fertiliser is indicated. Foliar fertilisation is also possible, but must not be done under hot weather conditions to avoid leaf burn.

Trace elements:

- The use of fertilisers with highly soluble trace elements, Ca and Mg must be registered (Bio Suisse). In case of doubt, enquire with the certification body.
- Foliar products must be used only in case of proven major deficiency (visual signs or sap analysis).
- In case of application, always leave a small control area without treatment to assess the soundness of the operation.
- As a main rule, 'feed the soil to feed the crops', using mature compost and other organic fertilisers.

pH:

- pH levels can be increased by applying lime fertiliser (see information on calcium).
- For information on decreasing pH levels, see the section on blueberries.

- Use acidic or neutralising commercial fertilisers.
- During the development phase, apply organic N-containing liquid fertiliser, if possible.
- Compost and farm manure are not suitable due to their pH-increasing properties.

Box 2: The effect of compost

In addition to the nutrient supply and the positive effect on the pH, a good compost can also play a major role in plant health:

- Introduction of antagonistic microorganisms that grow in the compost during maturation (e.g. *Trichoderma* ssp.)
- Beneficial/neutral fungal hyphae in the raspberry rhizosphere make it difficult for the plant pathogen to establish.
- Improving the structure and aeration of the soil (faster drainage and warming), but also water capacity.
- Promotion of microbiological activity and diversity in the soil
- Activation of the plant's defenses (induced resistance)

Note: To ensure microbial efficacy, the compost under no circumstances should be sterilised. Commercial products should not be packed airtight, and allow access of sufficient moisture.

Table 3: Nutrient content of compost, manure and liquid manure (in kg per m³ of fresh matter) and their optimal application time

	N total	N avail.	P_2O_5	K_2O	Mg	Ca	Optimum application time
Compost (1 m³ ≈ 500 kg)	3.5	0.2	2.0	2.85	1.55	14.0	Feb. – Mid April; raspberries: After removal of fruit bearing canes in summer
Heaped manure (1 m³ ≈ 700 kg)	3.4	0.7	2.2	4.6	0.6	2.6	Mid March – Mid April
Mushroom manure (1 m³ ≈ 500 kg)	3.5	1.5	2.5	4.0	1.5	2.7	Mid March – Mid April
Cattle liquid manure	4.3	2.2	1.8	8.0	0.5	2.0	April – May

The numbers in the table are average nutrient contents. In reality, the contents can differ significantly.

Irrigation

The water demand of bush berries is highest during fruit development. The supply of sufficient water during this period has a positive impact on fruit size and yield.

Micro-irrigation systems are preferred compared to overhead irrigation systems because they require less water, keep the fruits drier, and the orchard more accessible.

- In raspberry orchards, irrigation of rain-protected cultivations on dykes is a must.
- Water requirements of raspberry crops can be up to 6 mm/m² per day in June and July. The plants' water needs are particularly high:
  - After planting, especially when planting potted plants in summer
  - Summer raspberries: In June and July, as the plants need water for fruiting and for the growth of new shoots.
  - Autumn raspberries: In July and August, during shoot and fruit formation
- After harvest and/or once young shoots have reached the desired height, the crop should only be irrigated under exceptional circumstances in order to prevent root rot *(Phytophthora)*. Too much water in autumn reduces growth and has a negative effect on flower formation.
- Lack of water in spring reduces the number of side shoots and fruit size.

- Currant, blackcurrant and gooseberry bushes will reach their optimum height faster if irrigated.

- Blueberries are very sensitive to dryness due to their shallow root system.
- To ensure an even water distribution to the root system, micro-irrigation (microjet) systems should be used instead of sprinkler irrigation systems. However, microjet systems are more expensive and require more care since they are more prone to breakdowns.
- Alternatively, the blueberry rows can be irrigated with 2 parallel driplines, one on each side of the dam, to ensure a good water supply.
- Provide water regularly in small quantities. A crop in full yield will require up to 6 litres per plant, whereas young plants only need 1.5 to 2.5 litres.

If irrigation is not possible, the plant beds should be at least covered with spruce bark. The bark will significantly reduce water loss through evaporation and promote plant growth.

Table 4: Comparison of micro-sprinkler and drip irrigation

	Micro-sprinkler irrigation	Drip irrigation
Characteristics	• Irrigation is limited to the root zone of the plants. • Has a larger wetting pattern than drip irrigation. • Emits more water per hour than drip irrigation.	• Irrigation is limited to the root zone of the plants. • Operated at low pressure and low water volumes per hour.
Advantages	• High irrigation efficiency • The wetted area is wider than in drip systems allowing for maximum root penetration. • Precision irrigation according to the actual need of the plant • Micro-sprinkler emitters are larger than drip emitters and clog up less frequently.	• Very high irrigation efficiency • Lower investments required than for mini-sprinklers • Low labour requirement • Minimal water losses • Irrigation possible at any hour during the day • Low fungal disease pressure thanks to dry canopy • Minimal evaporation from the soil surface and weed growth in subsurface drip systems
Disadvantages	• High investment costs • Requires much water and high capacity pumps. • High energy requirement • High water losses through evaporation when used during hot and sunny or windy conditions • Uneven water distribution because of overlap between sprinklers	• Clogging of emitters by algae, bacterial slime or sediments possible • Root zone restricted to the wetted area • Narrow and deep wetting pattern in light soils • Needs an efficient filtering system. • Drip lines hinder mechanical weeding. • Difficult and costly maintenance in subsurface drip systems

Weather protection

Protected cultivation

Due to the lack of highly effective fungicides, protected cultivation, especially of the sensitive raspberry crops, can be even more important than in conventional production. The higher investment costs can be compensated by secure yields, better harvest performance and a longer shelf life of the fruit after harvest.

Advantages of rain covers

The cultivation of plants under rain covers has a number of advantages:

- Prevention of yield loss due to weather conditions (bursting, damage to fruit epidermis) and protection from different diseases.
- Slower perishing of the fruits, thus longer shelf life
- Continuous harvesting possible (major advantage if selling wholesale or direct)

- Fewer incidences of grey mould and shoot diseases
- Fewer incidences of blight *(Colletotrichum)*
- Postponed harvesting possible (can be very important, depending on the market situation)

For other berry productions, cost-effectiveness has not been proven yet.

Disadvantages of rain covers

- Relatively high resource and energy expenditures required for manufacturing
- Adverse impact on the natural scenery
- Increased occurrence of spider mites (e. g. in raspberry crops)
- Generally, an irrigation system is necessary.

Requirements for weather protection

- Profitability of such infrastructure must be ensured (based on revenue from the crops and annual costs, including amortisation).
- The putting up and taking down of protective covers must be time-efficient.
- High durability against wind and hail.
- Proper aeration must be ensured.

Cultivation under weather protection or in tunnels effectively prevents infections by fungal diseases like grey mould. These infrastructures also premature harvest. In combination with nets, they also protect the crops against birds and insect pests.

Box 3: Winter protection of raspberries

Well-developed, healthy wooden raspberry canes survive cold winters fairly well. Damage is mainly caused by cold and dry winter conditions with sun and wind. In some years and in exposed locations, damage can be considerable, resulting in poor spring bud break and yield losses. This is especially true for the Tulameen variety. The canes are green, but the frost-damaged buds do not sprout or sprout irregularly.

Wind can also slow down growth of the plants during the vegetation period, causing broken fruit shoots and fruit injuries. This also increases the risk of frost damage.

Main causes of winter frost damage:

- Varietal sensitivity (Tulameen in general, Meeker for late frost episodes)
- Canes weakened by fungal infestations such as *Didymella*, *Leptosphaeria*, or *Botrytis*
- Poorly woody canes or still growing canes (mainly due to excessive nitrogen fertilisation)
- A long vegetation period in autumn followed by a massive drop in temperature
- Severe cold snap after a warm period in winter
- Insufficient humidity during winter, especially in windy and sunny locations

In locations where bud break is often poor in spring, it is advisable to lay the stems on the ground in November and cover them with a protective sheet (about 30 g/m^2) during winter.

Late frost damage to flowers in spring is rare. However, late frosts may damage freshly sprouted side shoots or shoots on the ground.

Weed management: limiting competition by weeds

Good preparation before planting

Crop rotation before planting has an influence on weed pressure in bush berries, but also on the occurrence of soil diseases and parasites. To minimise weed pressure at planting, the beds for the berries should be prepared early (e. g. in the previous autumn). In spring, the flush of grass is eliminated by a shallow tillage operation before planting.

At planting, if a black plastic film or a biodegradable mulch mat is used to cover the dams, too large planting holes in the film or mat should be avoided to limit weed growth around the seedlings. Alternatively, the holes can be covered lightly with a handful of dry compost or straw.

Appraisal of options in crops

In organic farming, the use of herbicides is prohibited. Therefore, in bush berry crops, weed pressure is kept low by hand or mechanical weeding or by spreading mulch material such as straw, reusable ribbon fabrics or recyclable or degradable disposable plastic films. With mechanical regulation or hand weeding, early intervention against young weed stages is crucial to keep the workload low. A soil cover reduces weeding in the planting area. The use of compost or substrates also makes weed control easier.

As an alternative and as a supplement to soil cover, special equipment is available for mechanical weed control. In flat crops or next to dams, weed control can be done with brush or hoeing equipment. Mechanical weed management also has the advantages of incorporating compost into the ground and promoting the mineralisation of nutrients bound in the soil organic matter. To make the most of these effects, a first pass should be made early in the growing season. Brushes can also, at least in part, facilitate weed control in ridged crops such as blueberries.

Weed control by flaming has not shown satisfactory effects in berry crops, as only herbs and annual grasses are regulated and thus most well-established weeds with protected vegetation points are spared and can develop more strongly.

The regulation of the accompanying flora aims at reducing light, water and nutrient competition for the crop.

Crop-specific considerations

In raspberry crops, the bush rows should be free of weeds at least from emergence of the young canes to the end of harvest. Proper weeding minimises competition for water and nutrients, encouraging the development of fruits and young shoots, as well as to prevent cane diseases.

Weeding can be combined with thinning out of the young canes.

Of all bush berries, blackberries are the least sensitive to weed growth.

Weeding around the canes might be sufficient in the case of strong growing varieties and large planting distances. In other cases, weed control should be handled as for currants and gooseberries.

In currants and gooseberries, the rows must be weed-free during the entire emergence phase of new shoots. This is to ensure that the bushes reach their desired vegetative growth.

For weeding, common orchard hoeing machines can be used.

The rows of high-bush blueberries should be free of weeds during the entire year.

Weeding is generally done manually. Special attention must be paid not to injure the roots of the plants.

It is particularly important to remove couch grass *(Elymus repens)* and all other stoloniferous grasses early. Ideally, the runner grass weeds are also removed from the pathways.

Plant protection: optimising prevention and protection

Working with nature

Based on its principles of working with nature and minimising harmful impacts on the environment, and due to the limited effectiveness of most natural plant protection agents, organic farming strives to implement all the measures that contribute to the prevention of diseases and pests on crops in the best possible way. The optimal use of preventive measures (see also previous pages) should result in the growth of healthy and robust plants and effective natural regulation of the pests by natural enemies.

Multi-level approach

The crop protection strategy in organic farming can be seen as a stepped pyramid. Plant protection begins with the **planning of the orchard and the design of the cultivation system**. As most diseases develop under humid conditions, good aeration of the stands through the orientation of the planting rows in the direction of the wind and sufficient plant spacing reduce the pressure of infection.

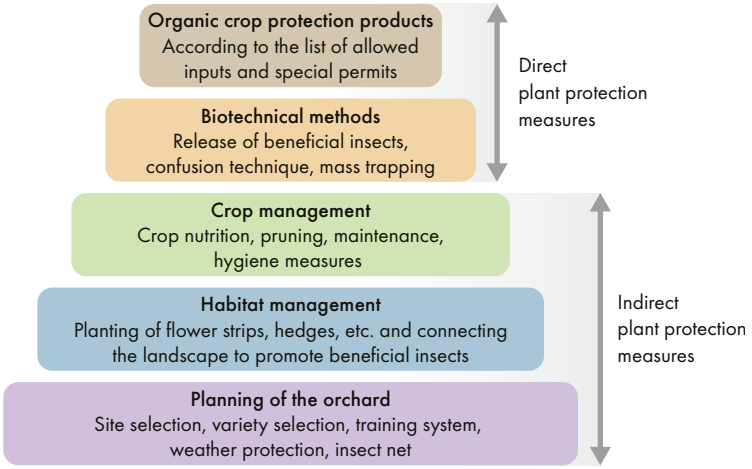
Biodiversity promotion measures in and around the orchard also make an important contribution to preventive crop protection. Diversifying orchards with near-natural habitats reduces the spread of pests on the one hand and also promotes natural enemies such as predatory and parasitoid insects (see also pages 8 and 9).

Appropriate **crop management measures** such as a balanced nutrition of the crop and appropriate care and hygiene measures, limit the spreading of pests and diseases, and create favourable conditions for a successful biological regulation of diseases and pests. The removal of weeds and unproductive shoots reduces the pressure of infection. Hygiene measures such as removing diseased fruit and plant parts from the plant also play a decisive role.

Biotechnical methods can be used to confuse pests when they appear (confusion technique), trap them (mass trapping) or control them by releasing beneficial insects.

Organic plant protection products are only used if the preventive (or indirect) plant protection measures and the biotechnical measures are not sufficient. In organic farming, only few insecticides and acaricides are available against pests, and most of them have only limited effectiveness. Sufficiently effective fungicides, especially against botrytis, are lacking. The use of synthetic chemical pesticides is prohibited in organic farming.

Figure 2: Organic crop protection pyramid



Plant protection begins with the planning of the orchard and the design of the cultivation system. The creation of a nature-near habitat creates favourable conditions for the promotion of natural enemies of pests. The implementation of appropriate crop management measures limits the development of pests and diseases. Biotechnical methods can be highly effective in pest control. As a least measure, organic crop protection agents are used to avoid major damages.

Targeted use of biopesticides

Plant protection products against insect pests use plant extracts as well as oils and soaps. Against fungal diseases, sulphur, copper as well as alumina preparations and special plant extracts are used. Alternative natural substances to replace copper are under development. In addition, plant-strengthening agents such as Laminarin or those based on microorganisms such as *Gliocladium catenulatum* or *Bacillus amyloliquefaciens* are available for the reduction of diseases.

Approved plant protection products for organic farming compliant with the EU legislation on organic production are listed in the European input list at www.inputs.eu.

Optimal application of the products is essential to achieve a complete coating on all susceptible parts of the plant, avoid adverse effects on non-target organisms and the environment, and to keep costs low. For small areas or spot treatments, pesticides should be applied with hand-operated or motorised backpack sprayers. For larger areas, air blast sprayers should be used. Pesticide mixtures at basic concentrations should be applied at a ratio of 500 to 1300 litres per hectare depending on the pests and diseases, and the development stage.

Management of common pests and diseases

Raspberry diseases and pests

Crown gall

Agrobacterium tumefaciens

How to recognise?

- Tumours (growths, ulcers) form on the root neck and the roots and can grow to the size of a fist.
- In case of severe infestation, growth vigour of the plant can be impaired.

Important to know

- The bacterium survives in the soil and is spread with water in the soil, even over longer distances via running water.
- Infections can only occur through injuries.
- After penetration of the plant, the bacterium induces a genetic modification of the plant tissue that results in the formation of tumours.

How to prevent?

- Do not grow raspberries, blackberries or blueberries on infected plots for 5 years.

How to control?

- No effective direct means or methods available

Root rot

Phytophthora fragariae var. *rubi*

How to recognise?

Young canes:

- Shoot tips wither.
- Leaves brighten and dry up.
- Shoots die off by early summer.

Mature canes:

- Stunted lateral shoots
- Leaves brighten and dry up.
- Shoots die off by harvest time.

Roots:

- Dark discoloration of the bark
- Few radicles

Important to know

- Can endanger the entire crop.
- Compacted, or permanently or alternating wet soil promotes infestation.
- Risk of infection is highest in spring and autumn at soil temperatures of 12 to 16 °C.
- The disease is spread through diseased plant material, soil tilling equipment, footwear and groundwater.
- Does not infest strawberry plants.

How to prevent?

- Do not grow crops on compacted, or permanently or alternating wet soils.
- Use healthy planting material only.
- Apply well-decomposed compost on a regular basis.
- Irrigate sparingly in spring and autumn.

- Avoid the use of varieties that are susceptible to root rot.
- Do not grow raspberries on infested plots for 15 years.
- Avoid the contamination of non-infested plots with contaminated soil attached to machines and tools. Do not exchange machinery with infested farms.

How to control?

- No effective direct means or methods available

Raspberry shoot disease

Didymella applanata, *Botrytis cinerea*, *Leptosphaeria coniothyrium*, *Elsinoe veneta*

How to recognise?

Didymella applanata

- Rapidly growing purple/brown spots on the buds of young canes
- Silvery-grey discolouration with small black fruiting bodies
- Stunted budding or no budding at all

Leptosphaeria coniothyrium

- Extensive purple/brown spots on the base of young canes
- Diseased canes die off the next year.

Botrytis cinerea

See under 'grey mould'.

Elsinoe veneta

- Initially purple spots on canes, petioles and blades; later on whitish/grey indented spots

Important to know

- Unlike root rot, cane diseases never lead to the death of the entire plant.

How to prevent?

- Ensure good crop aeration: remove superfluous young canes and weeds, keep the vegetation short.
- Avoid cane injuries, e. g. by removing strong canes with torn bark (raspberry cane midge).
- Remove cleared canes from the orchard immediately after the harvest.
- Apply nitrogen sparingly.

How to control?

- Preventive copper treatments are partially effective against *Didymella*.
- No agents approved against *Botrytis*.

Grey mould

Botrytis cinerea

How to recognise?

Fruits:

- Covered by a grey, dusty fungal coat
- Later, the soft and decaying berries shrink and harden.

Canes:

- Light brown spots around the buds of young shoots which rapidly increase in size
- Silver-grey discolouration in winter with large, black fungal coats
- Weak budding or no budding at all

Important to know

- The disease can lead to extensive losses if it rains during the harvest.
- Fruits that appear healthy on the outside can decay within a short storage period – especially if they were picked while being wet.
- The fungus remains on the canes during winter (see raspberry shoot disease).
- The blooming time is the main infection period.

How to prevent?

- Put up weather protection from the harvest beginning to the harvest end.
- Apply nitrogen sparingly.
- Remove diseased canes in winter.

How to control?

- No effective means of direct control are available.

Rust

Phragmidium rubidaei

How to recognise?

- Initially greenish/yellow pustules on the leaf top; then orange/red spore accumulations on leaf bottoms and stalks which turn black after some time.

Important to know

- The fungus remains only on fallen foliage during winter.

How to prevent?

- Put up weather protection from the beginning of vegetative growth to the end.
- Mulch the fallen leaves or remove them from the orchard.

How to control?

- No effective means and methods available

Aphids

Different species

How to recognise?

- Deformed shoots and leaves
- Purple blisters on red and white currants, yellowish-green blisters on black currants (currant aphid, *Cryptomyzus ribis*)

Important to know

- Aphids not only cause damage by sucking plant juices, but also by transmitting viral diseases.
- If heavily infested, severely stunted leaves and shoot deformations
- Aphids sucking on shoot tips cause a great deal of damage.
- Rarely a problem

How to prevent?

- Apply nitrogen sparingly.
- Create favourable conditions for beneficial insects

How to control?

- Application of insecticide (Neem products, Pyrethrin, Rotenone, fatty acids)
- Time of application: before the occurrence of shoot or leaf deformations

Leaf mites

Phyllocoptes gracilis

How to recognise?

Leaves, shoots:

- Bright square speckles on leaf tops. Leaves will dry up later on.
- Delicate cocoons containing mites in different developmental states

Mites:

- Usually on the bottom of leaves
- 0.3–0.6 mm in length, yellowish with two dark spots on each side of the body

Important to know

- Inspect at least 50 leaves from the middle section of the plant.

Damage threshold:

- Pre-bloom: 10 % infested leaves in the middle section
- After harvest: 40–60 % infested leaves in the middle section
- After the end of August: 10–20 % infested leaves in the middle section

Take predator mites into consideration!

Rule of thumb: If there are more leaves with predator mites (i. e. either predator mites only or both, spider mites and predator mites) than leaves with spider mites only, there is usually no need to control the infestation directly.

How to prevent?

- Do not use weather protection or use it only during harvest.
- Leave cut-off mature canes in the stand until their leaves have withered. This way, beneficial predator mites are able to move to young canes.

How to control?

- In case of infestation in the previous year or in spring (carry out control), treatment with 1 % wettable sulphur is required at a shoot length of 10 to 15 cm. Very good wetting of the entire plant and warm weather increase the effectiveness.
- In case of heavy infestation, a post-harvest treatment with sulphur at 1 % (10 kg per ha) can be carried out until the end of September, after which the mites migrate to the shoot buds for overwintering.

Raspberry blossom weevil

Anthonomus rubi

How to recognise?

- Snapped off blossoms which dry up and fall off afterwards
- Beetle: black/brown, 2.0–3.5 mm in length
- Slender antennae
- Forewings with longitudinal stripes of dots

Important to know

- The beetle remains under foliage or in the ground during winter.
- A significant number of beetles come from forests.
- One female can destroy 20–30 flower buds by laying an egg into each flower and gnawing at the pedicel.
- The pest also attacks strawberries and roses.

How to prevent?

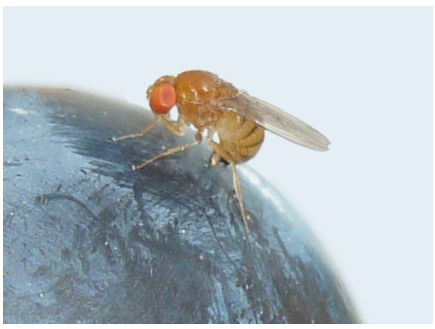
- Avoid areas in proximity of forests.

How to control?

- Spinosad applied at the beginning of flowering can be used to control both *Anthonomus rubi* and *Byturus tomentosus*. Carry out the treatment only outside the flight period of bees.

Spotted wing drosophila (SWD)

Drosophila suzukii



How to recognise?

- The eggs are laid into the ripe fruit. The boreholes formed during egg laying are entry points for fungi and other pests.
- Larvae: small white, translucent maggots with black mouthparts.
- The larvae develop inside the fruit leading to soft, juicy, later shrivelled fruits and single berries.
- Larvae of older development stages can be seen by the naked eye.

Important to know

- Life cycle: From spring onwards, the overwintered females lay eggs. Several generations follow each other in the course of the season. The population peak is usually reached in August and then progressively declines until autumn.

How to prevent?

- As the eggs cannot be seen by the naked eye, monitoring the population is of great importance.
- Place attracting traps every 5 to 10 m around the berry orchard (not inside the plantation) as a barrier against hedges or other sources of danger. Hang the traps at fruit height and, if possible, in a shaded area.
- Apply hygiene measures including the removal of harvest residues, and maintain short and strict harvesting procedures.
- The fruits must be cooled and settled quickly after harvesting.
- Weekly treatments with slaked lime ($Ca(OH)_2$) significantly reduces egg laying.
- Fine-meshed protective nets with a mesh size of maximum 1.3 mm reduce and delay the infestation.

How to control?

- In case of infestation, Spinosad can be applied every 10 days (waiting period 3 days for harvest). Spinosad is a total insecticide that is also harmful to beneficial insects.

Blueberry diseases and pests

Anthracnose fruit rot

Colletotrichum acutatum

How to recognise?

- Red-purple spots on shoots and leaves, which gradually spread
- Deformations and masses of salmon-coloured spores on the fruits
- The disease can develop even after harvesting.
- The fungus overwinters in the flower buds and in dead shoots. The spores released in spring mainly attack the flowers.

How to prevent?

- Ensure good ventilation through a suitable arrangement of the rows.
- Use healthy plants and select tolerant varieties.
- Check the crops regularly and remove infested plants.
- Remove plants and substrate in infested areas.

How to control?

- No effective means for direct control available

Botrytis blossom blight

Botrytis cinerea

How to recognise?

- At first, brown to black lesions form on the shoots, and then change to grey to light brown.
- Black spots may become visible in the dead zones.
- Greyish fungal turf on the fruits (typical of this disease). The fruits turn brown and fall off.
- The disease can also develop on the berries after harvest.

Important to know

- Infection occurs through natural openings in the flowers, and through plant injuries.
- For germination, the spores require leaf wetness.
- After infection, the fungus can cause either direct damage (infected flowers), or remain latent and break out later, often at fruit ripening. Damage at this stage is particularly high because healthy fruits are easily infected by infested neighbouring fruits.
- The fungus overwinters as sclerotia in infested tissues.

How to prevent?

- Ensure good ventilation through a suitable arrangement of the rows.
- Apply appropriate and early fertilisation (especially nitrogen).
- Harvest the fruits during the coolest part of the day, store them temporarily in shaded areas, and transfer them to cold storage as soon as possible.
- Weather protection systems that prevent leaf wetness strongly reduce infection risks.
- In case of cultivation of blueberries in tunnels, ventilation is recommended in the morning to prevent or limit the formation of dew (especially in spring and autumn).
- Infested fruits must be removed from the plant immediately, as well as infested shoots.

How to control?

- No effective means of direct control available

Stem blight

Botryosphaeria dothidea

How to recognise?

- Massive wilting of leaves on individual infested shoots. The leaves then turn brown or red.
- The leaves do not fall off at first, and infected shoots can be distinguished from healthy ones by their colour.

Important to know

- The fungal spores are spread by wind and rain.
- Entry points for infection are injuries on shoots caused by insects or by pruning, micro-injuries, leaf scars and frost damage.
- As a plant canker, the fungus forms fruiting bodies from which spores are released all year round.
- Most infections occur in early summer.
- Annual and biennial shrubs are particularly susceptible to the disease.
- Removing infected shoots, leaves, flowers and fruits from the orchard reduces the risk of infection in the following year. Neglected cutting can result in the death of entire shrubs.

How to prevent?

- Cut infected shoots to the healthy tissue, remove and destroy them.
- Infested shoots should be burned outside the orchard.
- Regular disinfection of the pruning equipment prevents spreading from infested to healthy plants.

How to control?

- No direct control measures available

Powdery mildew

Microsphaera vaccinii

How to recognise?

- Light green, yellow or reddish spots on leaves, and wrinkling of leaves. the symptoms usually only appear in mid-summer.
- Water-soaked spots on the undersides of the leaves
- Whiter spots may appear on the upper side of the leaves.
- In severe cases, the plants can defoliate.

Important to know

- Despite widespread occurrence of the disease, the damage is usually minor.

How to prevent?

- Use resistant varieties.
- Ensure good ventilation of the orchard through a suitable arrangement of the rows to reduce moisture.

How to control?

- Fungicides are not recommended unless the disease is severe.

Apple blossom beetle

Tropinota hirta

How to recognise?

- Dying plants. The plants are attacked by the pest at ground level (roots, root neck).
- Larvae: white, 30 to 60 mm long, curved abdominally with blackish posterior end

Important to know

- New plantings are very sensitive.
- Life cycle: The grubs are active from autumn of the year of flight until spring before the new flight (3-year cycle, 4 years at higher altitudes).
- The main damage is caused in the 2 years following the flight.

How to prevent?

- There is no damage threshold. A single white grub can infest 4 to 5 plants.
- Ploughing, weeding and other soil cultivation methods destroy many larvae.
- In the year of flight of the beetle, egg laying in bush berry orchards can be prevented with netting with a mesh size of no more than 8 mm.

How to control?

No products approved for the control of the beetle in berry production

Blueberry maggot

Rhagoletis mendax

How to recognise?

- Adult: body 3 to 4 mm long, mostly black; thorax with conspicuous white spot at the tip (scutellum) and a white stripe along each side
- Wing length of 3 to 4 mm, with conspicuous black bands
- Larva: creamy white, legless maggot attaining 5 to 6 mm in length

Important to know

- The species overwinters as pupae in the soil. The adult flies appear around late May and persist until late July (fruiting period of the deer berry, the native host plant).
- Adults have a pre-reproductive period of one to two weeks, during which they forage for nutrients on various plants. Upon attaining sexual maturity
- Hatching of first instar maggots after an egg incubation of 3 to 10 days. In the next 17 to 22 days the larvae feed in the fruit pulp and go through two additional molts.
- Then, the larvae fall to the ground, and pupate some centimeters in the ground.
- Most pupae overwinter in the soil for one winter only, but some pupae may remain in the soil for up to 5 years before metamorphosing to the adult stage.

How to prevent?

- *Pterostichus melanarius* is a main predator of larvae. Maintaining a permanent cover in the lanes, and avoiding tillage operations promote the ground beetle population.
- Potential blueberry maggot infestations can be monitored by trapping adult flies on yellow sticky traps. The boards are baited with ammonium carbonate and placed at a density of 4 to 8 traps per hectare.
- Place the traps at fruit height (between knee and waist level) in proximity of the bushes and, if possible, in a shaded area.

How to control?

- No effective biocompatible agents are known or approved so far.

Raspberry mosaic virus

How to recognise?

- Appears mainly on raspberries, rarely on blackberries.
- Chlorotic, unevenly distributed spots on leaves or chlorotic, discoloured leaf tissue along veins or net-like yellowing along lateral veins

Important to know

- The raspberry mosaic complex comprises numerous viruses and diseases, including rubus yellow net, black raspberry necrosis, raspberry leaf mottle, and raspberry leaf spot virus.
- Is transmitted by the small raspberry aphid *(Aphis idaei)* and the large raspberry aphid *(Amphorophora idaei)*.
- The symptoms should not be confused with the raspberry leaf mite.

How to prevent?

- Some raspberry varieties are resistant to the virus-transmitting aphids, like Titan, Glen Moy, Rumiloba and Rusilva.

Post-harvest management

Harvest

Raspberries do not ripen after harvest (non-climacteric fruits). Therefore, the fruits should be harvested at the optimal stage of ripeness (completely red fruits) in order to achieve a high taste quality that meets the expectations of the market. Before optimum ripeness, the two determining factors sugar content and aroma are insufficiently developed.

Quality

The taste quality of raspberries is often judged by the sugar content, the sugar-acid balance and the formation of fruity flavours.

Raspberries are nutritionally interesting because they are low in calories and high in fibres, vitamins, fruit acids and minerals (magnesium, calcium, etc.). They also have a very high content of vitamin C, and other compounds that have an antioxidant effect.

External quality refers to the fruit's characteristics such as size, ripeness, colour, shine, injuries and deformations (e. g. pest infestation).

Storage

Only best quality berries should be stored for several days. The fruits should have been harvested in dry weather, show no injuries and, if possible, come from crops cultivated under weather protection.

After harvest, rapid cooling is recommended in order to reduce the temperature of the fruits quickly, regardless of how the berries are further processed after harvesting (direct sale or storage). After cooling, it is recommended to cover the produce with a foil to keep the berries fresh. This does also greatly reduce weight losses.

Harvest

To achieve optimum fruit quality, the berries should not be picked before having reached the optimal harvest stage (fully coloured berries). Quality analyses of different varieties have shown that before this stage, the sugar content is much lower and the acid content too high.

After having reached the optimum harvest stage (deep blue colour, slightly waxy appearance, and are easily separated from the stem when picked), the fruits can remain on the bushes for a few more days to allow further development of the aroma. However, the fruits should not be left hanging on the bushes for too long, as they could easily fall off, resulting in significant crop losses, especially in windy areas. In order to maintain the infestation pressure by *Drosophila suzukii* low, short picking intervals should be maintained.

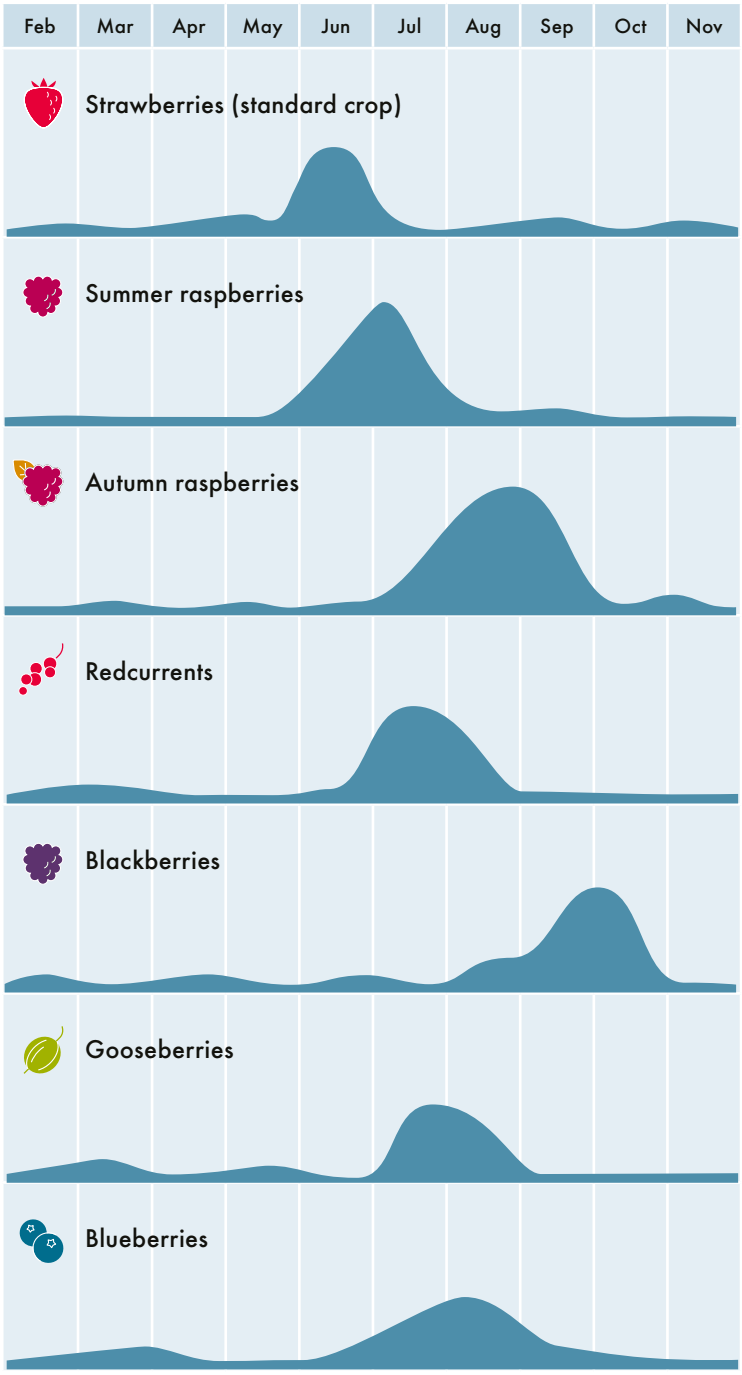
Storage

Blueberries spoil quickly at room temperature. Therefore, they should be cooled quickly after harvest to extend their shelf life and slow down the development of diseases such as anthracnose and grey mould. Depending on the requested shelf life, there are different storage possibilities.

The 'Bluecrop' variety is particularly suitable for CA storage. It can be stored for up to 6 weeks without problems. Tests have shown that 12 % CO_2 and no O_2 supply results in the best taste without inducing visual alterations or promoting grey rot.

Timely and adequate handling of the fruits after harvest ensures a longer shelf life and a higher quality for the fresh market.

Figure 3: Labour requirements in the course of the year for the different berry species (strawberries for comparison)



The amount of labour required in the course of the year can differ between varieties of a berry species. The figure illustrates the required labour as average values for a wide range of berry varieties.

Economic feasibility

Berry crops have a high time-related labour intensity and place high demands on labour management planning. At the same time, farmers are challenged to produce high fruit quality at low cost. Precise knowledge of investments, costs and labour input are indispensable prerequisites for a profitable production.. In terms of cost structure, bush berries differ significantly from annual crops. During the establishment phase of 1 to 3 years, depending on the crop, costs are incurred for the construction of the orchard and the maintenance of the crops, which are charged as depreciation of the yield phase as costs.

The economic efficiency of a crop mainly depends on the yields, the sales prices and the workload. It is therefore not possible to provide universally valid information on cost-effectiveness. Still, the most important economic factors to consider for organic berry production are the following:

- **Market demand and producer prices:** Analyse local and international demand for organic berries, and levels and trends of producer prices.
- **Initial and operating costs:** Calculate upfront investments and general ongoing expenses, including operation labour costs and expenses for organic certification. Implementation costs must be spread over the entire lifespan of the orchard.
- **Yield and production costs:** Estimate objectively expected yields and expenses for production, including costs for fertilisers, pesticides, machine use and manual labour.
- **Access to finances:** Explore funding options, including loans, grants, and subsidies for organic farming.
- **Risk management:** Identify potential risks such as weather incidents, crop losses due to pests and diseases, and market fluctuations, including the potential downgrading to the conventional price level. Securing crop loss insurance can be a valuable option to mitigate risks.

Marketing options

Before planting a new crop, potential sales and marketing options should be clear. Suitable distribution channels depend on the operational structure, the available labour time, and the geographical location of the orchard.

Table 5: Comparison of marketing options for bush berries

	Conditions	Advantages	Disadvantages
Wholesale distribution	• Steady delivery of large quantities required • High quality standards requested • Suitable transport options necessary (e. g. cooling van) • High flexibility (e. g. short-notice orders)	• Large sales quantities per delivery • Less time spent on marketing	• No direct contact with consumers • Exposed to more extensive price fluctuations
Direct sale and distribution	• Farm suitably located for sales • Sufficient sales staff available • Wide (berry) selection offered	• High prices • Fewer price fluctuations • Direct contact with consumers	• Time-consuming marketing • Sales infrastructure necessary • Clientele has to be built-up and maintained.
Self-picking	• Farm suitably located for sales • Sufficient customer service staff available • Suitable parking lots available	• No picking staff required • Direct contact with consumers	• Bad or insufficient picking (20 to 30 % of fruit – including rotting fruit – might remain on plants) • The frequent walking of pickers puts a heavy strain on the soil. • Extensive organisation and advertising effort
Further mechanical processing	• Freezing options must be available.	• Large quantities (also class II) can be sold. • Sales guaranteed (and binding!) with contract • Also suitable for remote locations	• Lower prices compared to selling dessert fruit.

Organic certification

Ensuring compliance with defined requirements

Marketing and labelling berries and other agricultural products as organic requires certification. This is the process by which an organic inspection and certification body gives a written and reliably confirmed assurance that the products have been produced in accordance with specific organic standards. Certification is crucial to building confidence among producers, processors, distributors and consumers.

For the export of organic products, farmers have to comply with the legal standards of the country of import. In Europe, the new Regulation (EU) 2018/848 is the legal basis of organic agriculture. However, organic imports into the EU are still certified under the previous Council Regulation (EC) 834/2007 until the end of 2024. These regulations define the rules for organic production, processing and labelling of agricultural products as 'organic' in the EU.

In some cases, additional certification against private organic standards is necessary. The standards from private label organisations (e.g. Naturland or Bio Suisse) are stricter than national regulations. Whereas the EU regulation permits farms to operate both an organic and a non-organic production unit under special restrictions, most private organic label organisations require that the entire farm must be managed organically.

Generally, for smaller farms, only the conversion of the entire farm is recommended. Parallel production of the same crop species under organic and non-organic management is not allowed even under the EU Regulation.

Defined certification process

The certification process starts with the signature of a contract with an organic certification body operating in the country. The conversion begins when the farmer renounces the use of synthetic pesticides, fertilisers, GMO and chemically treated seeds, and starts to apply all organic production requirements.

For existing perennial crops such as bush berries, the conversion period to organic is 3 years before harvest. If the orchard is established after the start of conversion, the conversion period is 2 years before marketing the products as organic. However, in this case the farmer has to comply with the organic rules on the use of planting material.

After 12 months of conversion, the products can be marketed as 'organic in conversion'. A stepwise reduction of agrochemical use is not considered part of the conversion period.

The national organic movement or organic certification bodies operating in the country can provide further guidance and support for organic certification. Farmers should first consult the national organic movement and then sign a certification contract with an accredited organic certification body operating in the country. Producers should work with a certification organisation that has the necessary accreditations for the required standard and target markets.

Box 4: Additional requirements for marketing organic berries in Switzerland

Bio Suisse certification gives foreign producers access to the Swiss organic market. Farmers applying for the Bio Suisse standard must be EU organic certified. In addition to the requirements of the EU organic standard, farmers must meet the following requirements (among others):

- A conversion period of 36 months since the last conventional management is mandatory.
- The entire farm must be managed organically.
- The manager of the organic farm cannot be responsible for non-organic operations.
- A specific inspection must be carried out by an authorised certification body. The final certificate is issued by ICB AG.
- At least 7 % of the farm's area must be dedicated to the enhancement of biodiversity (ADEB).
- Maximum fertiliser rates of 100 kg N and 30 kg P_2O_5 per hectare must not be exceeded.
- The maximum permitted rate of pure copper per hectare and year is 2 kg for berries.

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