6.1. Vegetative Buffer Strips (VBS)

Summary: The purpose of the VBS (also known as filter strips, buffer strips, and buffer zones buffer zones) is to reduce erosion and nutrient flow into water from erosion-sensitive and slanted or repeatedly under-flooded fields. The buffer zone is at least 15 m wide field area, which restricts to main drain or water and is covered by a perennial vegetation on which fertilizers and plant protection products are not spread.

Operation and maintenance: The buffer zone needs to be mowed at least once a year, but during the first years mowing is recommended two or even three times during the growing season. The mass must be removed from the buffer zone so that the nutrients will not enter to the water. **Efficiency** is dependent on the local conditions. Kronvang et al. compared different studies and found that P reductions were 41-97% and N reductions were notable too.

Efficiency and functionality Costs of the Practice Ease of Operation Potential for nutrient recovery

Basics of the good practice:

- Buffer zones effectively prevent leaching of soil and nutrients from fields. They reduce water eutrophication and dredging needs of ditches and beaches. Buffer zones are particularly useful in fields with high phosphorus levels in the soil. From these kind of fields the surface runoffs flush plenty of soluble phosphorus into waters, as well as particle-bound phosphorus.
- In many cases, a buffer zone is sufficient to prevent solid matter and nutrient entering into the water systems. In strongly inclination fields would be needed more wider buffer strips. If the inclination of the field is more than 10%, (i.e. the field rises one meter or more on 10 meters distance), it is appropriate to consider establishing a buffer zone.
- Buffers zones are very useful also in shoreline fields which collapse easily. Siltation of the shore, repetitive turbidity on the shore or small rivulets on the field during the rains show in practice where the buffer zones are needed.

Buffer zones:

- Covered with perennial lawn vegetation.
- It is preferably set up in sheltered clay or formed from old grass or green set-asides.
- Carefully managed by mowing or grazing
- Wild bushes or deciduous trees can be planted as small groups.
- The management of the buffer strip can also be accompanied by the vegetation management activities carried out in the natural area between it and the watercourse.
- Mowing is only possible if it does not harm the water protection.

Costs of the good practice: In Finland, the cost can be over 500 Euros/ha. About half the cost comes from the loss of income and the rest is establishment and management costs like seed drilling, mowing and removing the plant material.

Ability for climate chance mitigation: The greatest benefits of slurry injection in climate change mitigation is in minimizing and reducing surface runoff. The risk for nutrient losses may increase in the future over the climate change.

Potential for nutrient recovery: The use of vegetable mass in agricultural production is possible. The mowing waste can exploit as cattle food.

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Evidence of Success: Buffer zones

Long-term monitoring of buffer zone efficiency under different cultivation techniques in boreal conditions (Uusi-Kämppä, Jauhiainen)

- A 6-plot experimental field was established in clay soil in SW Finland in 1991 to study long-term changes in functioning of BZs and their retention capacity for total solids (TS), total P (TP), dissolved reactive P (DRP) and particulate P (PP) in different seasons.
- The steep slope in lower sections of four plots (18m wide×70m long) was planted with 10-m-wide mowed grass buffer zones (GBZ) or unmowed vegetated buffer zones (VBZ) growing natural herbage and shrubs.
- Surface runoff water samples from the GBZ and VBZ plots were compared to samples from plots cultivated without a buffer (NBZ).
- The source field area in all plots and the steep slope (12–18%) on the NBZ were ploughed in autumn, and sown with barley or oats in spring (conventional tillage, 1991–2001), sown with grass and grazed (72–234 cow grazing days ha−1yr−1; 2003–2005) and direct drilled without tillage (2006–2008).

GBZ = Grass Buffer Zone
VBZ = Vegetated Buffer Zone
NBZ = No Buffer Zone

- The BZs were most effective at decreasing TS, TP and PP with conventional tillage, less with direct drilling and least effective with grazing.
- In a conventionally tilled field, the TS and TP removal efficiencies were over 50% and 27–36%, respectively, for the BZs as compared to the NBZ.
- In the VBZ plots, the DRP load was, however, 60% greater than in the NBZ or GBZ plots. In direct drilling, the surface runoff losses were smaller than in conventionally tilled NBZ plots.
- The lowest losses of TS, TP and PP were found during grazing for all plots, but with grazing the DRP load, 0.3–0.4kgha−1yr−1, was higher than during grain growing in all treatments.
- The GBZ and VBZ were effective in retaining P in summer and autumn, whereas in spring their retention capacity was decreased.
- The reason for high DRP losses in spring was the high PAc in surface soil and frozen broken plant tissues in the VBZ and the grazed source field. Mowing and removing of swathe from the GBZ decreased the DRP losses.

MORE INFORMATION
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