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Supplementary file S1

Spreading of fertilizers in practice

For ground spreading, a Ponsse Gazelle forwarder was used with an Amazon centrifugal spreader, with two discs with longer vanes at the back and both sides for spreading fertilizer in forests. The settings of the spreader can be adjusted separately for each disc (i.e. rotational speed, usage and spreading rate, spreading width approximately 40 m maximum). The forwarder can carry 2 tons of fertilizer on the spreader and four to six extra sacks in the load space. The driver of the forwarder has a view of the spreading area on a forest background map with the intended usage. At the first study site, Liperi, the driver was not able to accurately evaluate the amount of fertilizer applied to each block because the forwarder did not have a scale on the spreader. When fertilizing from trails, the driver needed to change the usage each time when the target amount of fertilizer changed for the next block**.** Based on this, at the Ilomantsi study site, the shape of the blocks was considered when distributing the fertilizer.
For aerial spreading, an Airbus H125 Ecureuil was used with a specially made centrifugal spreader attached by a cable beneath the helicopter. The spreading amount per area unit was affected by the flying speed. The spreading width was 40–45 m. The spreader was controlled by the pilot. Depending on the loading location, the helicopter can take 700–1100 kg of fertilizer.
GPS data analyses. Both the ground and aerial methods involved GPS location-saving during spreading. It was thus possible to check which areas had been fertilized. If some area had not been covered, the lack of GPS tracking would be visible. However, the GPS tracking did not include any data on the spreader settings, although GPS tracks can imitate real spreading, even though lacking some data. Here, analysis of the GPS was done only for the aerial spreading. A comparison was made between the flight-recorded GPS locations and the location of the study plot. The test section level differences between the amounts of fertilizer were ±20%. When comparing the total mean of all measured fertilizer, the difference was only 2%. At the Juuka study site in the 200 kg N ha^{-1} fertilizer test blocks, the pilot needed to apply more fertilizer to the area, using only one flight line in the middle of the block, to spread a missing amount of 50 kg N ha^{-1}. This was shown via the GPS analysis as an increased N dose, although it was actually smaller, as measured using the funnel on the ground.