Getting started with compost in arable farming

Organic matter

Soil organic matter contributes to a good physical, chemical and biological soil fertility and is therefore indispensable for resilient agriculture under changing climate conditions. In Flanders, however, the organic matter contents of the agricultural soils are decreasing and already 10% of the agricultural area does not reach the required limit values for the organic matter content, drawn up in the context of the common agricultural policy.

Increasing organic matter within the standards of the 6th Manure Action Plan (MAP)

In order to build up the soil organic matter content within the current crop rotations, it is important to use an organic fertilizer that supplies sufficient organic carbon per unit of nitrogen (N) and phosphorus (P). The fertilizer standards, drawn up in the MAP 6, limit the application of manure. While slurry has a low carbon input (expressed in effective organic matter, EOC) per unit of total N and P, the carbon input per unit of total N and P of solid manure and compost is significantly higher (Figure 1).

Moreover, not all N in organic fertilizers is active and should not be counted completely within the rules of MAP 6. For example, in slurry 60% of the applied N is active, while the active N in farmyard manure and compost is only 30 and 15% of the total N. Expressed in active N, the carbon input of compost is thus considerably higher than that of any other organic fertiliser.

Consequently, compost is an important asset in building up organic matter levels within the standards of MAP 6.

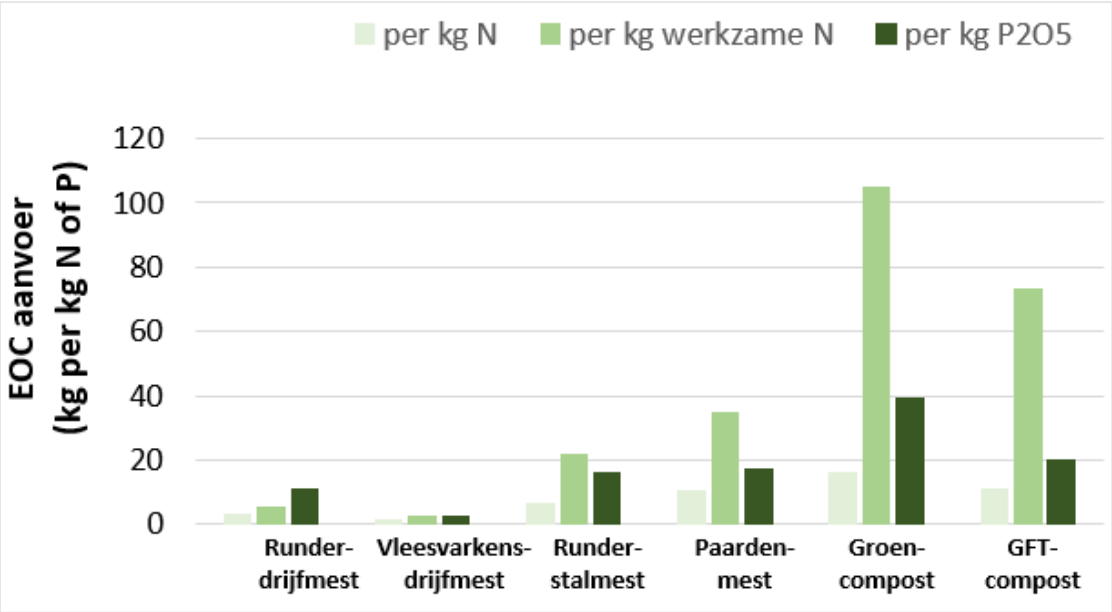


Figure 1 – Effective organic carbon input of different organic fertilizers expressed in kg total N, per kg active N and per kg. total P_2O_5

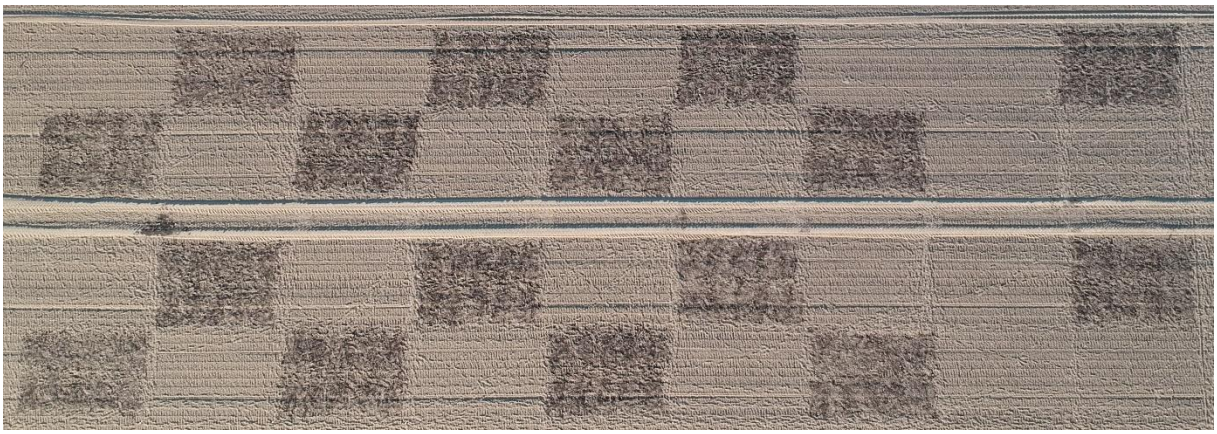
Trial 2020

Till now compost is used to a limited extent in arable farming. Therefore the Research Center for Potato Cultivation (PCA vzw.) set up a one-year compost trial in potato Fontane. On a sandy loam soil with a low organic carbon content of 0.99%. In the trial measurement were carried out on crop development, yield and nitrate residue of potatoes. Plots with mineral fertilization according to the advice, were compared with those of potatoes fertilized with 28.5 tons of green compost per ha (= 30 kg active N/ha) and mineral fertilizers supplemented to the advice. The green compost used was a VLACO-certified, fine (<15mm), well-ripened compost.

Mineraal		Compost + Mineraal
190 kg N/ha	?=?	160 kg N/ha
280 kg K_2O/ha		143 kg K_2O/ha
		28.5 ton/ha groencompost

PCA 2020

In addition, using the Demeter tool, a prediction was made of the evolution of the organic carbon (OC) content on this field (current OC content = 0.95%) under a rotation of potatoes, winter wheat, sugar beet and silage maize when these would be fertilized annually with maximum use of slurry (170 kg N/ha) or when 28.5 tons of green compost per ha is applied once every four years without using any other organic fertiliser.

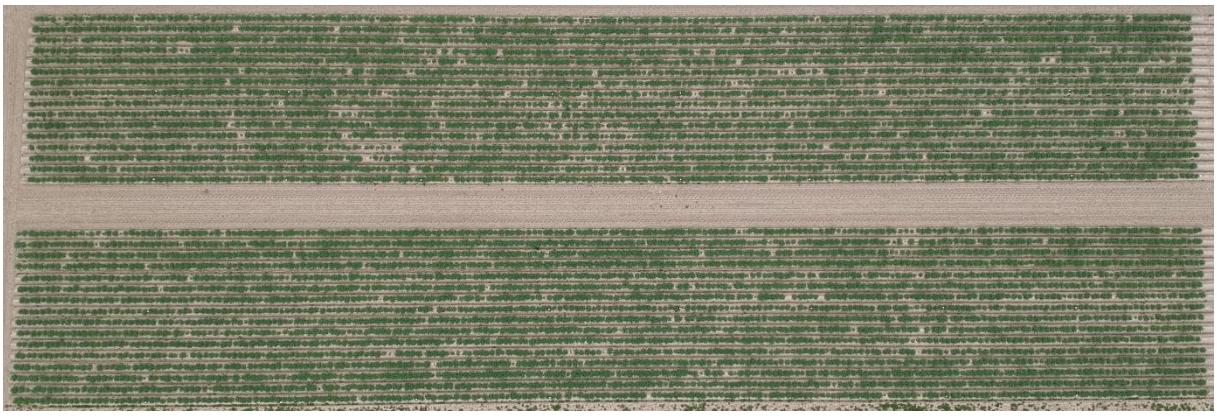


Results

→ Crop development

In both objects, the potatoes developed uniformly throughout the growing season. Mid-June the potatoes were in moderate health in both objects, after a period of drought (score 7.0). In July, after the welcome rain, the potatoes were generally healthy (score 8.0 - 8.3).

In both objects the soil covering was likewise. On June 12th, the ground cover was about 50% in both objects. By early July, the crop was closed and the ground was almost completely covered.



The development of the potatoes was also very similar in both objects. While on August 13, the development was about 33%. By the beginning of September the crop was about 69% ripe and ready for killing of the leaves.

Object	Development (%)		
	13/08/2020	27/08/2020	08/09/2020
Mineral	34	55	70
Compost + Mineral	33	51	68

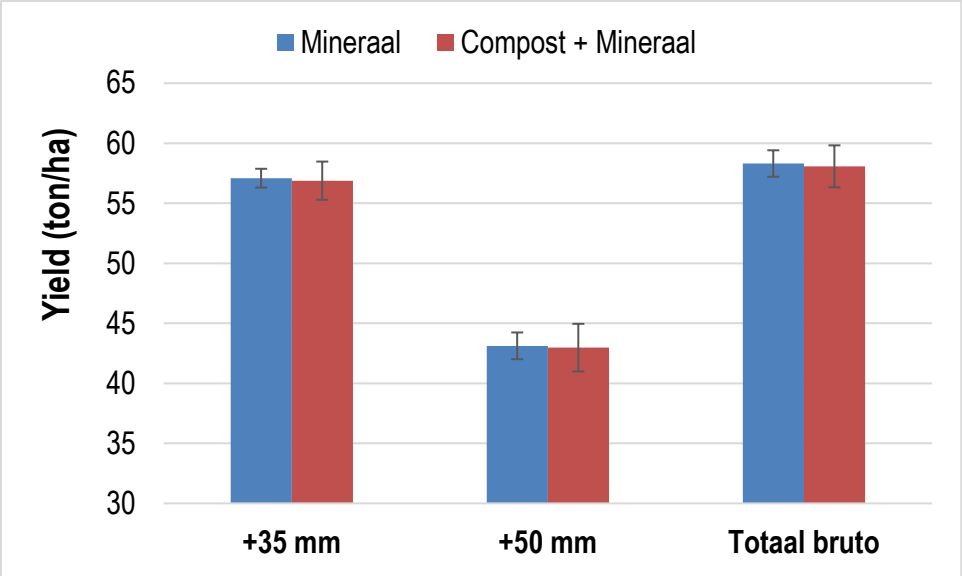
PCA 2020

Object	Crop (1-9)			Soil coverage (%)	
	12/06/2020	03/07/2020	23/07/2020	12/06/2020	03/07/2020
Mineral	7.0	8.0	8.1	51	99
Compost + Mineral	7.0	8.1	8.3	50	98

PCA 2020

→ Yield

The gross yield in both treatments, with 58.3 and 58.1 ton/ha, was high and almost equal. Moreover, there was no difference in the grading of the potatoes: 98 % of the potatoes were larger than 35 mm and 74 % of the potato was larger than 50 mm.



→ Nitrate residue

Although the nitrate residue in both objects was higher than the first nitrate residue threshold set in the MAP, it was noticeable that the nitrate residue in the object fertilized with compost was on average 15 kg NO_3-N/ha lower than in the mineral fertilized object. Either the actual N release from compost was lower than the expected 30 kg N/ha, or there was some N fixation towards the end of the growing season due to the relatively high carbon/nitrogen content of the compost.

Object	Nitrate residue (kg NO_3-N/ha)
Mineral	157
Compost + Mineral	142

PCA 2020

→ Development of the organic carbon content

When the sample plot under a rotation of potatoes, winter wheat, sugar beet and silage maize is fertilized annually with a maximum use of slurry, the organic carbon content of the plot will hardly increase over time. And it will be a challenge to keep the plot in optimal soil health (Figure 2). If, on the other hand, we apply 28.5 tons of green compost per hectare once every four years, the organic carbon content of the plot will slowly increase to an optimal organic matter content. Where it is possible to a maximum advantage of good physical, chemical and biological soil fertility (Figure 3).

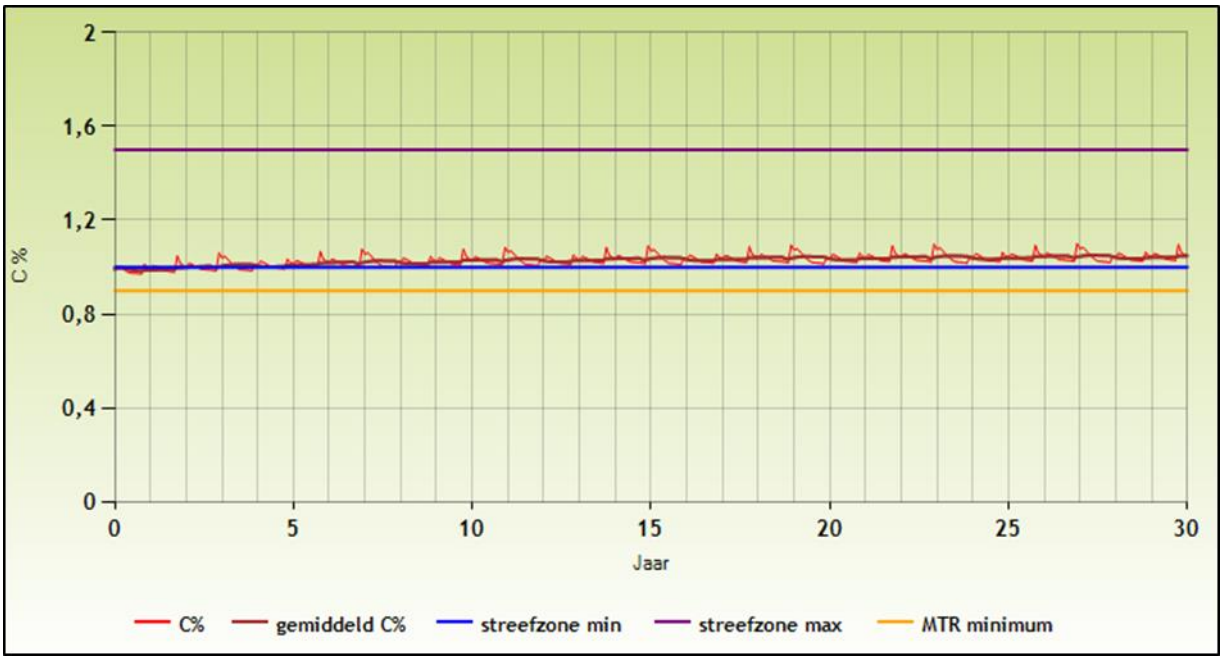


Figure 2 – Development organic matter content of a arable crop rotation potatoes-winter wheat- sugar beet- maize, maximal fertilized with slurry

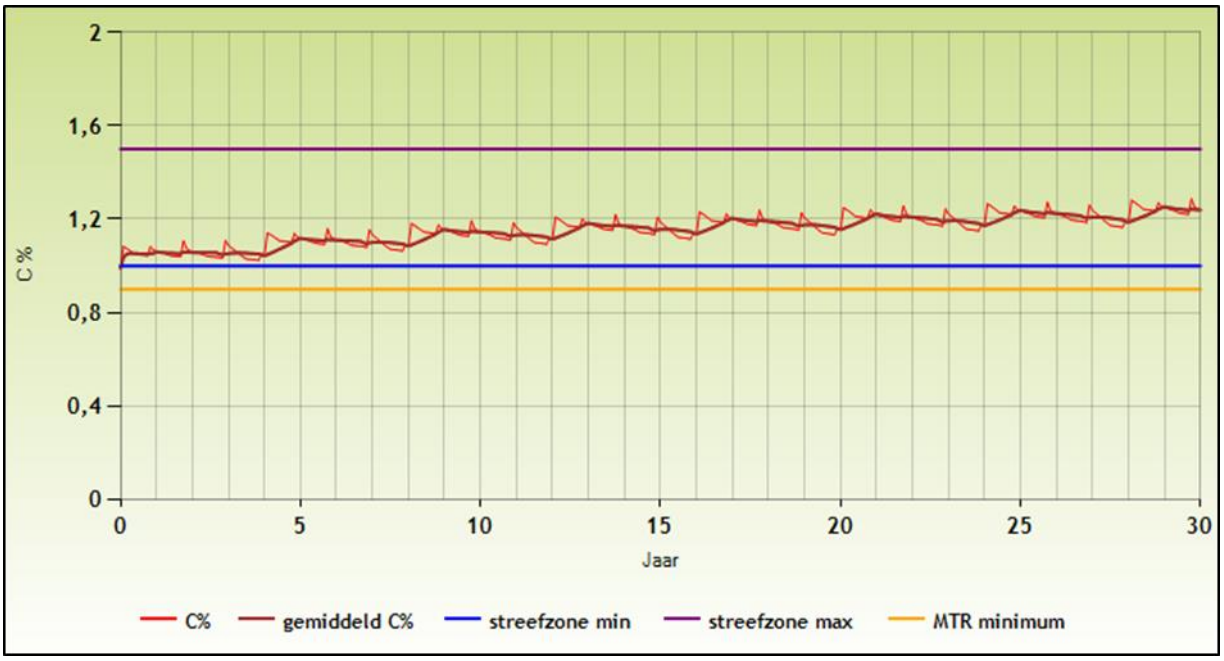


Figure 2 – Development of the organic matter content of an arable crop rotation potatoes-winter wheat- sugar beet- maize, maximal fertilized with 1x 28.5 ton green compost per ha per 4 years

Conclusions

No differences in crop development or yield were observed between the two test subjects. However, the nitrate residue in the objects fertilized with compost was slightly lower on average. This shows that compost application in the fertilization strategy is possible without decreasing yield and crop quality.

In the medium term, a regular compost application will ensure an organic matter build-up. These higher organic matter contents will contribute to better physical, chemical and biological soil fertility. In this medium term, it can therefore be expected that crops grown on fields fertilized with compost will perform better than on fields where the organic matter content remains low.

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