



Retrofitting of particulate filters on tractors

Filter systems need to be adapted to vehicle use

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Machines used in agriculture also emit diesel soot particles. The latest calculations of the Swiss Federal Office for the Environment FOEN assume the emissions to stand at around 400 tonnes per annum. The ultrafine particles are harmful to health owing to their carcinogenicity. Filter systems can considerably reduce tractor particulate emissions. To date, tractors are not equipped with particulate filters as standard. Moreover, tractors remain in service for an above average period (half the tractors registered in Switzerland are over 20 years old), so it seemed advisable to investigate the feasibility of retrofitting particulate filters to agricultural machinery.

Eight tractors and a self-propelled loader were retrofitted with filters. These vehicles are used in various areas of agriculture and forestry and cover many different jobs in these spheres. These vehicles have emission stage 2 engines or older. A data logger was used to record the exhaust temperatures in the trial vehicles over a prolonged period so that a suitable filter system could be selected for this application. All the filters were fitted by filter manufacturers or importers. Closed filter systems with different types of regeneration systems were fitted.

All the closed filter systems examined so far proved highly effective when new, with a separation rate of over 99 %. At a few load points the particulate concentration downstream of the filter was sometimes less than that in the surrounding air.

Malfunctions occurred in some filters during the trial. The spectrum ranged from excessive back pressures, necessitating the fitting of a new, larger filter, through problems with the electronic filter monitoring systems, to three vehicles in which there were one or more filter defects. There was no engine damage. There were several reasons for filter damage. One filter model was still at the prototype stage and one vehicle failed to reach the requisite exhaust temperatures for the passive system, the engine beginning to pump oil at low rpm at the same time, which clogged the filter.

A filter fitting on a medium-sized tractor engenders costs between CHF 8,000 and CHF 15,000. In addition, recurrent costs accrue for filter-cleaning, and for additional energy in the case of active filter systems.

Trial conclusion:

Every filter fitting must be adapted to the individual vehicle. There is no universal solution.

The detailed results of the trial are published in the ART report 677 entitled "Partikelfilter-Nachrüstung bei Traktoren" (only available in German or French).

http://www.services.art.admin.ch/pdf/ART_Bericht_677_D.pdf

Particulate filters on tractors

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For some time now Agroscope Reckenholz-Tänikon ART has been running a project funded by the Swiss Federal Office for the Environment, the purpose of which is

Evaluation of effective and economical particulate filter systems for farm tractors.

Nine vehicles used in agriculture and forestry were fitted with closed particulate filters with different regeneration systems.

Deutz Agrotron K100 (70 kW) 	Hürlimann 908XT (63 kW) 	Schäffer 4042 (self-propelled loader) (29 kW) 	John Deere 6620 (92 kW) 	Fendt 411 Vario (81 kW) 
Lindner Geotrac 65 (48 kW) 	Valtra 6350-4 (66 kW) 	Valtra 6350-4 (74 kW) 	Same Dorado 75 (53 kW) 	

Project results

- Separation rate of over 99 % very high relative to the particulate count in all vehicles
- Minor faults, such as excessive exhaust back pressure, or problems with filter monitoring
- Partially restricted field of vision
- Filter damage in three vehicles
- No engine damage

Difficulties

- Not much space in which to fit the filter
- Frequent partial load operation, hence low exhaust temperatures
- Filter mountings are still expensive. Financial incentive systems are being considered by the Swiss Federal Office for the Environment