Silage effluent - an environmental problem

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Introduction

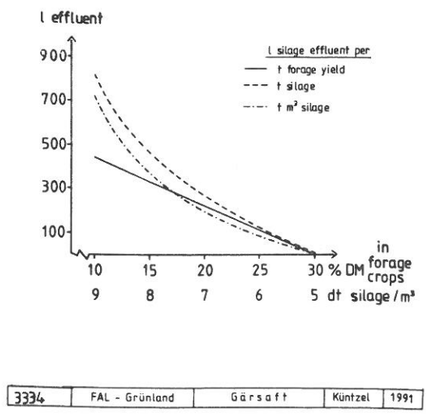
Ensiled green forage with less than 30 % DM produce silage effluent. From silage made in field clamps the effluent seeps into the soil. Years gone-bye in different experiments was determined

-1. the migration of effluent compounds in the soil under clamps. It was attempt the evaluation of the danger for the underground water.

-2. the fertilizing effect of silage effluent.

Amounts and composition of silage effluent

Fig. 1: The effect of forage DM on amounts of silage effluent



The expected amount of effluent is correlated with the DM-content of the ensiled green forage and with the dimension of the clamp. In fig. 1 the amounts of effluent as functions of the DM-content of the green forage are plotted. Complementary in the lower scale the average weight of silage per m^3 silo-volume for given DM-contents is shown.

Table 1 shows the amounts of effluent for an average yield/ha for different crops. Maximum flow occurs during the first days after ensiling.

Table 1: Amounts of silage effluent

forage crop	green fodder yield t/ha	% DM	effluent supply l per t fodder	m^3/ha
sugar beet leaves	40	12-18	500-200	20 - 8
maize	50	25-30	100- 0	5 - 0
grass, clover grass				
- fresh	28	17-22	290-180	8 - 5
- prewilted	26	> 28	0	0
catch crops	15-50	10-15	440-330	22 - 5

Crushing or additives may raise the speed of discharge but not the amount of effluent.

Table 2: Composition of silage effluent (in kg/m^3)

Dry matter	30 - 60	Nitrogen (N)	0.8 - 1.5
Organic matter	22 - 45	Potassium (K_2O)	2.6 - 3.0
Organic acids	7.5- 17.5	Phosphorus (P_2O_5)	0.4 - 0.8
BOD_5	45 -100	Chlorids	2.6 - 3.5
pH-value	3.8- 4.5		

The composition of effluents from different green forages varies only little (table 2).

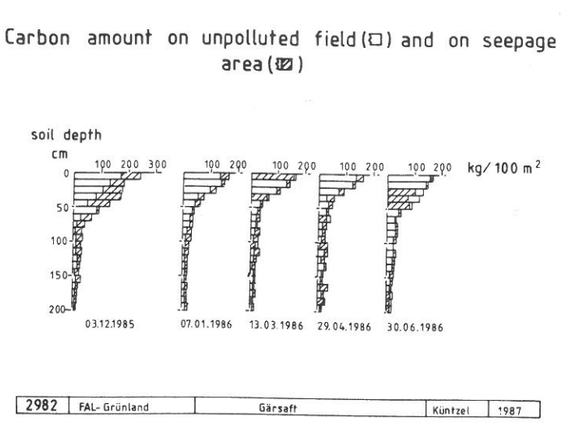
Migration of silage effluent under clamps

From the starts of experiments in October or November of various years to spring in the next year the climatic water balances were positive. That means the water movement in the soils were downward.

The pH in the soils mostly remained unchanged under clamps; sometimes it decreased nearly at 0.5 pH units after effluent seepage within the upper 60 cm of the soil. Until March the pH reached again its initial level. Afterwards the pH was a little bit higher in all effluent treated soils than in the untreated ones.

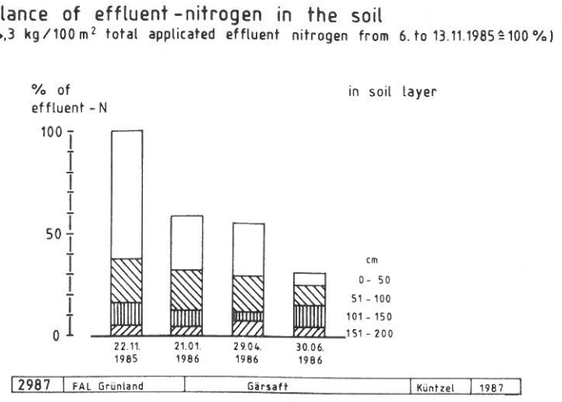
The available phosphate increased up to 70 cm depth in the soil after application of effluent. It was probably fixed in unavailable forms and did not migrate into deep soil layers, even on light soils. The available potassium increased at depths of 2m but decreased later on in all soil sections. The organic matter i.e. carbon of the silage effluent led to a higher microbial activity in the soil. In June all organic matter applied was disintegrated and also some organic soil substances (fig. 2).

Fig. 2:



A balance of total N in the soil profile down to a depth of 2m shows N-losses of nearly 40 % in the upper layer within 2 months after application of effluent (fig. 3). The examinations show that due to conversion processes in the soil the negative effects of silage effluent were evidently reduced.

Fig. 3:



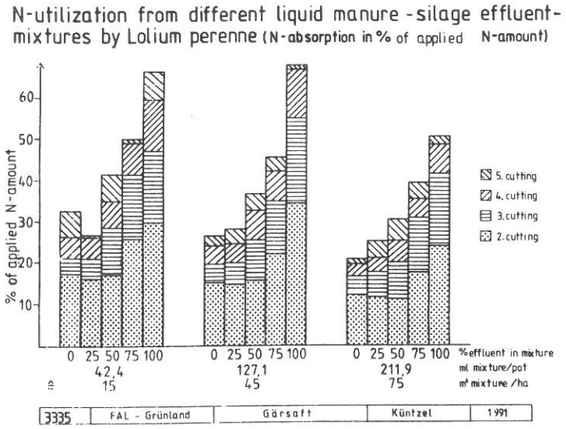
Fertilizing effect of silage effluent

In several years field and pot experiments of the fertilizing effect of silage effluent to grains, mowing pasture and grass species on different soil have been tried.

More than 50 m^3/ha (100 resp. 140 kg N/ha) effluent applied in autumn to fallow land with subsequent spring grain (barley, oat) had a lodging effect, resulting in yield reduction. On the other hand 100 and 200 m^3/ha effluent on mowing pasture had a yield increasing effect. Whilst 50 m^3/ha reduced the yield in tendency, probably as a result of increasing denitrification.

N from liquid manure gave the same DM-yield like from silage effluent but the N-absorption was higher by silage effluent (fig. 4).

Fig. 4:



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