

New ways of liquid manure application

Strip Till - Culex

Volmer Engineering GmbH
Thomas Fehmer



structure

- **Goal setting and motivation**
- **The main subject is liquid “manure-belt”**
- **Under-root-fertilization and under-floor fertilization**
- **Function of the Volmer Culex Strip Till**
- **Advantages of the Culex system**
- **Observations**
- **Suggestions for practical use**

new fertilizer ordinance valid since 2017

- max. 170 kg/Ha N from farmyard manure
- admissable N- and P-balances
N-balance: from 2018 max. 50 kg N/ha (3-year annual average)
P-balance: from 2018 max. 10 kg P₂O₅/ha (6-year average)



***„Nobody” wants that our
drinking water becomes sick!?***

conclusion:

to convert (transform) the nutrients derived from liquid manure into yields as ecologically compatible and efficient as possible.

goal setting

Reduction of nutrients into the atmosphere as well as into the ground water.



to incorporate (mix in) the liquid manure immediately into the soil



the best effect of nitrification inhibitors as Piadin, N-Lock, Vizura and Entec fl. are shown in the liquid manure depots.

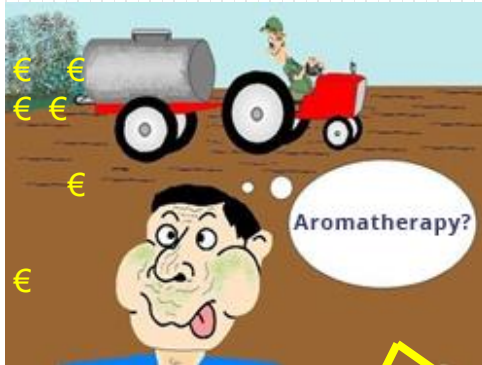
Nitrification inhibitors have an effect for corn (maize) with liquid manure Strip-Till in two directions:

- 1. They reduce on one side the nitrogen loss risk by the displacement of nitrogen (torrential rain) and denitrification (nitrate breathing)**
- 2. On the other side the long-lasting ammonium-nitrate-mixed diet. The growth of roots, the absorption of manganese, zinc, phosphate and nitrogen as well as the yield production.**

The effect of the inhibitors is in a liquid manure-belt **much stronger and longer-lasting** because of the **higher concentration** as well as a broad liquid manure mix into the soil. According to several examinations, the effect lasts approximately eight to ten weeks. During this time, the corn (maize) can be **nourished with emphasis on ammonium**. Because of the **acidification** of the rhizosphere, the absorption of manganese and zinc improves. **In addition, the liquid manure phosphate becomes water-soluble and has the effect as a mineral diammonium phosphate.**

goal setting

Reduce loss of nutrients into the atmosphere as well as into the ground water.



**Blending of the liquid
manure immediately into
the soil**



Volmer short disk harrow



**The best effect of nitrification
inhibitors as Piadin, N-Lock, Vizura
and Entzec fl. are shown in the
liquid manure depots**



Volmer strip till Culex

goal setting

Reduce loss of nutrients into the atmosphere as well as into the ground water.

To use available nutrients more efficiently, particularly in the rows – interspaces.

Method 1: Improved distribution of plants



**Double rows 12-20 cm distance
in a diagonal bracing**



**Narrow spacing of corn (maize)
30-40 cm of row spacing**



Broad spreading

goal setting

**Reduction of nutrients into the atmosphere as well as into the ground water.
More efficient use of available nutrients, particularly in the row-interspaces.**

Method 2: To bring the nutrients to the plants. .



**Ridge planting – Broadly spread
natural fertilizer will be cock-hayed.**

First aim will not be reached



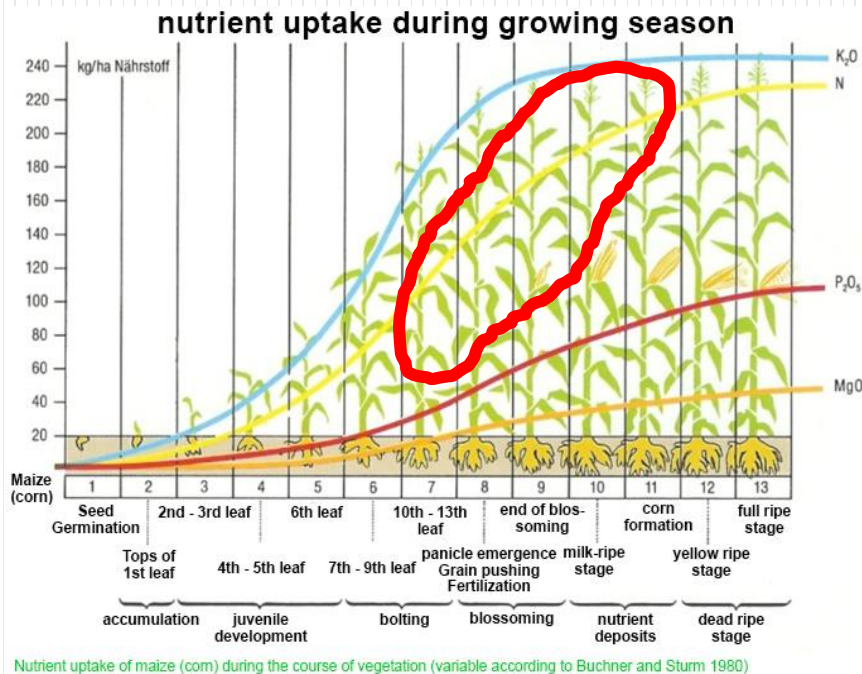
strip till / manure-belt

goal setting

reduction of nutrients into atmosphere as well as into the ground water.

more efficient use of available nutrients, particularly in the row-interspaces.

to keep the available nutrients from the liquid manure as long as they are needed.



June to August high requirements of N / withdrawal

**P does not relocate/shift!
P will be needed at the root!**



strip till with liquid manure-belt and nitrification inhibitor

Fertilization with emphasis on ammonium

goal setting

reduction of loss of nutrients into the atmosphere as well as into the ground water.
more efficient of available nutrients, particularly into the row-interspaces.
keep the available nutrients from the liquid manure ready until they are required.

ammonium based fertiliser → Cultan-effect → Secure juvenile development without under-root fertilization.

ammonium nutrition nitrate nutrition ph-value



Quelle: Römheld, 1986

Ammonium fertilization effects a reduction of pH-value in the root area by formation **organic acids**

Increased absorption of phosphate and micro nutrients

motivation and
objective

strip till and
Fertilizer-root

under-root vs.
underfloor.

function Culex

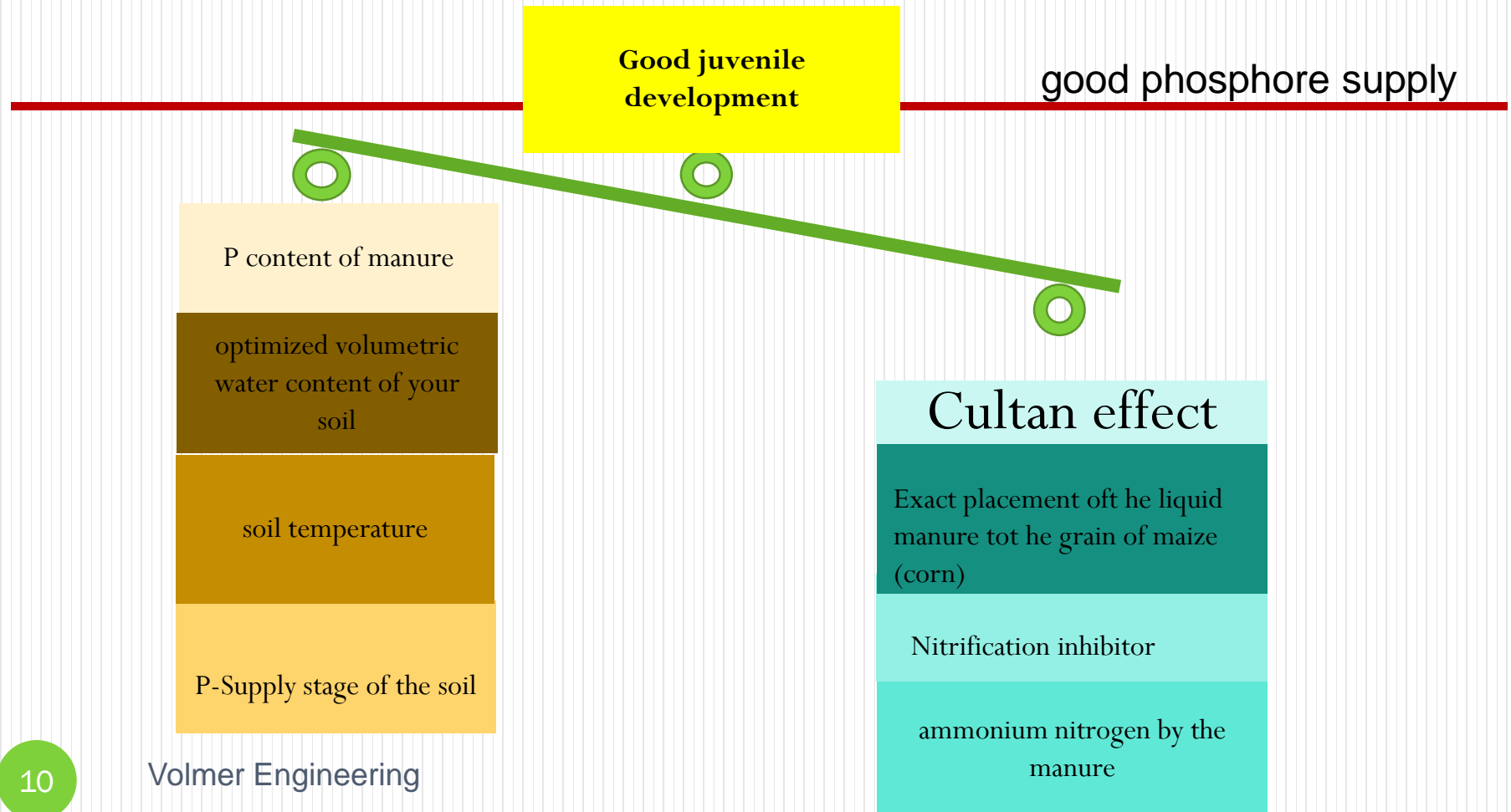
advantages

observation

practice tips

goal setting

ammonium based fertiliser → Cultan-effect → Secure juvenile development without under-root fertilization.



motivation and
objective

strip till and
Fertilizer-root

under-root vs.
underfloor.

function Culex

advantages

observation

practice tips

goal setting

ammonium based fertiliser → Cultan-effect → Secure juvenile development without under-root fertilization.

**Good juvenile
development**

good phosphore supply

Ammonium from ASL to
reinforce the Cultan effect

→ **170kg of natural fertilizer+
ASL (N – mineral fertilizer)**

P content of manure

optimized volumetric
water content of your
soil

moderate soil
temperatur

P-Supply stage of the soil

Cultan effect

Exact placement oft he liquid
manure tot he grain of maize
(corn)

Nitrification inhibitor

ammonium nitrogen by the
manure

motivation and
objective

strip till and
Fertilizer-root

under-root vs.
underfloor.

function Culex

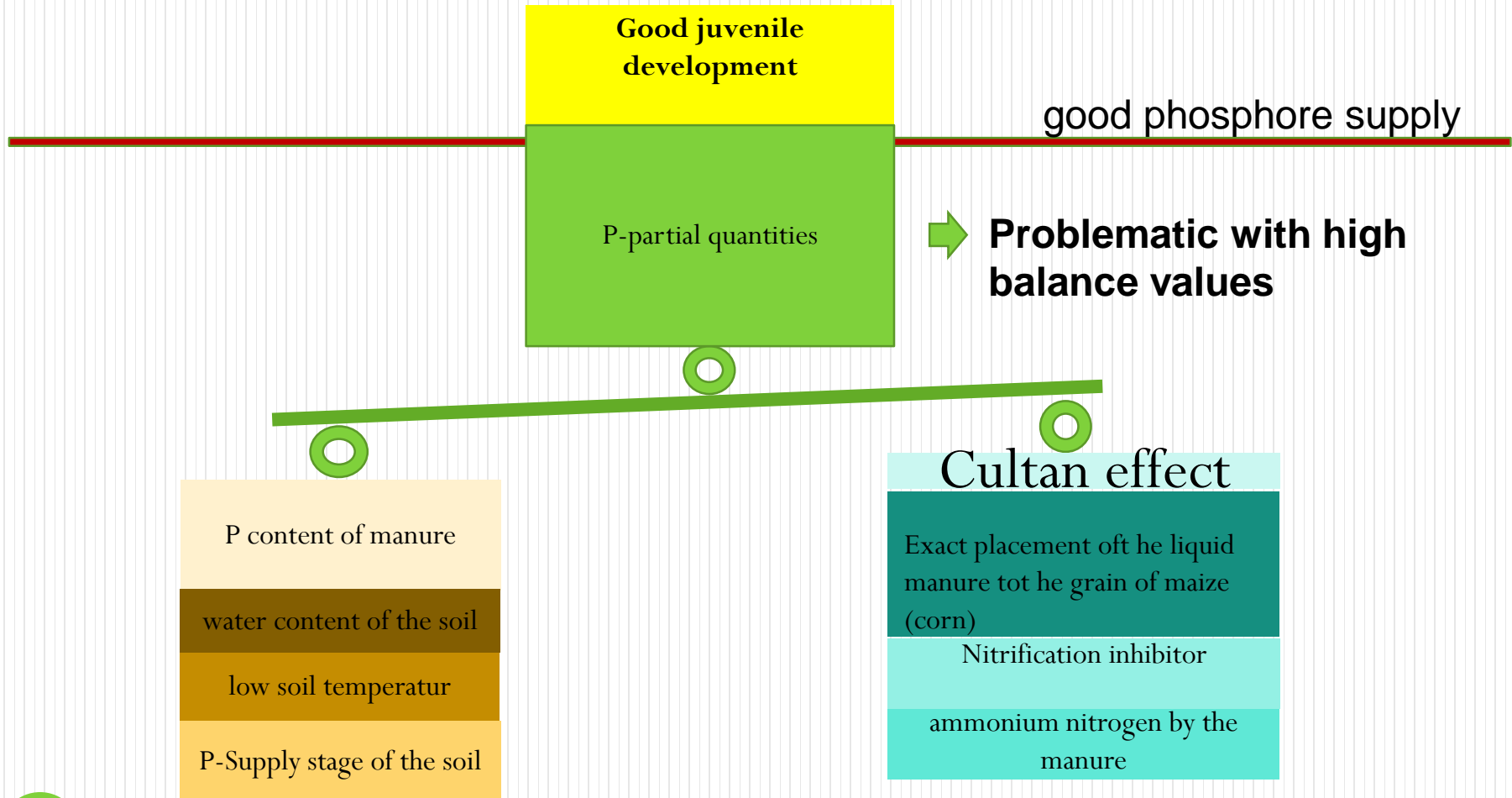
advantages

observation

practice tips

goal setting

ammonium based fertiliser → Cultan-effect → Secure juvenile development without under-root fertilization.



motivation and
objective

strip till and
Fertilizer-root

under-root vs.
underfloor.

function Culex

advantages

observation

practice tips

goal setting

ammonium based fertiliser → **Cultan-effect** → **Secure juvenile development without under-root fertilization.**

**Good juvenile
development**

good phosphore supply

P-partial quantities from
under-root fertilization

Soil loosening for soil heating

→ **Problematic with high
balance values**

P content of manure

water content of the soil

low soil temperatur

P-Supply stage of the soil

Cultan effect

Exact placement oft he liquid
manure tot he grain of maize
(corn)

Nitrification inhibitor

ammonium nitrogen by the
manure

motivation and
objective

strip till and
fertilizer-root

under-root vs.
underfloor.

function Culex

advantages

observation

practice tips

goal setting

ammonium based fertiliser → Cultan-effect → secure juvenile development without under-root fertilization.

**Good juvenile
development**

good phosphore supply

Ammonium from ASL to
reinforce the Cultan effect

→ **170kg phosphore
+ ASL (N – mineral fertilizer)**

Soil looseing to heat up the



Don't drive over the strip
when

P content of manure
water content of the soil
low soil temperatur
P-Supply stage of the soil

Cultan effect

Exact placement oft he liquid
manure tot he grain of maize
(corn)

Nitrification inhibitor

ammonium nitrogen by the
manure

stripp till comes from America

- In America 35% are direct seeding surfaces.
- Concerning the rest of the surfaces, direct seeding reaches its limits, as these are either to “cold” or to “wet.”
- For this Strip Till was developed.
- In Germany we proceed historically seen from the full-surface tillage.
- Structural damage, surrounding weeds, soil heating and further influences continue to require, respectively justify a full-surface tillage.

manure-belt

- reduction or loss of nutrients in the atmosphere as into ground water.
- more efficient use of available nutrients, particularly in the row-interspaces.
- keep the available nutrients from liquid manure ready as long as possible until they are required.
- fertilization with emphasis on ammonium → Cultan-effect → Juvenile development without under-root fertilization.

we want to reach these goals in the whole field of cultivation of maize (corn) growing, whether work is done with Strip Till, disc harrow, cultivator, or plough (plow) (with packer) system. The Volmer Culex was designed in such a way so that it can be equipped with a liquid manure-belt under possibly many conditions.

strip till is not paramount, however, the best possible placement of nutrients.



~~strip till with~~
**liquid manure-belt
and nitrification
inhibitor**

Under-root fertilization (UFD)

- + maximum distance of the grain of maize (corn) to the liquid manure 7 cm
- + should / can replace mineral under-root-fertilization
- + easier than underfloor fertilization
- Loosening depth dependent on the quantity of liquid manure
- - Root growth in deeper region means lower risk of flower pot effect
- - Danger of flower-pot risk above all in the ruts

vs.

Underfloor fertilization

- + proper loosening depth up to 25 cm
- + deep nutrients „pull“roots downwards ☐☐ Less drought stress
- More difficult than under-root fertilization
- - More wet soil will be transported (hauled) upwards (clay soils)
- - Mineral under-floor fertilization cannot be dispensed with.

STRIP – TILL - Culex

by

Volmer Engineering

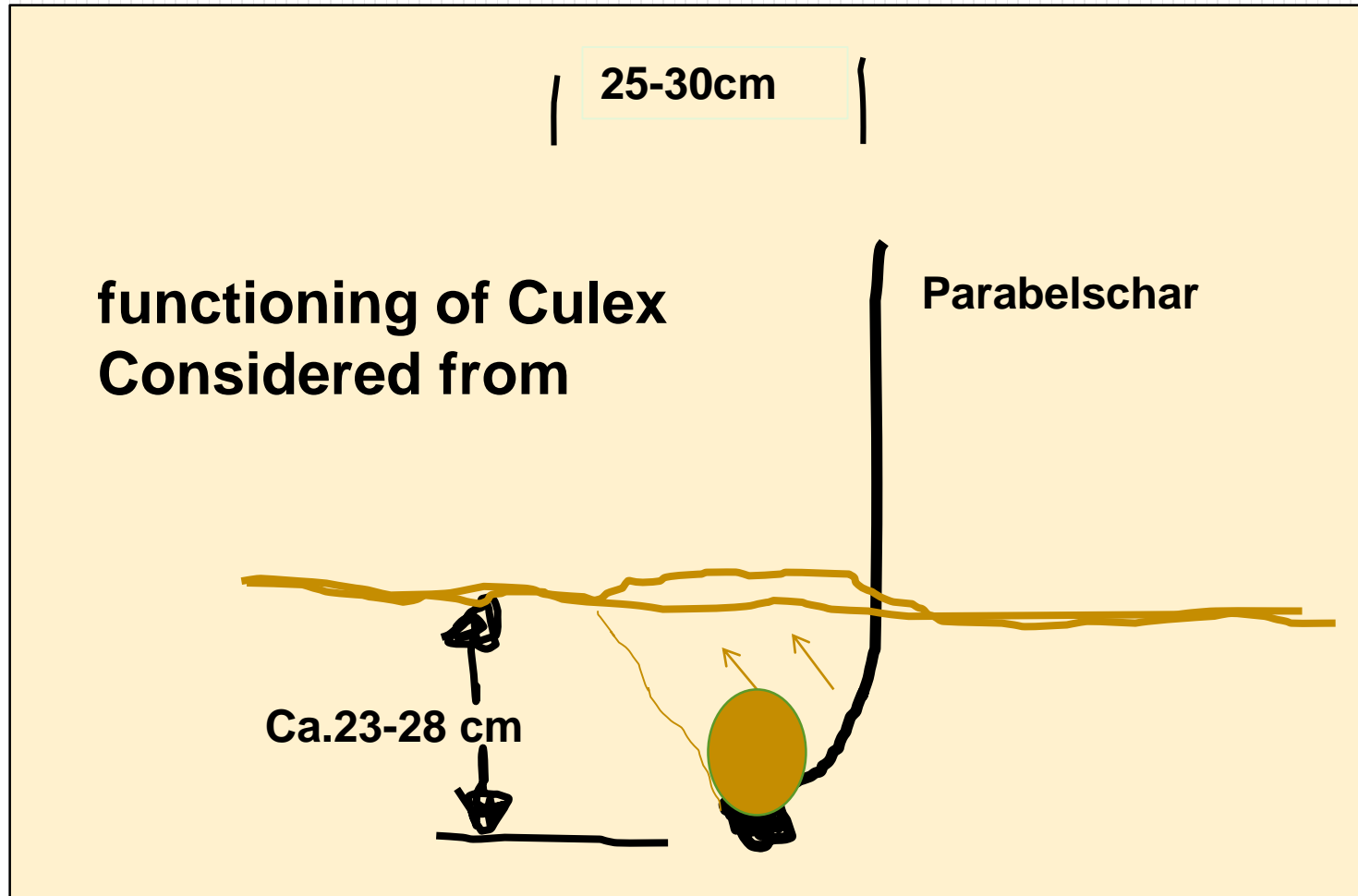
**The first system which was specially designed for the putting
on (applying) of a liquid manure-belt.**

**The Culex offers a great deal of advantages
compared with the traditional systems!**

The center piece of the Culex strip till-untis

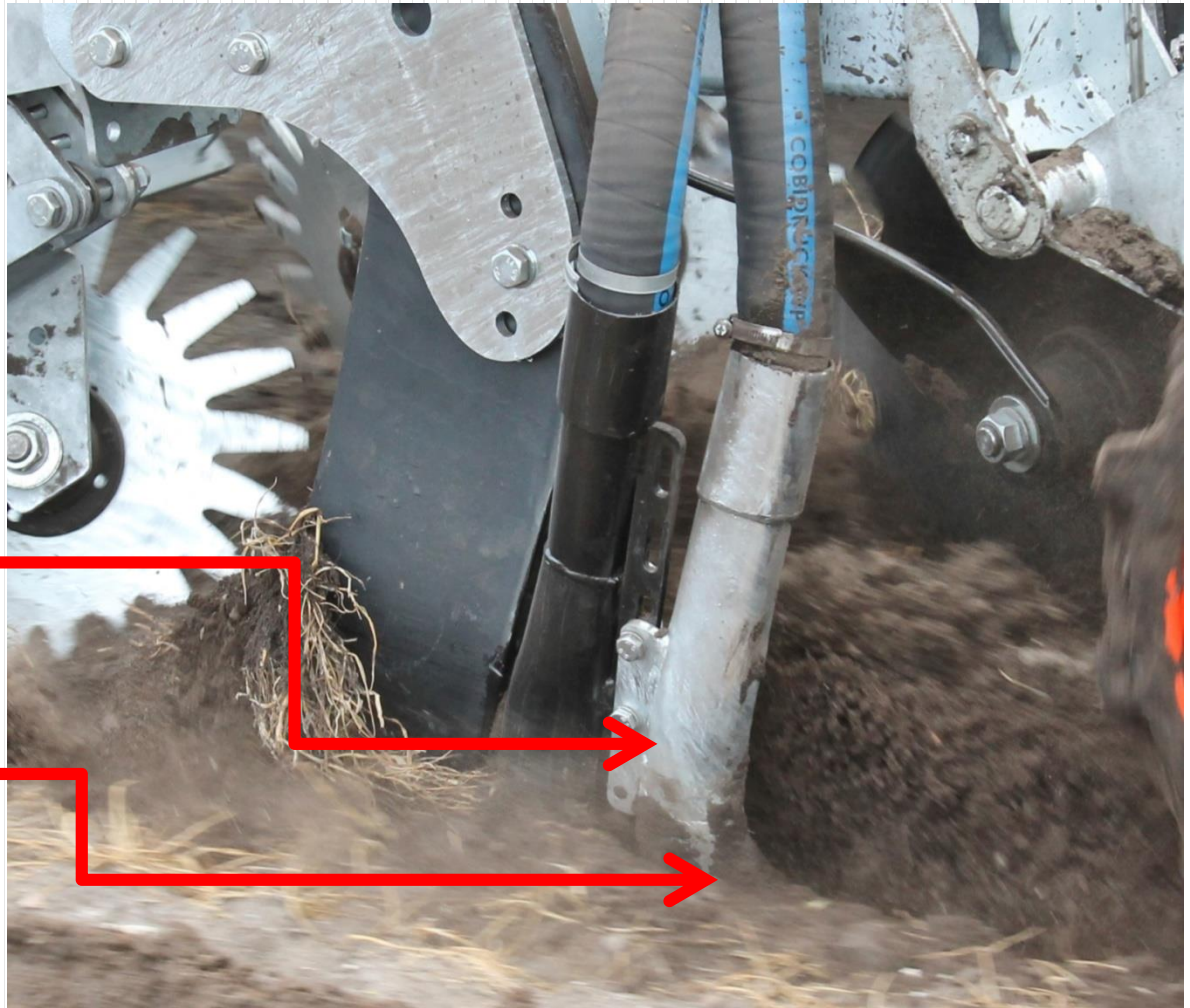


Parabelschar

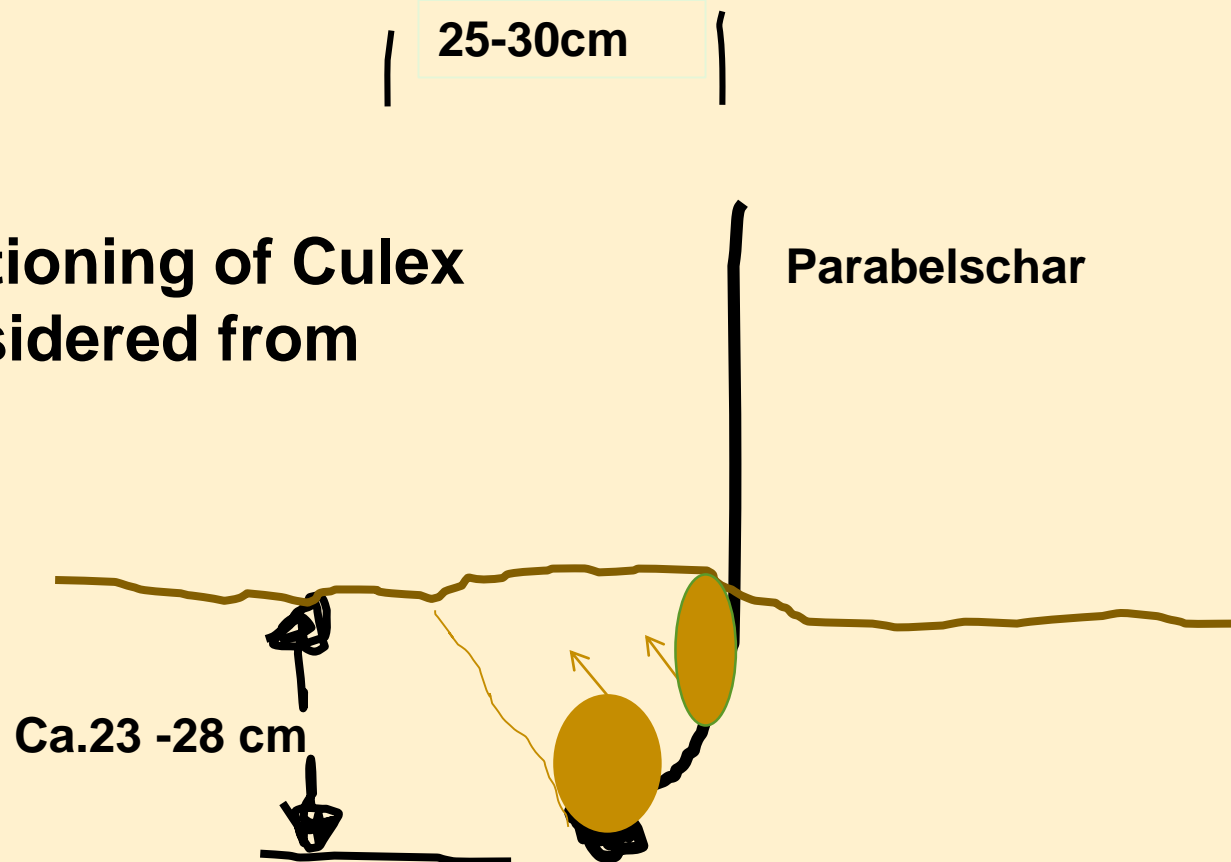


**rear, upper
manure pipe**

90° arc



functioning of Culex Considered from

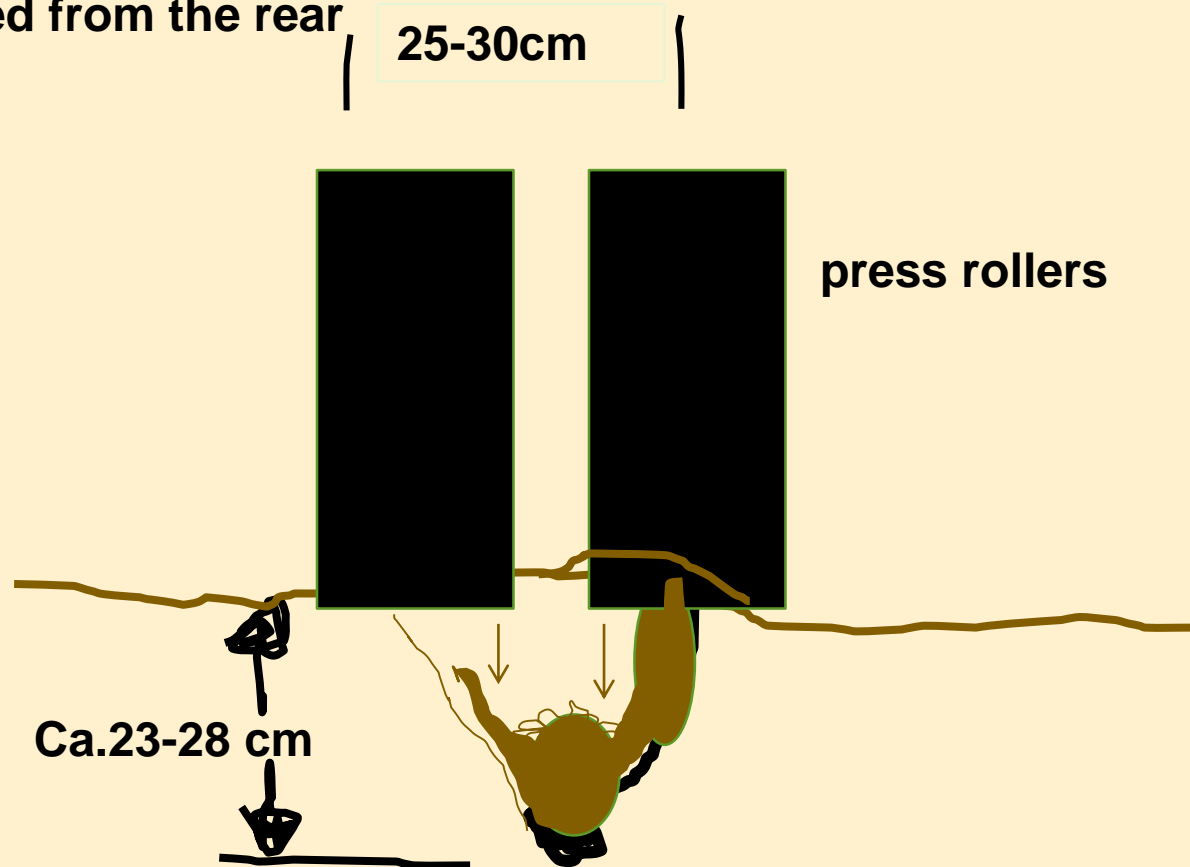




rear upper manure dispenses manure
towards the rear when the soil ridges closes

**deliberate pressing of the
Earth into manure**

Functioning Culex considered from the rear



motivation and
objective

strip till and
fertilizer-root

under-root vs.
underfloor.

function Culex

advantages

observation

practice tips



motivation and
objective

strip till and
fertilizer-root

under-root vs.
underfloor.

function Culex

advantages

observation

practice tips



motivation and
objective

strip till and
fertilizer-root

under-root vs.
underfloor.

function Culex

advantages

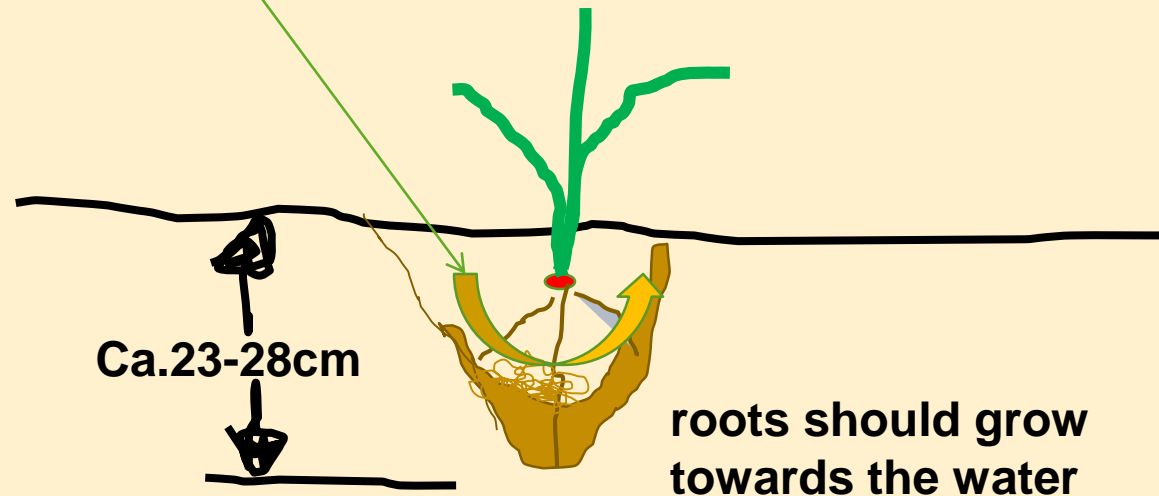
observation

practice tips



the lateral target „target window“ when drilling maize (corn) is pleasantly tolerant.

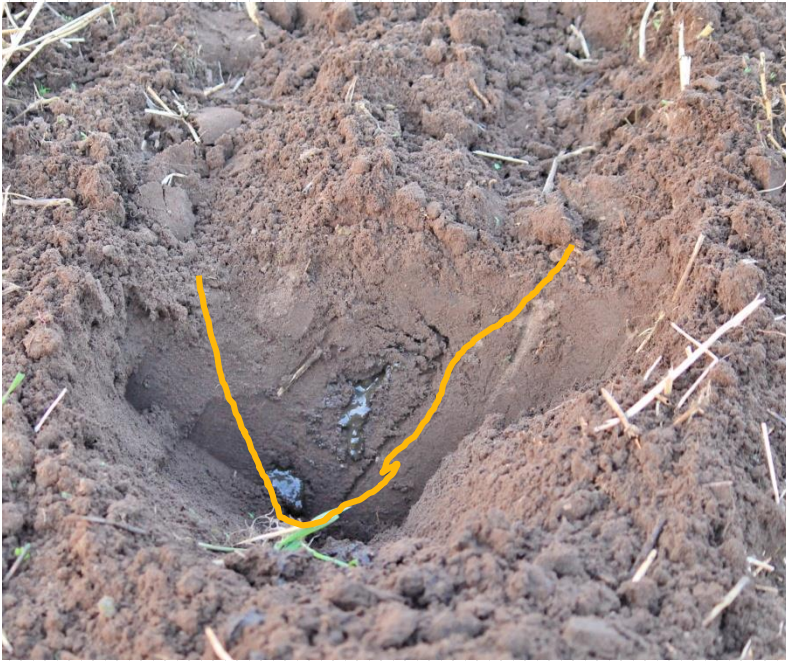
the distance from the maize (corn) to the manure-belt should be approx. 7cm



„mechanical“ advantages of the Volmer Culex-system

- Excellent loosening of the soil also in the ruts → extremely efficient against the flower pot effect.
- No “wet earth” will be hauled upwards.
- This system is also appropriate for slope positions as no "drainage canal" remains open.
- The injection slot will also be safely closed on heavy soil.
- The seed farrow and the slot for the filling of the liquid manure are situated one next to the other → lower risk of salt damages to the seedling.
- Directly after spreading of liquid manure, seeding can be started.
- Easier procedure as no bulldozer effect occurs.

strip till in Coesfeld with Culex and competition



Volmer Culex



competitor

- the 12 cm rule was adhered to with both appliances

„crop farming relevant “ advantages of the Volmer Culex-Systems

- Under-root and under-floor fertilization in one working cycle
- No abrupt transitions running parallel to the surface of the soil between loosened and not loosened soils (smear layers)
- Hardly any structural damage caused by „overwetting“ in the belt
- Good implementation of organically tied nutrients by mixing of liquid manure with the soil (soil bacteria)
- Good rooting of the whole area by attraction effect of the nutrients → less drought stress

strip till in Vreden after grass condition caused by competitor

attempt was started on 18.5.2015.

picture shot on 08.09.2015



- low root growth, flower pot effect

- hardly any implementation of solid elements of the Organic manure

strip till with Culex in Vreden after grass condition caused by competitor

attempt started on 18.5.2015.

picture shot on 08.09.2015



- Big root ball

- no solid elements of organic manure are visible in the strip till-belt

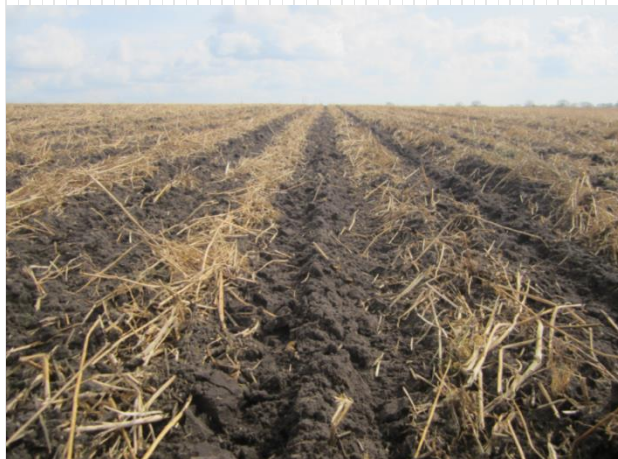
Use advantages under many conditions!!



Lush rye population in the State of Schleswig-Holstein



Volunteer grain with green fertilization



Too loose sandy soil

profiting from many conditions!!



ploughed (plowed)



Heavy soil with Culex-7-Reiher



after rye



Sod (turfgrass) 9-10 cm thick

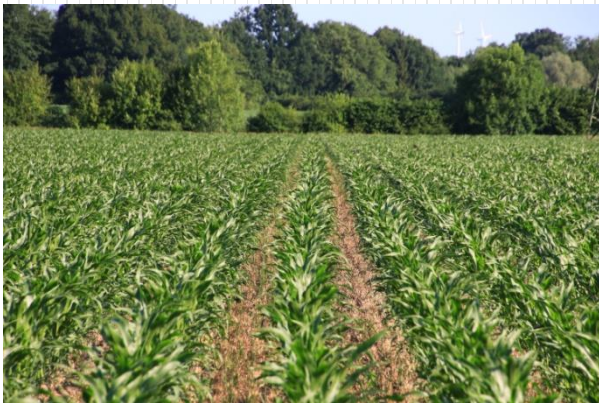
advantages with drought in 2017



strip till on 12.05.2017 near muenster



Population on 02.06.2017 near muenster



population on 21.06.2017 near muenster



soil profile 02.06.2017

Observation in the Culex Strip Till- maize (corn) populations during the years 2013, 2014, 2015, 2016, 2017.

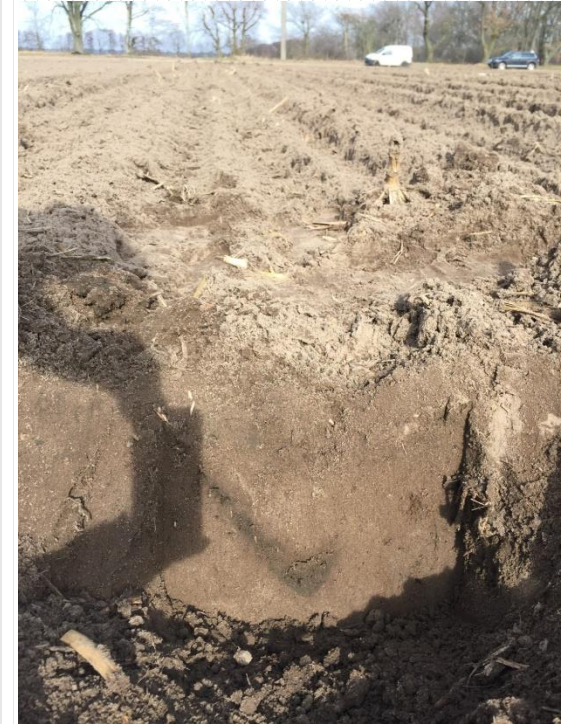
- Extremely good nutrient supply mid-July until end of August
- When digging up the maize (corn) roots by the end of August no solid elements of the organic fertilizer were no longer found.
- The closer to the seeding of maize (corn) the manure-belt will be applied, the better will be the effect in the summer

Maize (corn) „loves“ heat

Observations in the Culex Strip Till- maize (corn) population during the years 2013, 2014, 2015, 2016, 2017.



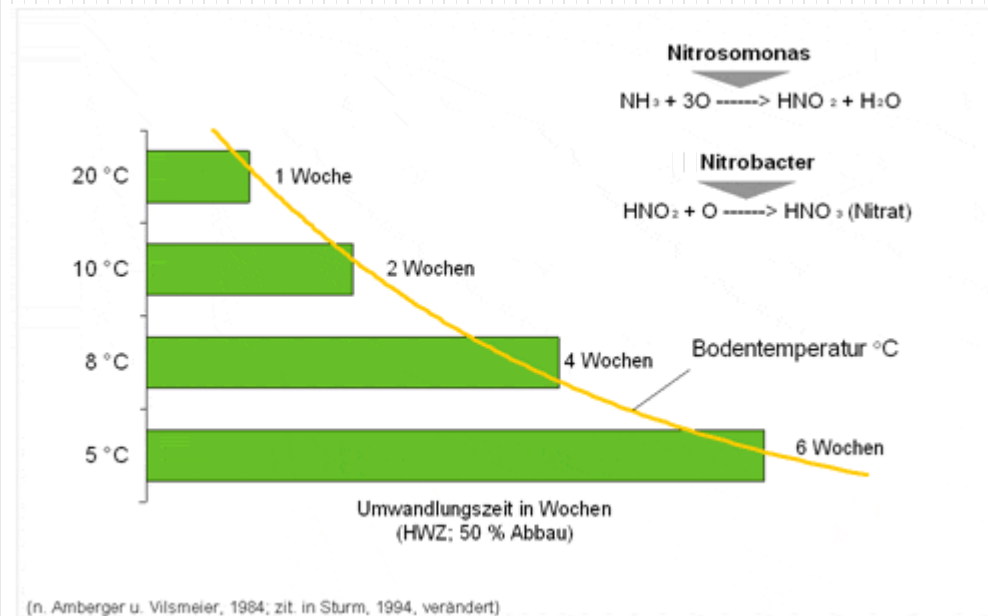
Directly “drawn through” from Strip Till to 25 cm – 30 cm.



Maize (corn) „loves“ heat

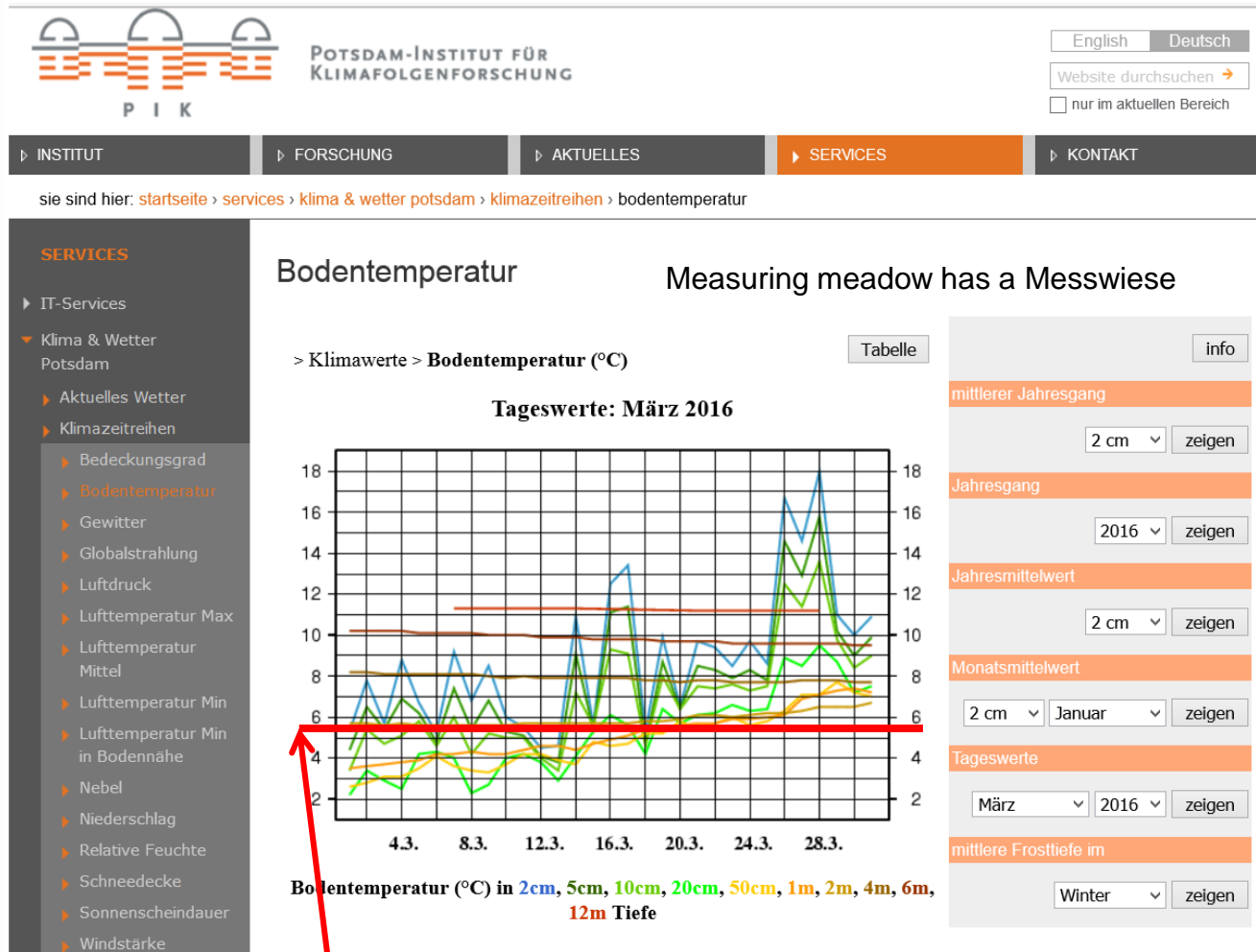
Soils with good gas exchange capacities heat up faster and promote the growth of roots.

Conversion of ammonium-N into Nitrat-N dependent on the temperature of the soil



- Conversion starts with + 5 degrees Celsius
- The effect will be postponed with nitrification inhibitor by eight to ten weeks

Conversion of ammonium -N to nitrate N dependent on the temperature of the soil

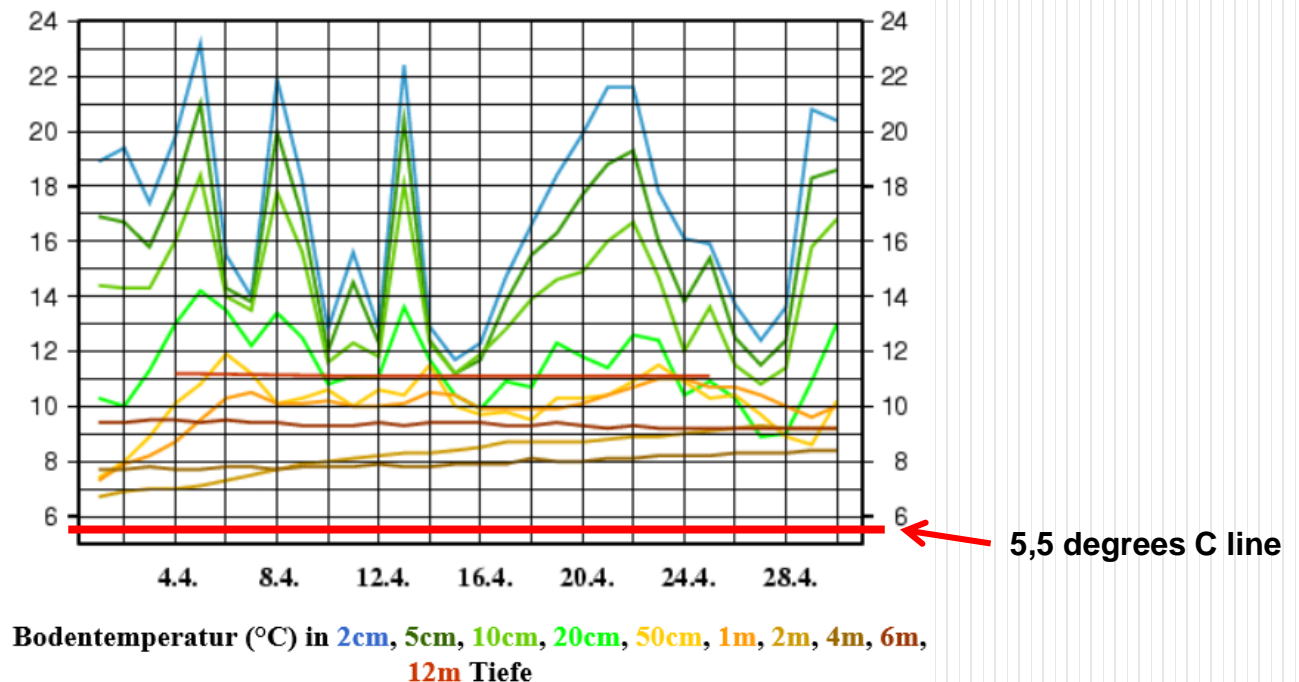


conversion of ammonium-N into nitrat N dependent on the temperature of the soil

> Klimawerte > Bodentemperatur (°C)

Tabelle

Tageswerte: April 2016



- in 25 cm soil depth it is in March and April approx. 4 degrees colder than in 15 cm soil depth

Observation in the Culex Strip Till maize (corn) populations in the years 2013, 2014, 2015, 2016, 2017

- excellent subsequent delivery from mid-July to the end of August.
- when digging up the maize (corn) roots by the end of August, solid elements of organaic fertilizers are no longer found.
- **The closer to the maize (corn) seed the liquid manure-belt is applied, the better seems to be its effect in the summer.**

Posing of a question in general?

- How much influence does the „ground deposition“ exert between the application of the liquid manure-belt and the maize (corn) seed (exchange of gas)?
- Is „time wasted “ (nutrients until the end of August), if the liquid manure-belt is positioned too early and too flat?

Influence the track systems exert on the maize (corn) yields with conventionnel cultivation of maize (corn).



For the „small tires it constitutes a very high weight if the drill is in division of labor.

Influence track systems exert on the maize (corn) yields with conventionnel cultivation of maize (corn).

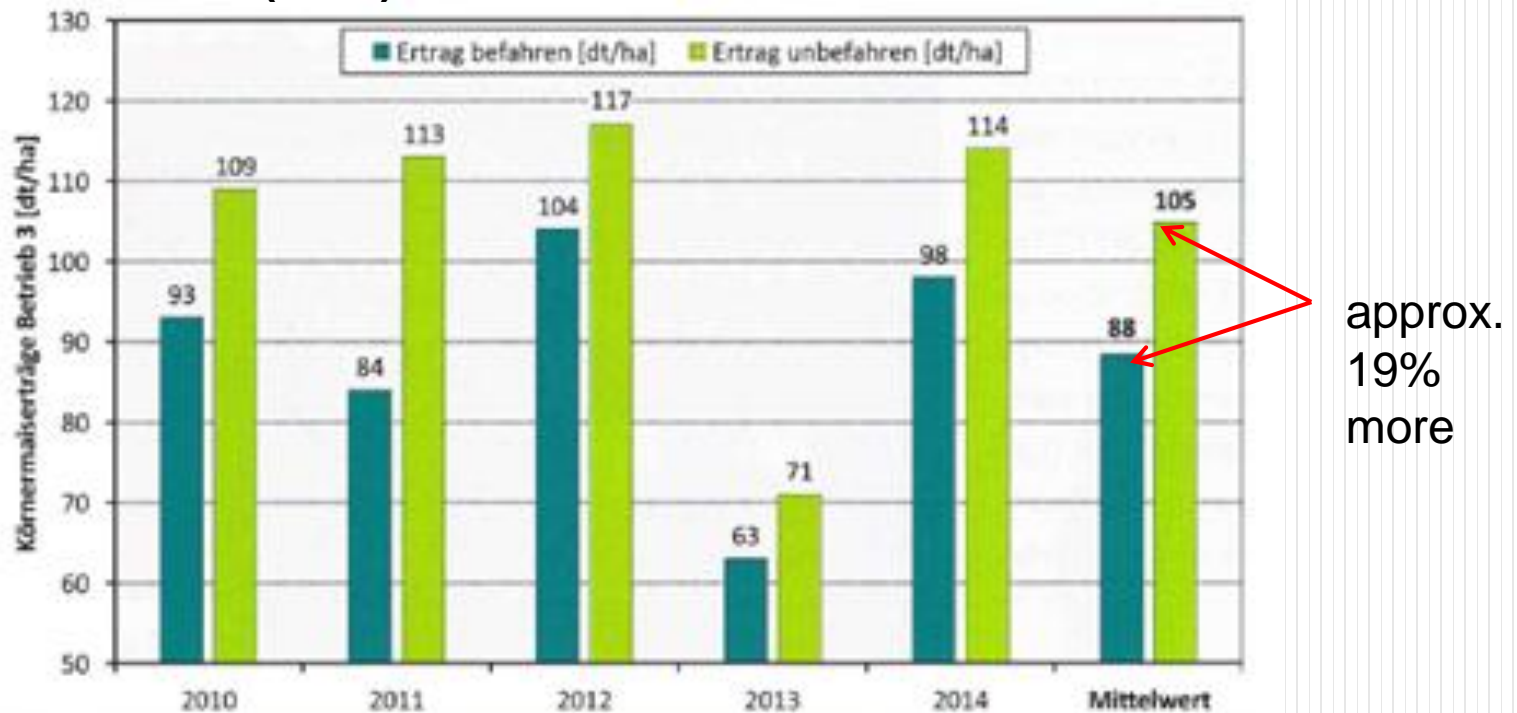


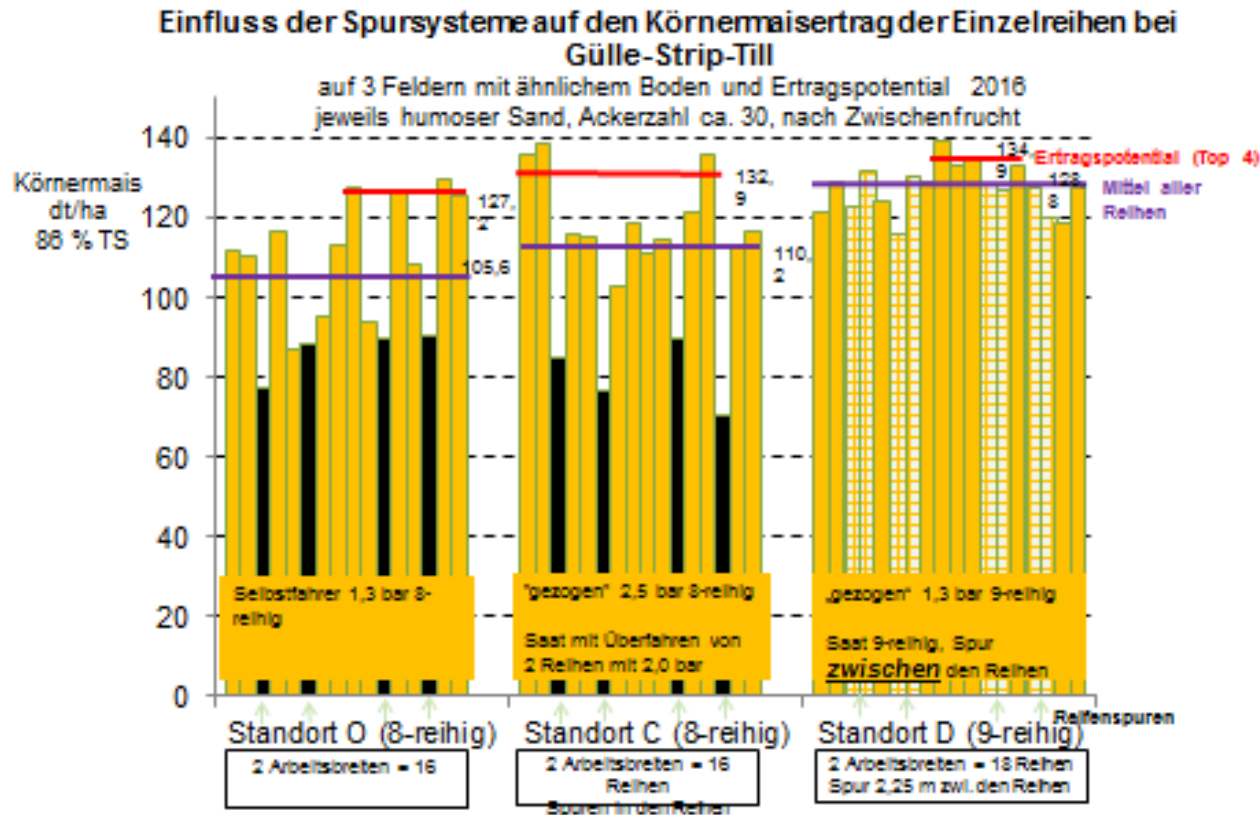
Abb. 7: Körnermaiserträge, befahren – unbefahren, Betrieb 3.

no strip till

M.Demmel et al. 2016 (LOP 11/2016)

If no maize (corn) rows would be cruised (traversed) by agricultural vehicles, this means additional yields of up to 4.5 %.

Influence track systems exert on the maize (corn) yields with conventional cultivation of maize (corn).



Stefan Schulte-Übbling, WRRL-Berater Betreuung Modellbetriebe

Movable frame for maize (corn) drilling and other appliances



- tractor track 2250 mm

It must not always be a liquid manure container!

- a small „grommet (sleeve)“ on the manure-barrel of the customer and he will be able to drive close to the spreader barrel thanks to his big tyres – this increases performance significantly



- a small walkie-talkie is sufficient to discuss the transition point.
- Smaller distances up to 3 km can be bridged with two feeders in such a way.

Involuntary window for fertilization

38 cbm porker (hog) manure without under-root-fertilization



- Never „draw through (traverse) up to the end if the barrel is empty!!
- Please pay attention before use that the required manure quantity is due.
- The maize (corn) drill always follows the liquid manure-belt!!
(notwithstanding what the GPS – Signal indicates)

In spite of the under-root fertilizer, you recognize the effect of the liquid manure-belt.



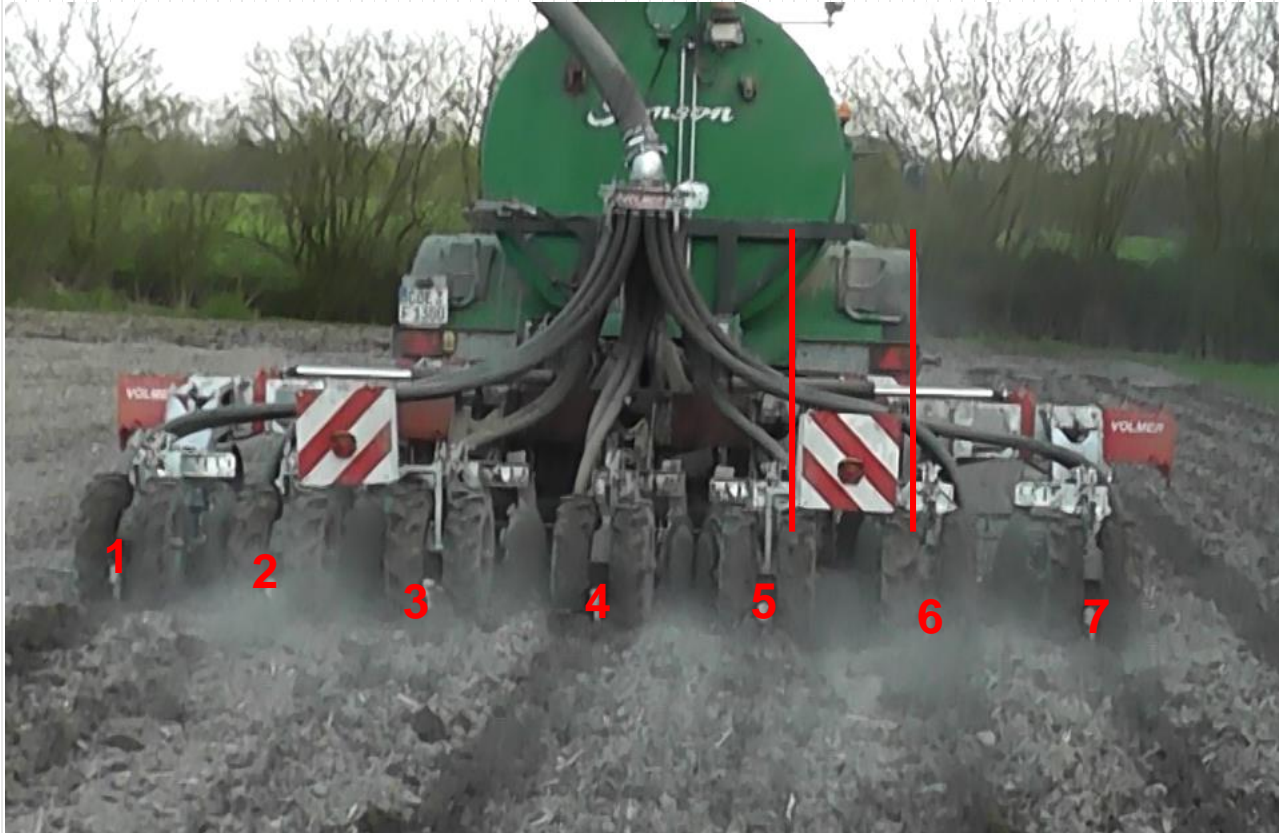
-The maize (corn) drill should feature half or the identical row number as the appliance which positions the liquid manure-belt.

Strip Till on clayey soil in the year 2016

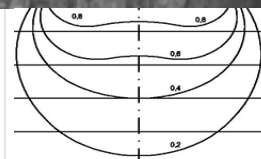
- Preceding crop CCM maize (corn)
- After harvest of 2015 a drive over with Mulcher
- In spring 2016 loosening to approx. 25 cm with subsoiler in combination with a flatly-adjusted circular harrow
- After sowing (seeding) a drive over with Cambridge roller.



influence track systems exert on the maize (corn) yields



- 7- or
9-rows!



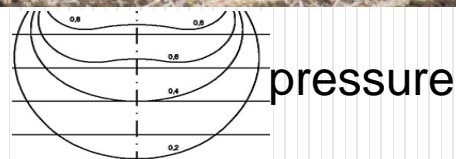
pressure

- Insufficient fine soil exists on the **extremely heavy soils** in spite of loosening by the tine.

influence the track systems exert on the maize (corn) yields



- applicance shifted by 37.5 cm!



- Insufficient fine soil exists on **extremely heavy soils** in spite of loosening up by tines in the ruts (lanes).

strip till on clayey soil in the year 2016



Seeding on 21.04.2016

strip till on clayey soil in the year 2016



strip till on clayey soil in the year 2016



strip till on clayey soil in the year 2016



strip till on clayey soil in the year 2016



strip till on clayey soil in the year 2016



strip till on clayey soil in the year 2016



strip till on clayey soil in the year 2016



strip till on clayey soil in the year 2016



Population on 4.06.2016 (without mineral UFD)

strip till on clayey soil in the year 2016

Please pre-arrange correspondingly in autumn (fall) of the preceding year!

- The soil structure should not be „too solid" in spring.
- A certain proportion of fine soil will facilitate Strip Till (frost action)
- Please avoid shallow root fruits, for ex. grass (fine soil could be lacking)
- Volmer Culex functions also after levelled winter furrow!

potatoes

According to the experiential report of Bernhard Lübbers (LU) → highly recommended

Approach:

- Use of plough (plow) with packer in the spring
- Adjustment of the Parabelschares to a depth of 30 cm
- Distance between the soil surface and the liquid manure upper edge approx. 1820 cm
- 30 cbm liquid manure/ha mixed in with nitrification inhibitor
- Wait two days 2 (as the planting tractor equipped with small tyres encountered difficulties to stay on the “solid bank (embankment))
- Planting machine with efficient emission block and embankment.
- „Populations were always ahead of experimental plots and looked better! “

conclusion:

All advantages which can apply for the cultivation of maize (corn) is seemingly transferrable to potato growing.

motivation
and objective

strip till and
fertilizer-root

under-root vs.
underfloor.

function Culex

advantages

observation

practice tips



Thank you very much for your attention