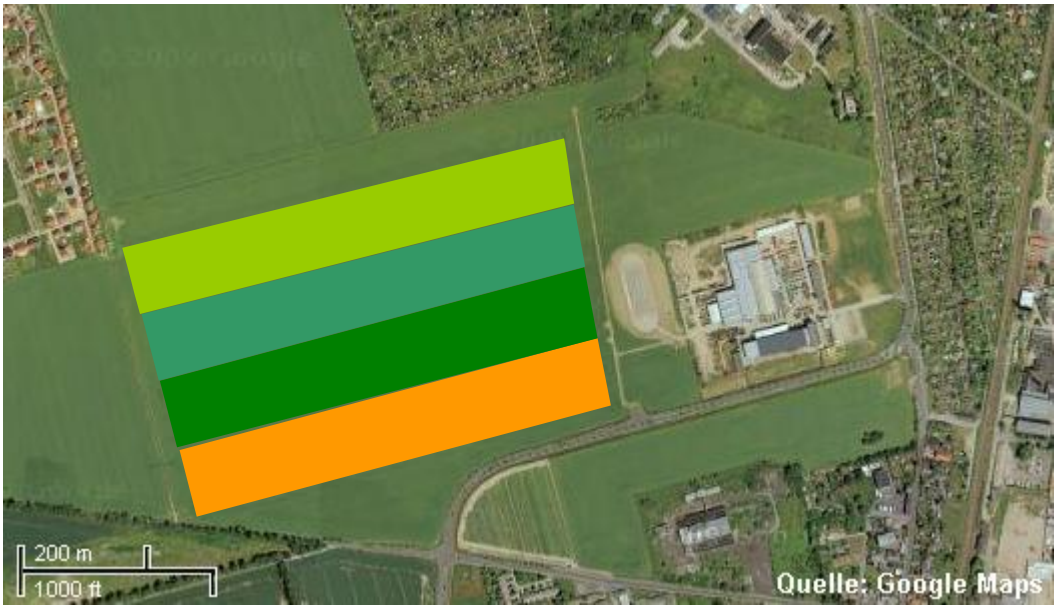
Intelligent crop production

Active Farming

3C – the crop establishment concept

Leipzig trials site



Overview of the results
System techniques
Details
Fuel consumption
Statistical analysis

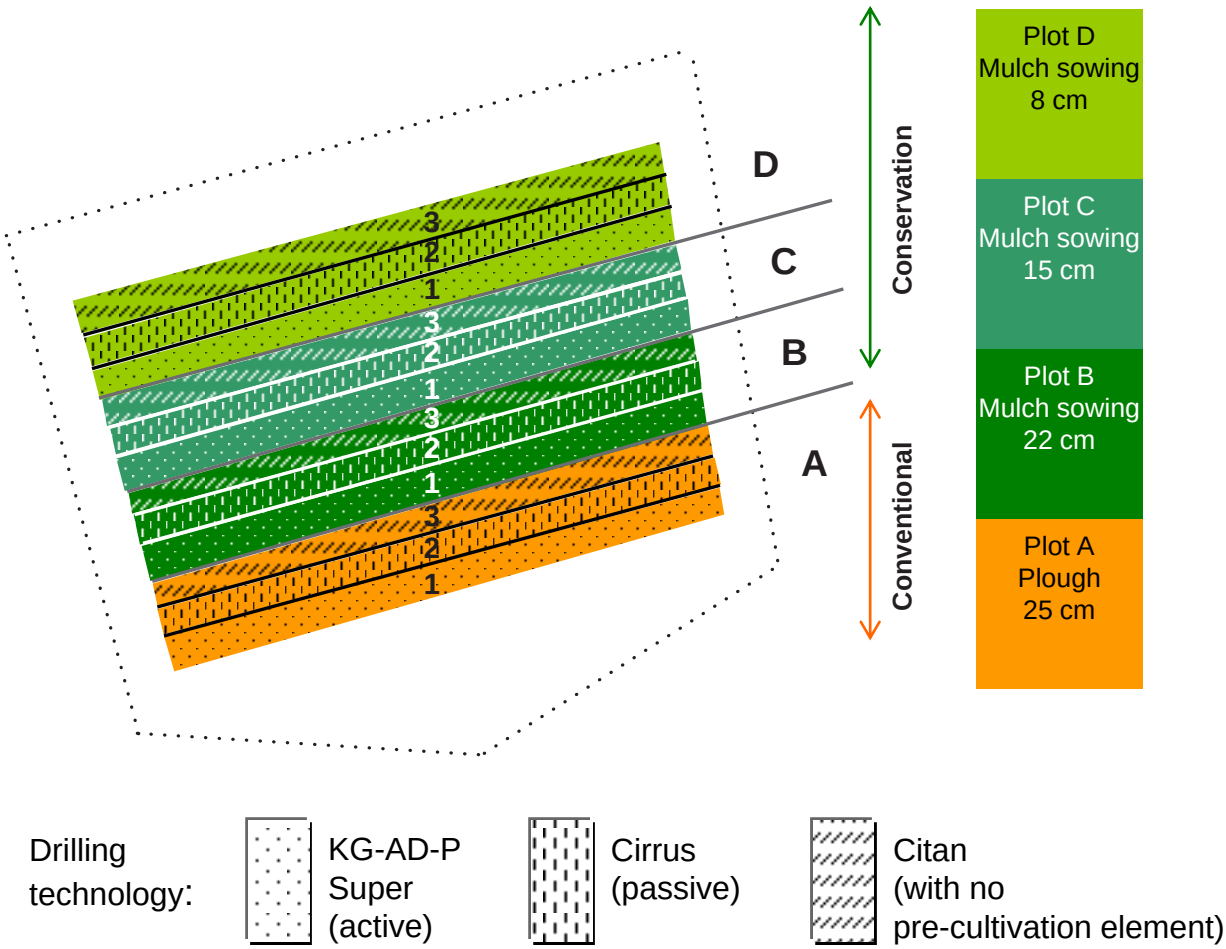
AMAZONE

Overview of the results: Leipzig trial site (Molkerei field)

Aim of the trials:

What plant improvements and economic potential do different arable farming procedures offer in regions with a distinct tendency to pre-summer drought?

Trials structure:



Drilling technology:

KG-AD-P Super (active)

Cirrus (passive)

Citan (with no pre-cultivation element)

The trials layout comprises of differing arable farming procedures with varying levels of intensity.

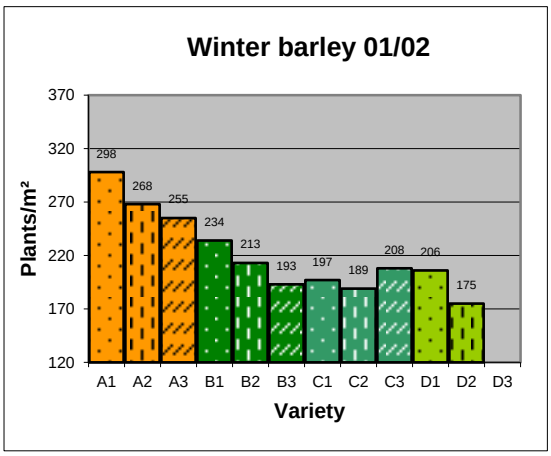
Whilst in plot A, for the basic soil tillage, the plough is used, in plots B, C & D conservation tillage is carried out using a tine & disc combination cultivator or a compact disc harrow.

Initially, a stubble cultivation is carried out over all the plots with a compact disc harrow. Plot A is ploughed at a depth of 25 cm and then reconsolidated afterwards with a pass form the compact disc harrow. In the min-till plots B and C, the soil tillage is carried out with a multi-row mulch cultivator at a depth of 22 cm and at 15 cm respectively. Plot D is worked again with the compact disc harrow at a depth of 8 cm.

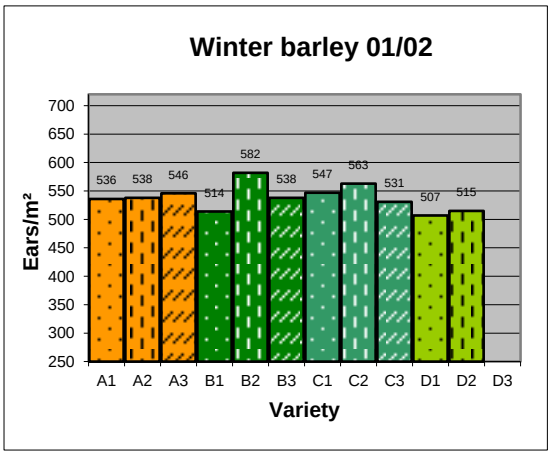
The different levels of intensity are also followed during drilling. In plots A1, B1, C1 and D1, an active seed drill combination is used, whereas in Plots A2, B2, C2 and D2, a passive seed drill is used and in A3, B3, C3 and D3, a solo drill with no pre-cultivation element is used.

Trials results 01/02:

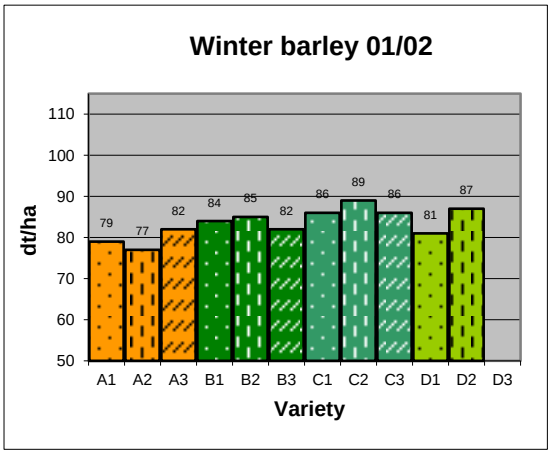
Plant emergence



Crop density

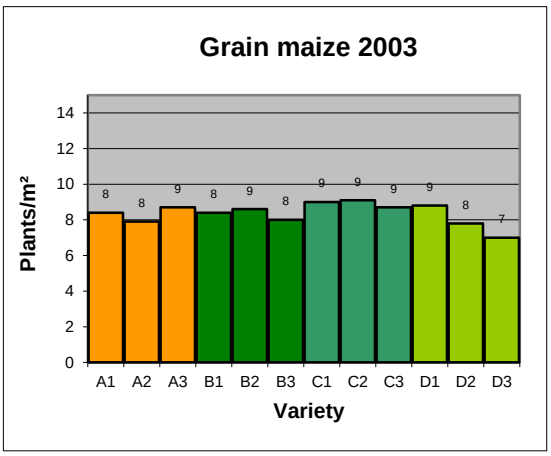


Yield



Trials results 2003:

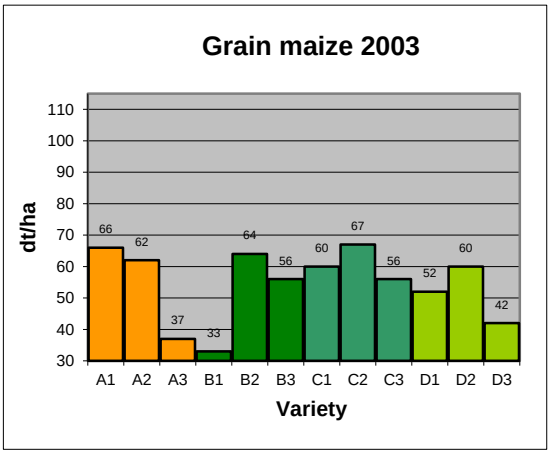
Plant emergence



Crop density

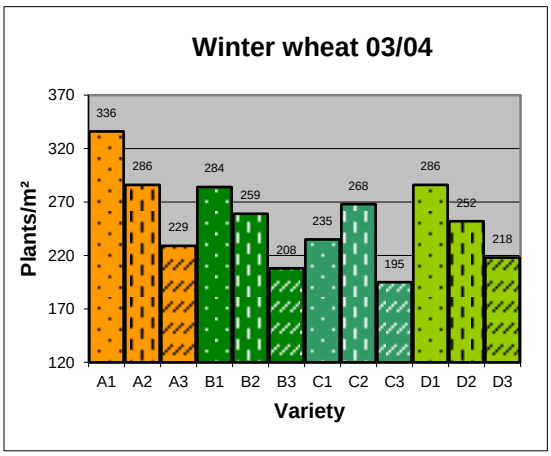
Data not collected
in this trials year!

Yield

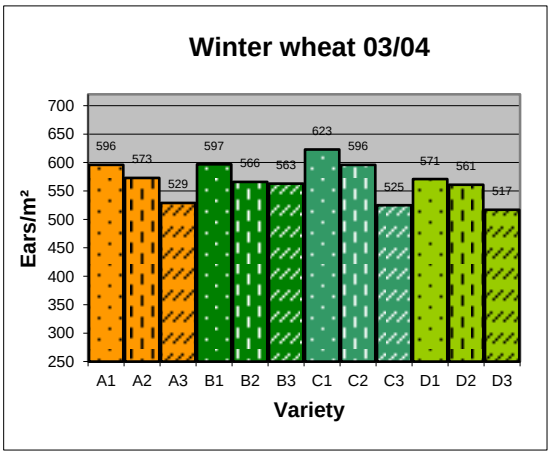


Trials results 03/04:

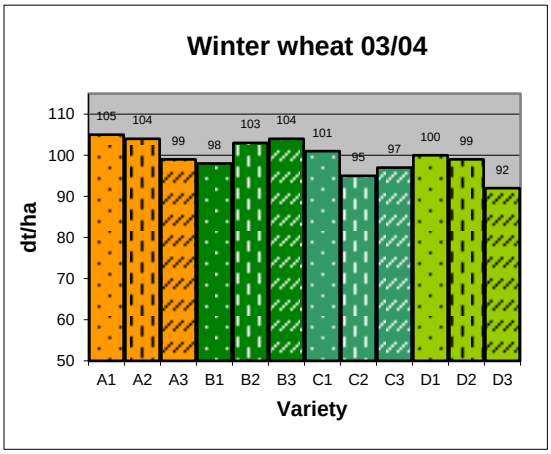
Plant emergence



Crop density

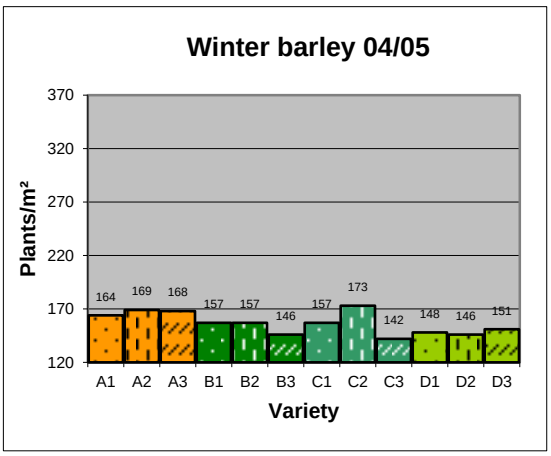


Yield

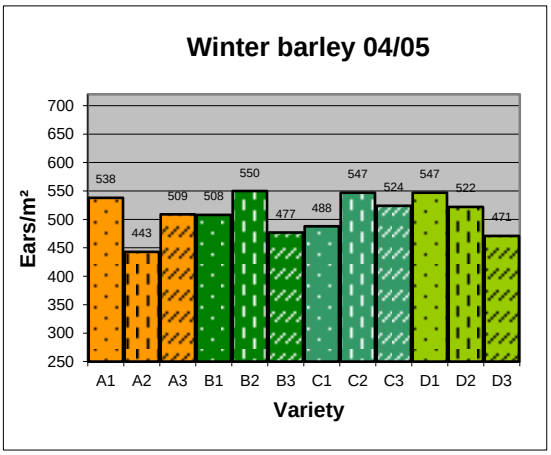


Trials results 04/05:

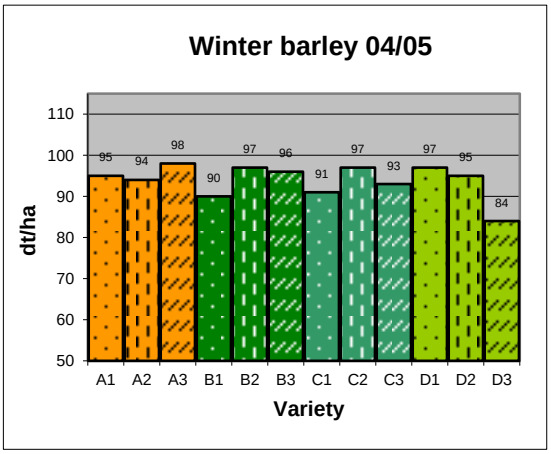
Plant emergence



Crop density

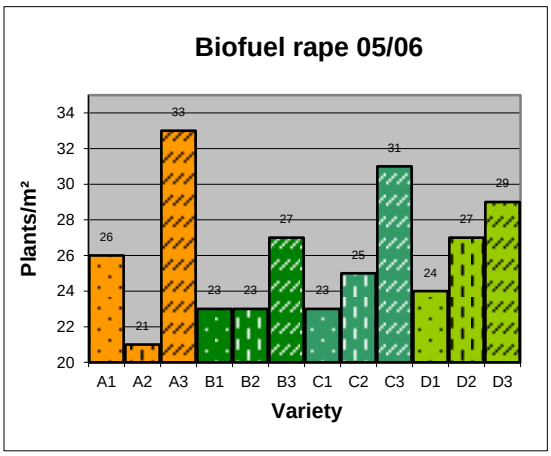


Yield



Trials results 05/06:

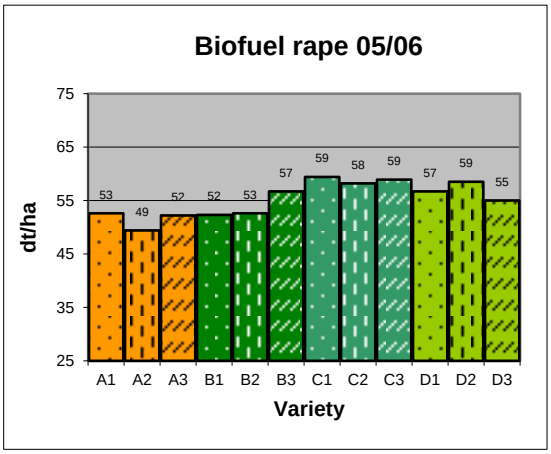
Plant emergence



Crop density

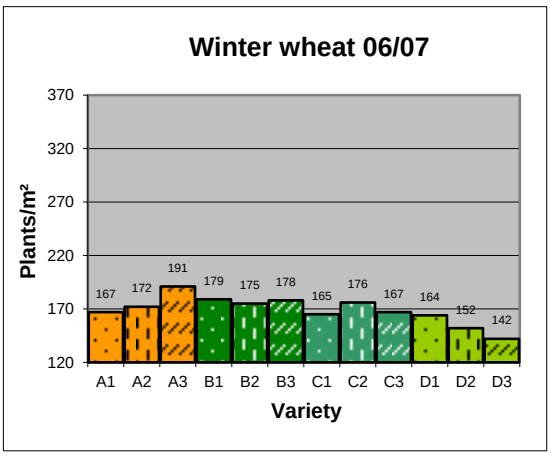
Data not collected in this trials year!

Yield

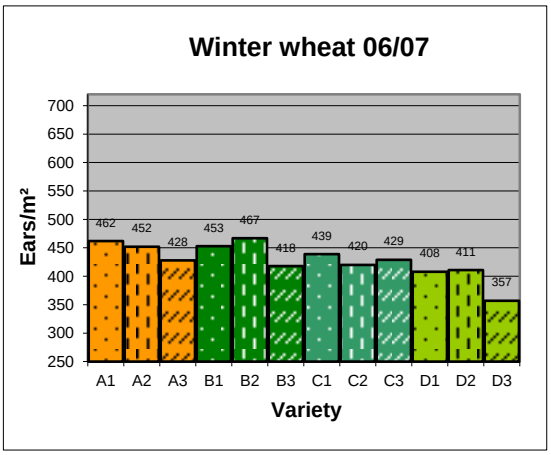


Trials results 06/07:

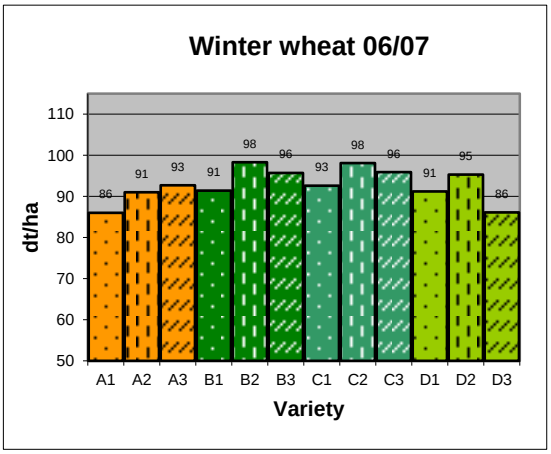
Plant emergence



Crop density

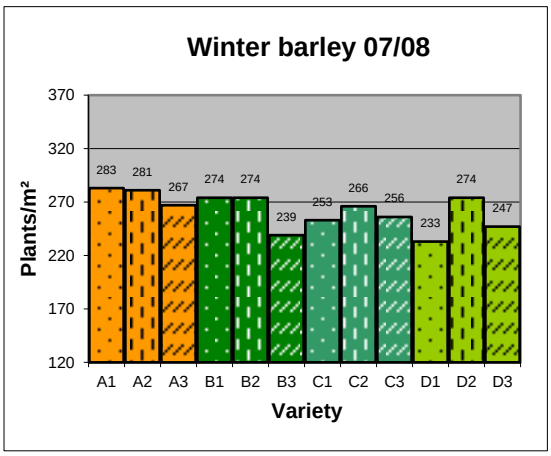


Yield

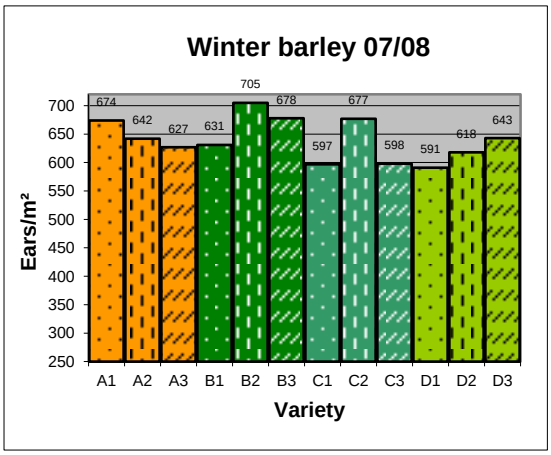


Trials results 07/08:

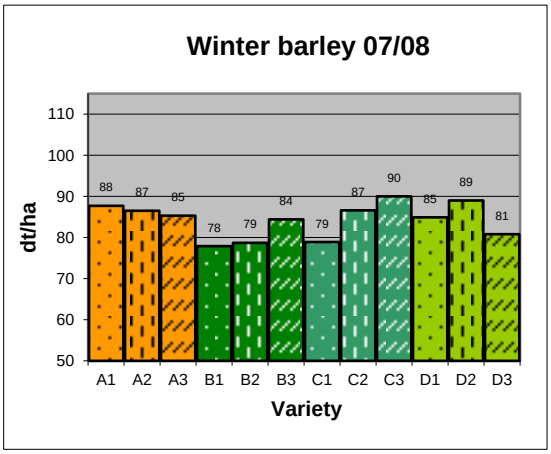
Plant emergence



Crop density

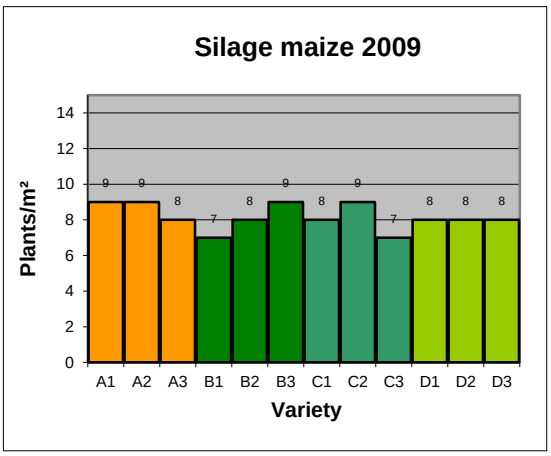


Yield



Trials results 2009:

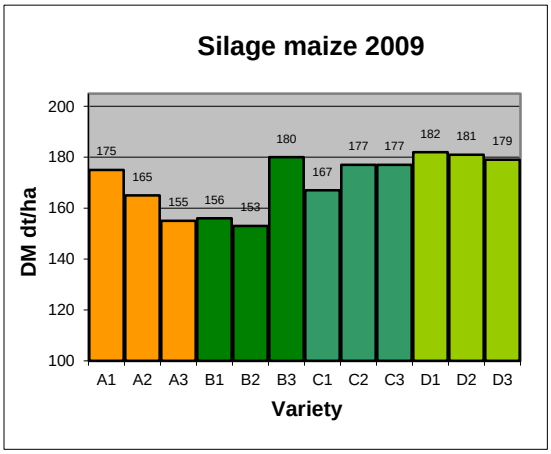
Plant emergence



Crop density

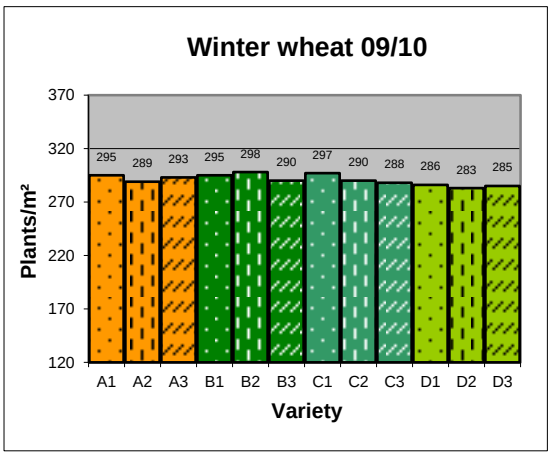
Data not collected
in this trials year!

Yield

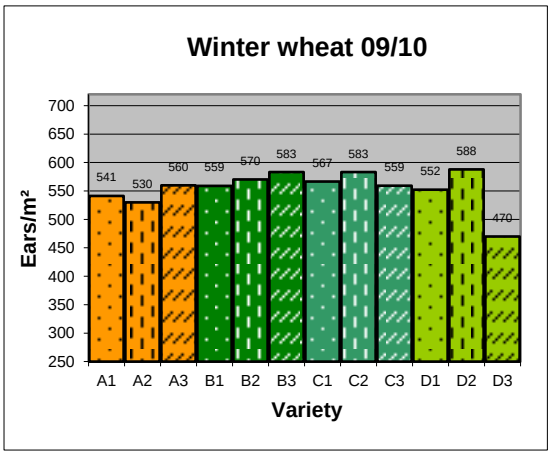


Trials results 09/10:

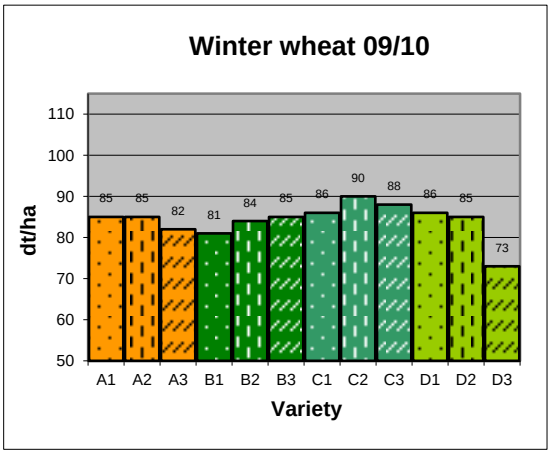
Plant emergence



Crop density

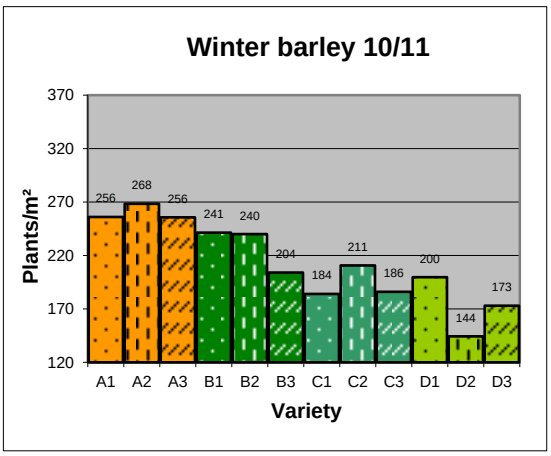


Yield

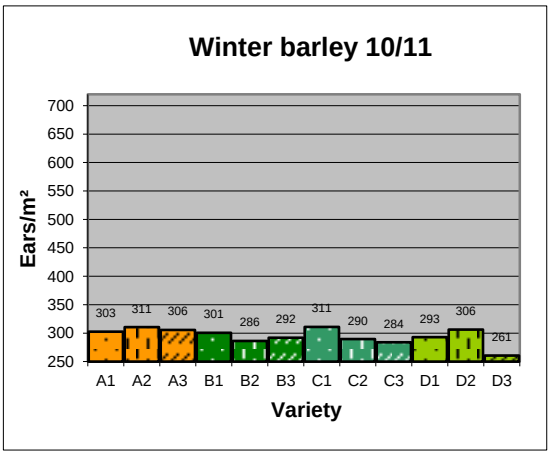


Trials results 10/11:

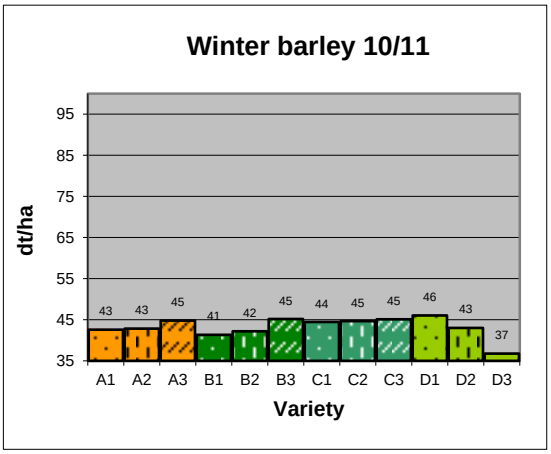
Plant emergence



Crop density



Yield



System techniques: Leipzig trials site (Molkerei field)

Trial plots for tillage, seedbed preparation and sowing

	Plot A Plough 25 cm			Plot B Mulch sowing 22 cm			Plot C Mulch sowing 15 cm			Plot D Mulch sowing 8 cm		
	Plot A1	Plot A2	Plot A3	Plot B1	Plot B2	Plot B3	Plot C1	Plot C2	Plot C3	Plot D1	Plot D2	Plot D3
Mulching after maize	Flail mulching machine											
Stubble working	Catros, working depth 6 cm											
Tillage	Plough 25 cm			Centaur 22 cm			Centaur 15 cm			Catros 8 cm		
	Catros											
Seedbed and seeding cereals, rape	KG - AD-P Super	Cirrus	Citan	KG - AD-P Super	Cirrus	Citan	KG - AD-P Super	Cirrus	Citan	KG - AD-P Super	Cirrus	Citan
Seed maize	EDX											

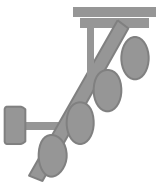
decreasing tillage intensity

Stubble cultivation

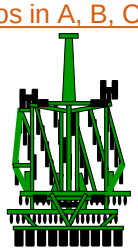
Catros in A, B, C & D

Mulched after maize in A, B, C & D

Soil tillage



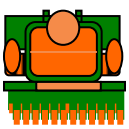
Plough in A



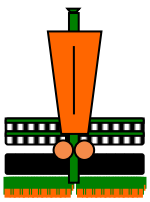
Centaur in B & C

Catros in D (and in A after the plough)

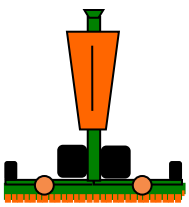
Sowing



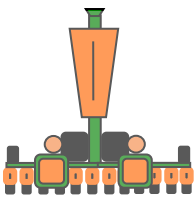
AD-P Super in A1, B1, C1 & D1



Cirrus in A2, B2, C2 & D2

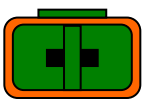


Citan in A3, B3, C3 & D3



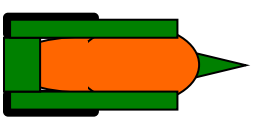
EDX for maize in A, B, C & D

Fertilisation



ZA-M Ultra in A, B, C & D

Crop protection



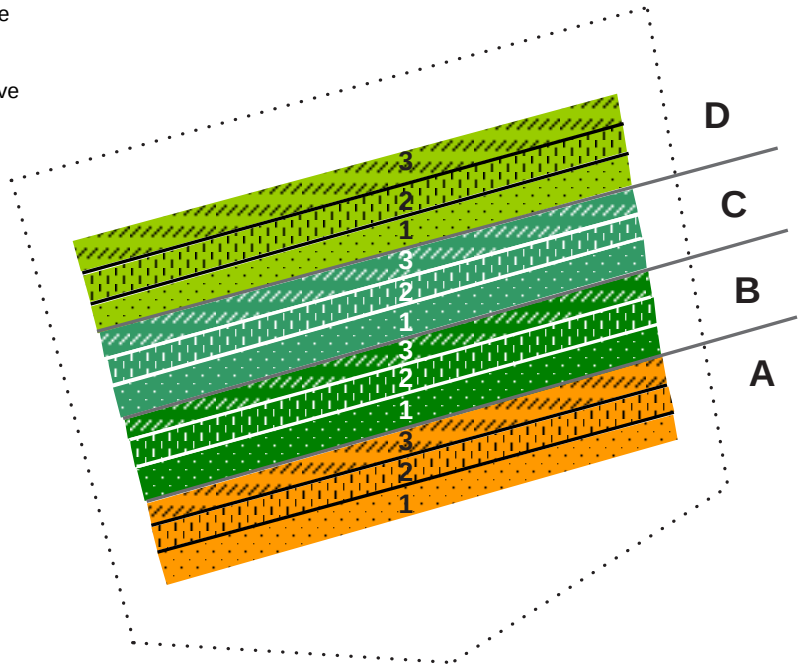
UX in A, B, C & D

AMAZONE trials at Molkerei in the Leipzig region (Saxony)

The Leipzig, in Saxony site is representative of arable farming on large acreages. A continental climate prevails – little rainfall and early summer drought are representative and here, water and climate are the yield limiting factors.

The trials site is situated on the farm of Agrarprodukte Kitzen e.G. near Leipzig. Out of a farm size of just over 3,000 hectares approximately 770 ha of trials are cultivated in co-operation with AMAZONE. On a total of 75 ha exact trials have been carried out now over the last 8 seasons since 2000 and evaluated by the Johann Heinrich von Thünen-Institut (vTI) Braunschweig (under Dr. Voßhenrich). With regard to crop protection and fertilisation all the plots are treated identically.

Layout of the 40 ha trials area on the farm Agrarprodukte Kitzen e.G. near Leipzig



Plot A is worked conventionally with the plough, whereas plots B, C and D follow a min-till conservation tillage regime. In each case, the plots are sown with 3 varieties.

Site data	
Soil	Clay sand, part-brown soils, humus share 3.1 %
Climate	Annual rainfall: 530 mm Average temperature: 8.6°C
Crop rotation	Winter wheat, winter barley, maize, winter wheat, winter barley, winter rape
Tramline width	36 m

Trial results in an overview:

On the site characterised by a continental climate equal yields are achieved on the mulch sowing plots and on the conventional plots.

Working depth is round about 15 cm, which has been matched to the soil conditions and preserves the ground water supply in the crumb and results in the highest yields.

At the same time, the reduction in the working intensity results in a clear reduction in the operational costs.

Trial plots for tillage, seedbed preparation and sowing

	Plot A Plough 25 cm			Plot B Mulch sowing 22 cm			Plot C Mulch sowing 15 cm			Plot D Mulch sowing 8 cm		
	Plot A1	Plot A2	Plot A3	Plot B1	Plot B2	Plot B3	Plot C1	Plot C2	Plot C3	Plot D1	Plot D2	Plot D3
Mulching after maize	Flail mulching machine											
Stubble working	Catros, working depth 6 cm											
Tillage	Plough 25 cm Catros			Centaur 22 cm			Centaur 15 cm			Catros 8 cm		
Seedbed and seeding cereals, rape	KG - AD-P Super	Cirrus	Citan	KG - AD-P Super	Cirrus	Citan	KG - AD-P Super	Cirrus	Citan	KG - AD-P Super	Cirrus	Citan
Seed maize	EDX											

decreasing tillage intensity

Yield results (dt/ha) in comparison

	Plot A Plough 25 cm			Plot B Mulch sowing 22 cm			Plot C Mulch sowing 15 cm			Plot D Mulch sowing 8 cm		
	Plot A1	Plot A2	Plot A3	Plot B1	Plot B2	Plot B3	Plot C1	Plot C2	Plot C3	Plot D1	Plot D2	Plot D3
Winter barley 01/02												
Seed rate seeds/m²	350 (variety Candesse)											
Seedling emergence (plants/m²)	298	268	255	234	213	193	197	189	208	206	175	
Crop density (ears/m²)	536	538	546	514	582	538	547	563	531	507	515	
Yield dt/ha	**79**	**77**	**82**	**84**	**85**	**82**	**86**	**89**	**86**	**81**	**87**	
Grain maize 2003												
Seed rate seeds/ha	100,000 (variety Lukas)											
Seedling emergence (plants/m²)	8	8	9	8	9	8	9	9	9	9	8	7
Yield dt/ha	**66**	**62**	**37**	**33**	**64**	**56**	**60**	**67**	**56**	**52**	**60**	**42**
Winter wheat 03/04												
Seed rate seeds/m²	380 (variety Sokrates)											
Seedling emergence (plants/m²)	336	286	229	284	259	208	235	268	195	286	252	218
Crop density (ears/m²)	596	573	529	597	566	563	623	596	525	571	561	517
Yield dt/ha	**105**	**104**	**99**	**98**	**103**	**104**	**101**	**95**	**97**	**100**	**99**	**92**
Winter barley 04/05												
Seed rate seeds/m²	250 (variety Merlot)											
Seedling emergence (plants/m²)	164	169	168	157	157	146	157	173	142	148	146	151
Crop density (ears/m²)	538	443	509	508	550	477	488	547	524	547	522	471
Yield dt/ha	**95**	**94**	**98**	**90**	**97**	**96**	**91**	**97**	**93**	**97**	**95**	**84**
Biofuel rape 05/06												
Seed rate seeds/m²	38 (variety Titan)											
Seedling emergence (plants/m²)	26	21	33	23	23	27	23	25	31	24	27	29
Yield dt/ha	**53**	**49**	**52**	**52**	**53**	**57**	**59**	**58**	**59**	**57**	**59**	**55**
Winter wheat 06/07												
Seed rate seeds/m²	235 (variety Tommi)											
Seedling emergence (plants/m²)	167	172	191	179	175	178	165	176	167	164	152	142
Crop density (ears/m²)	462	452	428	453	467	418	439	420	429	408	411	357
Yield dt/ha	**86**	**91**	**93**	**91**	**98**	**96**	**93**	**98**	**96**	**91**	**95**	**86**
Winter barley 07/08												
Seed rate seeds/m²	320 (variety Naomi)											
Seedling emergence (plants/m²)	283	281	267	274	274	239	253	266	256	233	274	247
Crop density (ears/m²)	674	642	627	631	705	678	597	677	598	591	618	643
Yield dt/ha	**88**	**87**	**85**	**78**	**79**	**84**	**79**	**87**	**90**	**85**	**89**	**81**

Silage maize 2009												
Seed rate seeds/ha	90,000 (variety Sensation)											
Seedling emergence (plants/m²)	9	9	8	7	8	9	8	9	7	8	8	8
Yield DM dt/ha	**175**	**165**	**155**	**156**	**153**	**180**	**167**	**177**	**177**	**182**	**181**	**179**
Winter wheat 09/10												
Seed rate seeds/m²	340 (variety Akteur)											
Seedling emergence (plants/m²)	295	289	293	295	298	290	297	290	288	286	283	285
Crop density (ears/m²)	541	530	560	559	570	583	567	583	559	552	588	470
Yield dt/ha	**85**	**85**	**82**	**81**	**84**	**85**	**86**	**90**	**88**	**86**	**85**	**73**
Winter barley 10/11												
Seed rate seeds/m²	316 (variety Highlight)											
Seedling emergence (plants/m²)	256	268	256	241	240	204	184	211	186	200	144	173
Crop density (ears/m²)	303	311	306	301	286	292	311	290	284	293	306	261
Yield dt/ha	**57**	**57**	**60**	**55**	**56**	**60**	**59**	**60**	**60**	**61**	**57**	**49**

The yield results were determined in co-operation with PD Dr. Voßhenrich from vTI Braunschweig

Comment to the trials results in Leipzig

by Dr. Sven Dutzi, AMAZONEN-WERKE

The crop rotation related long-term trial at the site in Leipzig runs for the 10th year in 2011. As a result, the crop rotation typical for the farm has already been investigated once in the course of the trials.

The comparison between conventional and conservation tillage shows that at comparable tillage depths (plot A and B) plough tillage seemingly produces higher yields. But leaving the peculiarities of the extreme year 2003 on plot B1 (22 cm mulch sowing) out of the equation the yields are at a comparable level.

Reduction of the tillage depth in Plot C (15 cm working depth) results in an increase of the annual average yield. Depending on the crop rotation element additional yields of up to 10 % are achieved. This is due to the increased water availability which influences growth mainly in years with severe pre-summer droughts.

Reduction of the tillage depth to 8 cm (block D) produces yields at the level of conventional tillage. Despite tillage depth being reduced by 60 % the yield level can keep up with that of plough tillage at significantly reduced labour costs. Compared with Plot C, however, the yield level is slightly lower because the water availability is impaired by the negative effect of an increased straw concentration in the surface layer.

In summary: the yields are influenced mainly by the primary tillage system used, not by the sowing technology. Hence tillage method and depth are the decisive factors.

In addition conservation tillage results in large saving potentials which are the result of targeted measurements concerning labour requirements and fuel consumption. You can find the references to these on the following pages.

Results regarding fuel consumption and working time (Leipzig/Saxony)

In view of continuously increasing fuel prices the potential savings offered by crop establishment systems are of particular interest. Therefore, in co-operation with the German Agricultural Association (DLG) comprehensive measurements have been carried out on the trial sites at BBG Leipzig in the years 2005 and 2006. The trials and the layout of the plots have already been described in connection with the yield results.

The investigations show that the different systems offer considerable fuel saving potentials. In instances of initial stubble cultivation no significant differences are shown regarding fuel consumption. The consumption data varies only slightly in the range from 3.6 to 3.9 l/ha. The values show, however, that the use of the Catros compact disc harrow, compared with the use of a standard cultivator, can result in saving potentials of 4 to 5 l Diesel/ha.

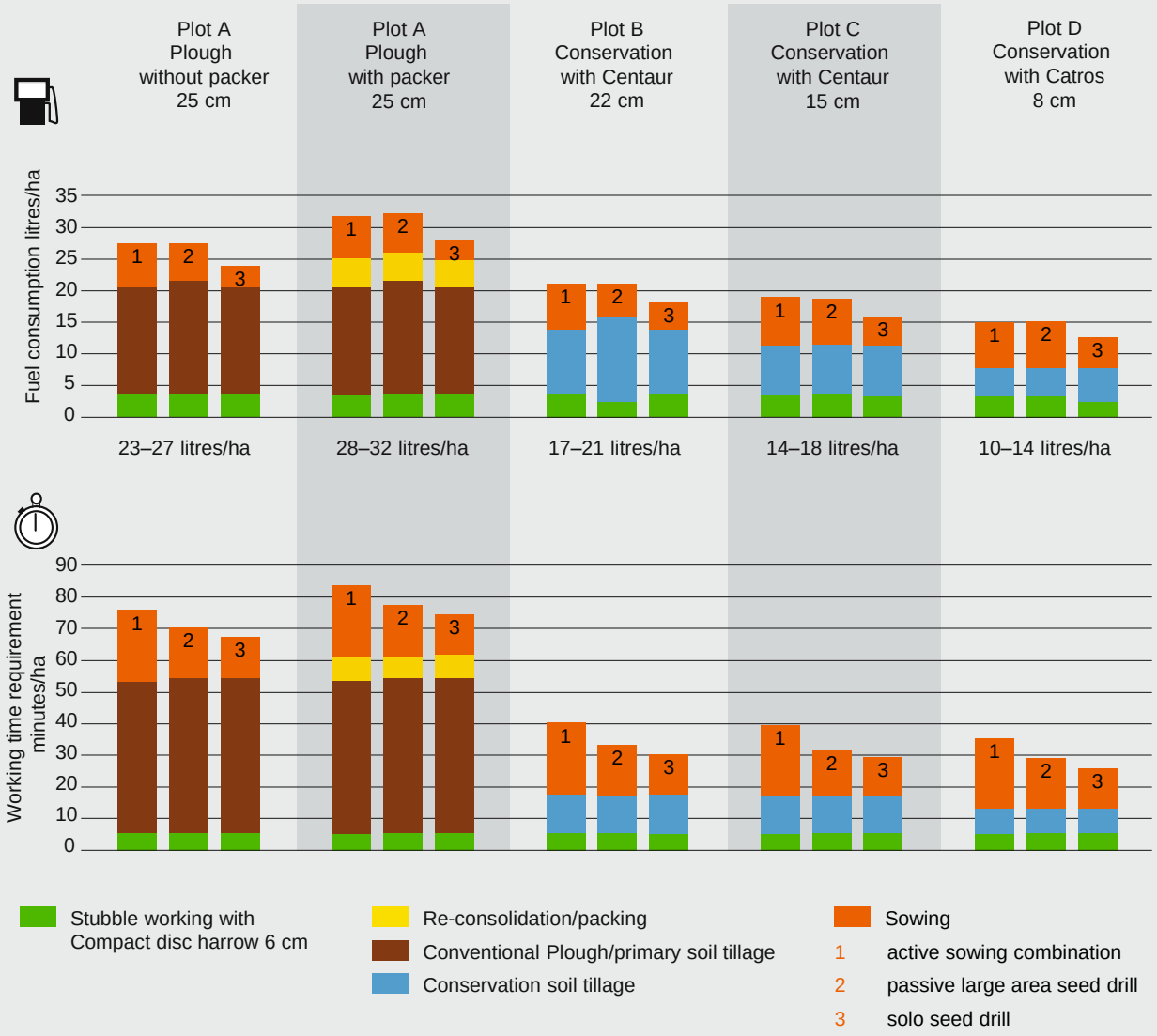
Clear differences in fuel consumption, however, show up in primary soil tillage. So, with conventional cultivation using the plough, consumption values of 17 to 17.7 l/ha and 21.5 to 22.2 l/ha (with an additional packer on the plough) were registered.

In conservation systems, on the other hand, the measurements result in significantly lower consumption figures which are between 10.2 l/ha and 4.3 l/ha (depending on implement type and intensity). This results in differences of up to 17 l/ha compared to working with the plough. Realistic and in practical operation the saving potential amounts to approx. 7 l/ha. This is shown in the direct comparison between plot A (with plough) and B (without plough), because on these plots the operational intensities were about the same. If one adds the packer operation on the plough one even gets figures of approx. 11 l/ha.

In general the consumption values of the active sowing combination and the trailed Cirrus PacTeC seed drill with integrated compact disc harrow are low. The differences between these two systems are only 0.5 to 1 l/ha in favour of the PacTeC seed drill. Extremely low consumption values result from the use of the solo seed drill because here no seedbed preparation takes place. In general, there is only little scope by the selection of sowing technology, regarding the reduction in fuel consumption. The question for the correct mechanisation of the sowing operation is rather more determined by the local site factors.

Fuel consumption and working time requirements of the systems

(results of the DLG test institute [Groß-Umstadt] and vTI [Braunschweig])



Summarising the total fuel consumption of the systems shows that operation with the plough requires approx. 7 l diesel/ha more than operation without the plough. The fuel consumption of the individual total systems is decisively influenced by the kind of primary soil tillage. So, the key for success is the choice and intensity of the primary soil tillage.

Apart from a more favourable fuel consumption then also the working time for the total systems are reduced in favour of cultivation without the plough. For a mulch sowing system it is halved, with even savings of up to 60 % being realistic.

Trials results in an overview:

Different methods and intensities in primary soil tillage result in clear differences in fuel consumption.

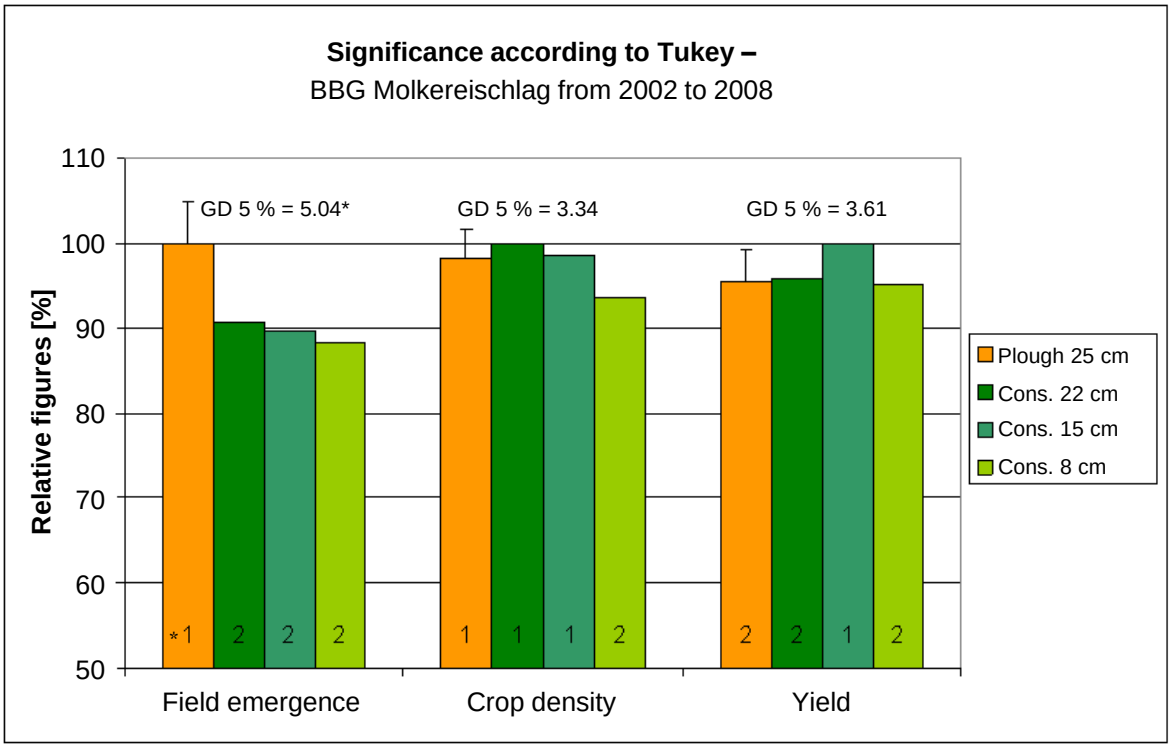
Depending on the method, saving potentials of 35 % down to 20 % can be achieved.

For the working time required, savings of up to 60 % can be realised.

The differences in the use of the different seed drills are negligible.

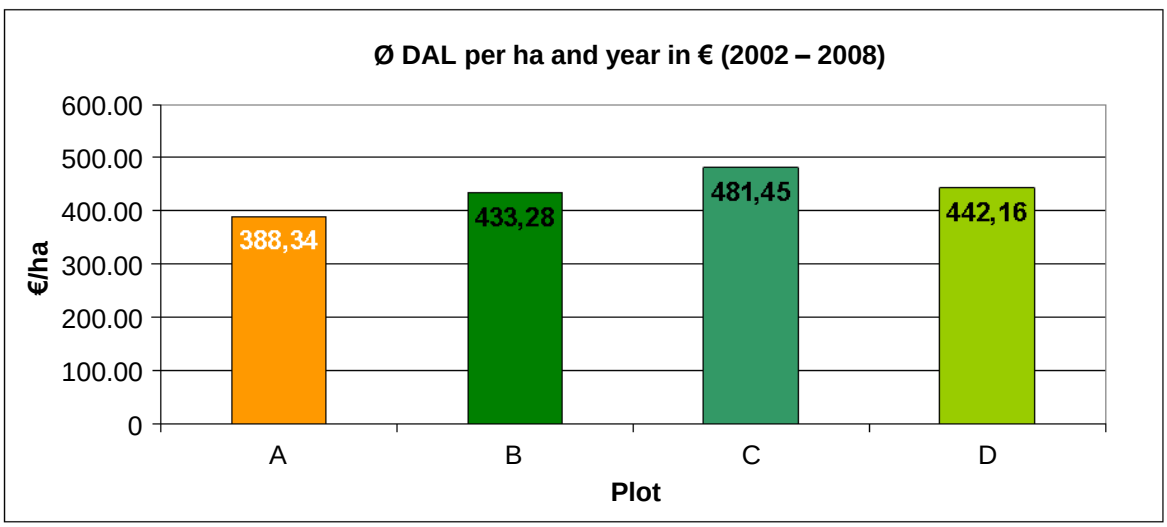
Statistical analysis, trial site Leipzig (Molkereischlag)

Assessment of the entire crop rotation (2002 – 2008):



* 1 differs significantly from 2

Average direct and operational cost free capacity (DAL) per hectare and year – € (2001 – 2008):



Comments on the statistical evidence of the results:

Statistical analysis

Graph 1 brings together the most important parameters of the respective trials years (monitored period 2002 – 2008). The statistical procedure was put into action after Tukey. The analysis was carried out by vTI Braunschweig.

When considering the field emergence, a clear significance in favour of plot 1 is noticed. That means, over the reporting period, the plough plot proves to have the highest field emergence.

In the results of the crop density, the situation is reversed (the compensation ability of the crop has to be considered). Here the plots A – C significantly differ from D (lowest crop density). So, over the years, plot D has the lowest ear, pods and cobs figures.

At the relative yield investigation, Block C significantly differs from all the others. So one can concur that there is a statistically ensured yield increase by using a conservation tillage method at a 15 cm working depth.

Comments on the economic viability

Within the framework of a master's thesis at the University of Applied Sciences, Southern Westfalia, the profitability of the methods used in Leipzig was investigated.

The calculation for the different trial years was carried out with the valid figures for the relevant actual year. The reporting period also includes the years 2002 to 2008.

The results clearly show that the revenue level is obviously higher for all conservation systems than for conventional systems.

Depending on the system, up to 100 €/ha more per year can be generated. Even the most extensive plot with the plough (plot D), which is relatively even in terms of yield, results in, due to clearly reduced operational costs, a surplus of approximately 55 €/ha and year.

For the calculations, payments of premiums and rents have not been considered, due to big regional differences.