SOILAssist: Decision Matrix Trafficability - foresighted planning of soil conserving measures and processing chains

M. Lorenz[1], J. Brunotte[1], N. Fröba[2], F.-J. Löpmeier[3]

[1] Thünen Institute of Agricultural Technology, Braunschweig, Germany
[2] Association for Technology and Structures in Agriculture (KTBL), Darmstadt, Germany
[3] German Wether Service (DWD), Centre for agrometeorological research (ZAMF), Braunschweig, Germany

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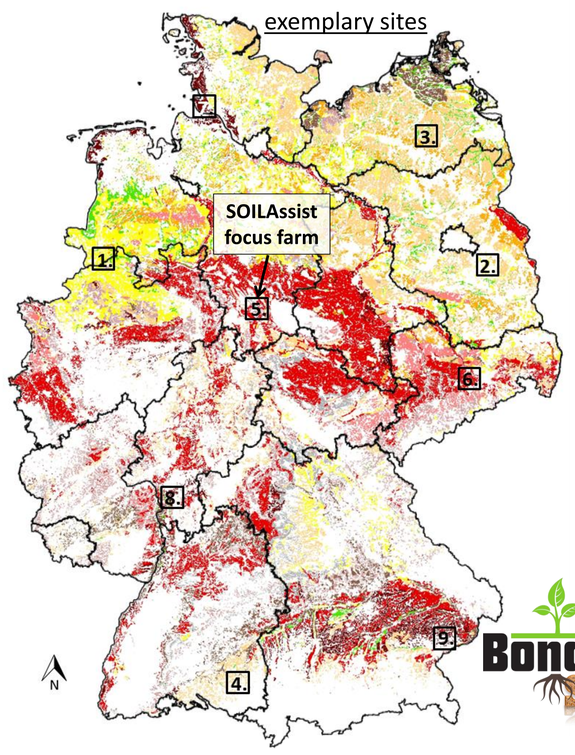
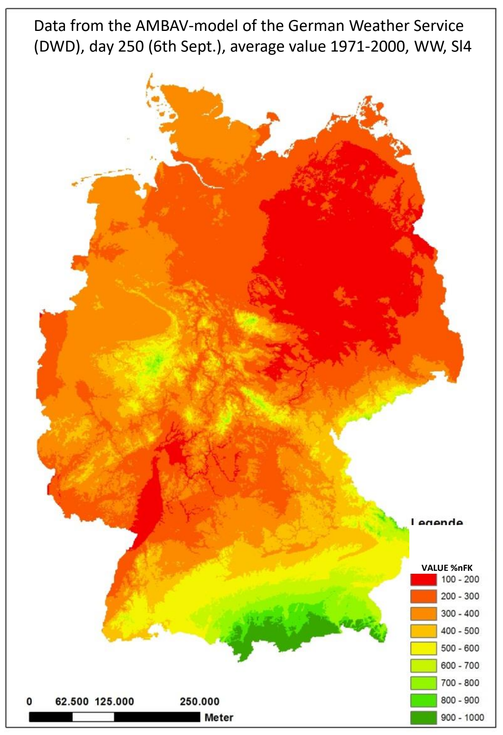
The SOILAssist Decision Matrix Trafficability

The Decision Matrix Trafficability with its concept to 'adapt machinery specifications to the susceptibility of soil to compaction' combines basic soil data of soil texture and results of the soil water model AMBAV (DWD) of soil moisture with expert knowledge and derives the susceptibility of soil to compaction and the long term trafficability of typical sites in Germany for main time spans of field work. Therefore, the susceptibility of soil to compaction was compared with the soil load of the agricultural machinery. From this data, average days of trafficability of agricultural soil were derived depending on machinery and agricultural technique. By now the concept gives recommendations for the harvesting of silage maize, sugar beet, winter wheat, summer wheat, potatoes and the application of liquid manure and digestates.

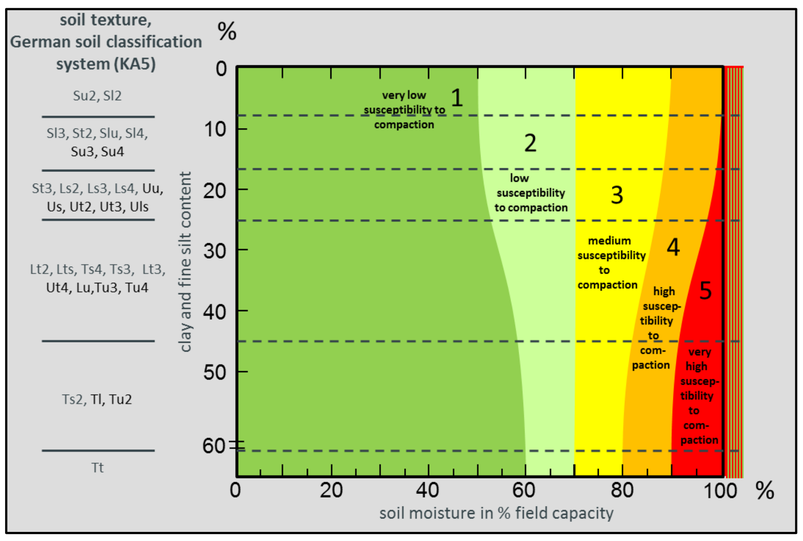


soil data:

soil texture
+
soil moisture



susceptibility of soil to compaction



SOILAssist Decision Matrix Trafficability:

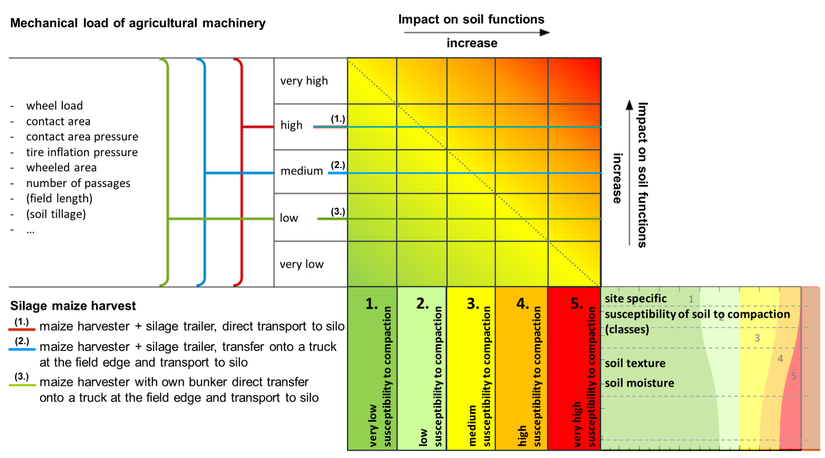
- to support decision making of farmers
- for a foresighted planning
- of investments, operating levels of machinery and
- of soil conserving measures

→

- average days of trafficability of agricultural soil
- comparing different processing chains and machines
- comparing different fields and farms

→ Internet application for farmers

silage maize



Silage maize harvest

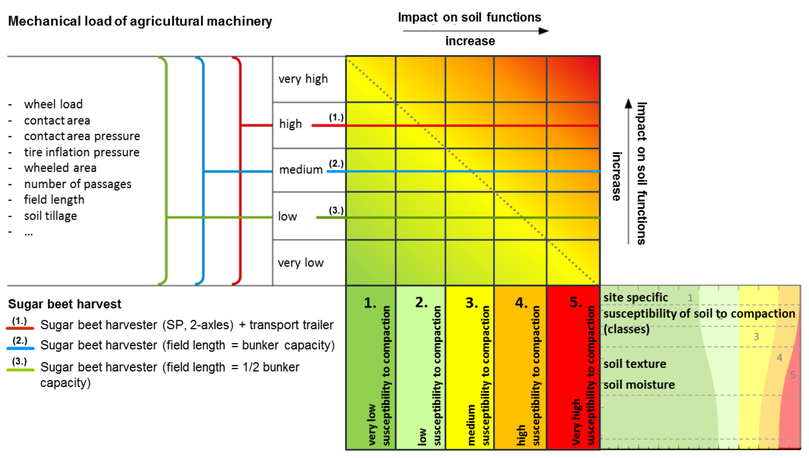
(1.) maize harvester + silage trailer, direct transport to silo
(2.) maize harvester + silage trailer, transfer onto a truck at the field edge and transport to silo
(3.) maize harvester with own bunker direct transfer onto a truck at the field edge and transport to silo

topsoil subsoil

61 days exemplary sites	Days of trafficability for different mechanical soil load (01.09. - 31.10) (1.) maize harvester + silage trailer, direct transport to silo	(2.) maize harvester + silage trailer, transfer onto a truck at the field edge and transport to silo	(3.) maize harvester with own bunker direct transfer onto a truck at the field edge and transport to silo
Sl2 1.	39 (±2)	61	61
Sl2 2.	61	61	61
Sl4 3.	60 (±1)	61	61
Sl4 4.	30 (±2)	41 (±2)	59 (±2)
Ut3 5.	61	61	61
Ut3 6.	61	61	61
Lu 7.	38 (±2)	48 (±3)	57 (±3)
Lu 8.	52 (±2)	61	61
Lu 9.	39 (±2)	49 (±3)	58 (±3)

61 days exemplary sites	Days of trafficability for different mechanical soil load (01.09. - 31.10) (1.) maize harvester + silage trailer, direct transport to silo	(2.) maize harvester + silage trailer, transfer onto a truck at the field edge and transport to silo	(3.) maize harvester with own bunker direct transfer onto a truck at the field edge and transport to silo
fS 1.	56 (±2)	61	61
mS 2.	61	61	61
Ls3 3.	61	61	61
Lt2 4.	35 (±2)	46 (±3)	57 (±3)
Ut4 5.	61	61	61
Ut4 6.	61	61	61
Su3 7.	60 (±1)	61	61
Sl2 8.	61	61	61
Tu3 9.	38 (±2)	57 (±3)	61

sugar beet



Sugar beet harvest

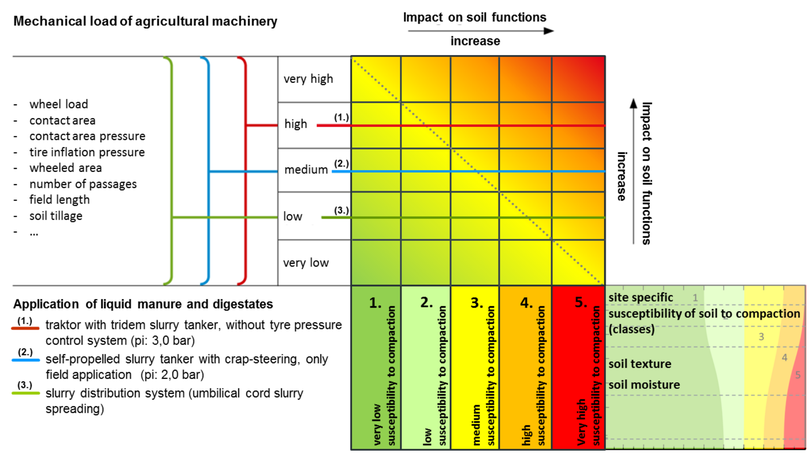
(1.) Sugar beet harvester (SP, 2-axles) + transport trailer
(2.) Sugar beet harvester (field length = bunker capacity)
(3.) Sugar beet harvester (field length = 1/2 bunker capacity)

topsoil subsoil

91 days exemplary sites	Days of trafficability for different mechanical soil load (01.09. - 30.11) (1.) sugar beet harvester (SP, 2-axles) + transport trailer	(2.) sugar beet harvester (field length = bunker capacity)	(3.) sugar beet harvester (field length = 1/2 bunker capacity)
Sl2 1.	58 (±2)	81 (±2)	91
Sl2 2.	91	91	91
Sl4 3.	79 (±2)	91	91
Sl4 4.	28 (±2)	49 (±2)	73 (±2)
Ut3 5.	79 (±2)	91	91
Ut3 6.	91	91	91
Lu 7.	52 (±2)	74 (±3)	77 (±3)
Lu 8.	65 (±2)	77 (±3)	83 (±3)
Lu 9.	47 (±2)	59 (±3)	73 (±3)

91 days exemplary sites	Days of trafficability for different mechanical soil load (01.09. - 30.11) (1.) sugar beet harvester (SP, 2-axles) + transport trailer	(2.) sugar beet harvester (field length = bunker capacity)	(3.) sugar beet harvester (field length = 1/2 bunker capacity)
fS 1.	74 (±2)	91	91
mS 2.	91	91	91
Ls3 3.	91	91	91
Lt2 4.	32 (±2)	49 (±3)	72 (±3)
Ut4 5.	91	91	91
Ut4 6.	91	91	91
Su3 7.	83 (±2)	91	91
Sl2 8.	91	91	91
Tu3 9.	44 (±2)	71 (±4)	78 (±3)

application of liquid manure and digestates



Application of liquid manure and digestates

(1.) traktor with tridem slurry tanker, without tyre pressure control system (pi: 3,0 bar)
(2.) self-propelled slurry tanker with crap-steering, only field application (pi: 2,0 bar)
(3.) slurry distribution system (umbilical cord slurry spreading)

topsoil subsoil

61 days autumn exemplary sites	Days of trafficability for different mechanical soil load (01.09. - 31.10) (1.) traktor with tridem slurry tanker, without tire pressure control system (pi: 3,0 bar)	(2.) self-propelled slurry tanker with crap-steering, only field application (pi: 2,0 bar)	(3.) slurry distribution system (umbilical cord slurry spreading) (0,8 bar)
Sl2 1.	8 (± 2)	36 (± 2)	61
Sl2 2.	57 (± 2)	61 (± 2)	61
Sl4 3.	35 (± 2)	60 (± 1)	61
Sl4 4.	2 (±2)	2 (±2)	34 (± 2)
Ut3 5.	36 (± 2)	61	61
Ut3 6.	56 (± 2)	61	61
Lu 7.	9 (± 2)	25 (± 2)	36 (± 2)
Lu 8.	35 (± 2)	49 (± 3)	61
Lu 9.	2 (±2)	2 (± 1)	26 (± 4)

61 days autumn exemplary sites	Days of trafficability for different mechanical soil load (01.09. - 31.10) (1.) traktor with tridem slurry tanker, without tire pressure control system (pi: 3,0 bar)	(2.) self-propelled slurry tanker with crap-steering, only field application (pi: 2,0 bar)	(3.) slurry distribution system (umbilical cord slurry spreading) (0,8 bar)
fS 1.	11 (± 2)	48 (± 2)	61
mS 2.	61	61	61
Ls3 3.	51 (± 2)	61	61
Lt2 4.	2 (±2)	2 (±2)	9 (± 3)
Ut4 5.	37 (± 2)	61	61
Ut4 6.	50 (± 2)	61	61
Su3 7.	14 (± 2)	61	61
Sl2 8.	31 (± 2)	61	61
Tu3 9.	2 (±2)	2 (±2)	18 (± 5)

89 days spring exemplary sites	Days of trafficability for different mechanical soil load (01.02. - 30.04) (1.) traktor with tridem slurry tanker, without tyre pressure control system (pi: 3,0 bar)	(2.) self-propelled slurry tanker with crap-steering, only field application (pi: 2,0 bar)	(3.) slurry distribution system (umbilical cord slurry spreading) (pi: 0,8 bar)
Sl2 1.	2 (±2)	17 (±2)	73 (±2)
Sl2 2.	2 (±2)	34 (±2)	89 (±2)
Sl4 3.	2 (±2)	14 (±2)	33 (±2)
Sl4 4.	2 (±2)	2 (±2)	10 (±2)
Ut3 5.	2 (±2)	10 (±2)	29 (±4)
Ut3 6.	2 (±2)	13 (±2)	45 (±5)
Lu 7.	2 (±2)	2 (±2)	14 (±3)
Lu 8.	2 (±2)	3 (±3)	22 (±4)
Lu 9.	2 (±2)	2 (±2)	10 (±2)

89 days spring exemplary sites	Days of trafficability for different mechanical soil load (01.02. - 30.04) (1.) traktor with tridem slurry tanker, without tyre pressure control system (pi: 3,0 bar)	(2.) self-propelled slurry tanker with crap-steering, only field application (pi: 2,0 bar)	(3.) slurry distribution system (umbilical cord slurry spreading) (pi: 0,8 bar)
fS 1.	2 (±2)	9 (±2)	20 (±2)
mS 2.	2 (±2)	14 (±2)	46 (±2)
Ls3 3.	2 (±2)	7 (±2)	6 (±3)
Lt2 4.	2 (±2)	2 (±2)	4 (+2)
Ut4 5.	2 (±2)	5 (±2)	7 (+2)
Ut4 6.	2 (±2)	6 (±2)	12 (+2)
Su3 7.	2 (±2)	2 (±2)	20 (±2)
Sl2 8.	2 (±2)	3 (±3)	39 (±2)
Tu3 9.	2 (±2)	2 (±2)	4 (+2)

Conclusions

The Decision Matrix Trafficability derives average days of trafficability of agricultural soil, depending on the susceptibility of soil to compaction and the soil load of machinery. The information of trafficability for main time spans of field work is helpful for the farmer to plan new investments and operating levels of machinery, and to adapt machinery specifications to the prevailing soil conditions to carry out soil conserving traffic on arable land.

Lorenz et al. (2016): Adaption of load input by agricultural machines to the susceptibility of soil to compaction (...). Appl. Agric. and Forest. Res. 66(2), 101-143.

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Contact:
Marco.Lorenz@thuenen.de
Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries