

Soil structure, Cultivations and Establishment.

**Soil Structure & Cultivations:
strategies for the repair and
avoidance of damage.**

The Future – Prevention is better than cure
The Present – Repair & remediation

Philip Wright

Wright Resolutions Limited

www.wrightresolutions.co.uk






Drainage: a key cornerstone.

Benefits of good drainage:

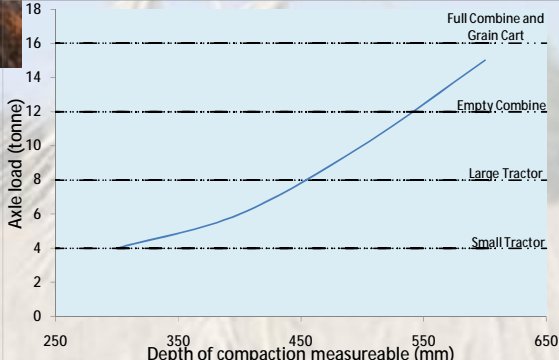
- Allows the water/air balance to be restored rapidly following rainfall
- Avoids anaerobic conditions – improved soil “biology”
- Improved soil conditions for field operations – timeliness
- Reduced potential for soil structure damage
- Efficient fertiliser use – reduced denitrification & leaching.



Soil compaction: causes

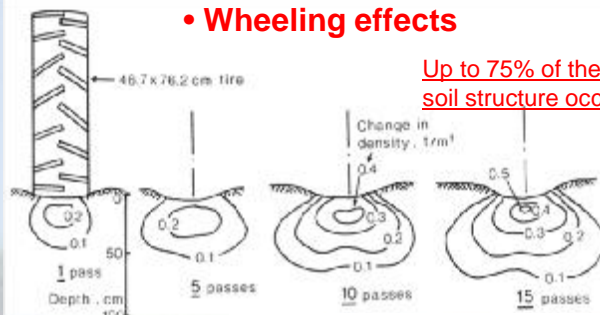




- **Soil structure – cause and effect**
 - Tyre & machine technology has resulted in reasonable surface ground pressures
 - Axle loadings have increased with consequences at depth
 - **This is exacerbated in wet situations.**



Soil Structure: trafficking

- **Wheeling effects**



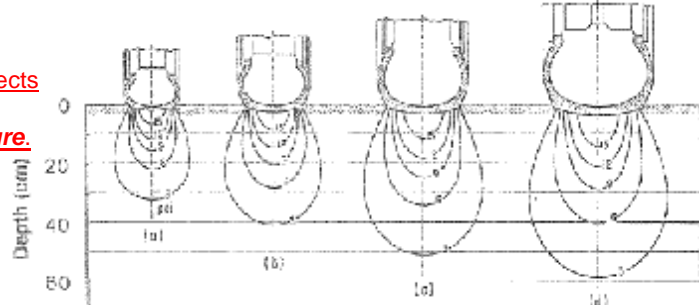
Change in density, t/m^3


After: Raghavan et al 1976

After: Söhne (1958)

Up to 75% of the trafficking damage to soil structure occurs in the first pass

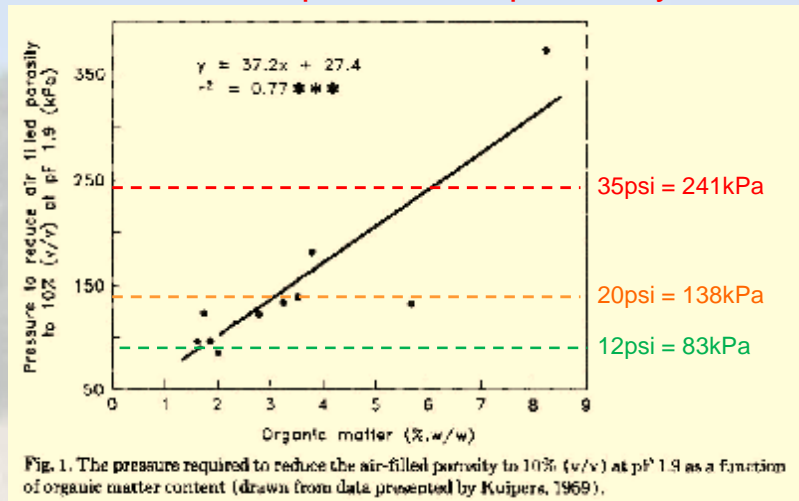
Compaction effects for constant ground pressure.





Soil Structure: natural stability

Soil resistance to compaction is improved by OM%



- An OM increase from 1% to 3% reduces erosion by 20%-33%.

Soil structure, Cultivations and Establishment.

Discussion.

The Future – prevention is better than cure

The Present – Repair & remediation

Identification & assessment of structure problems

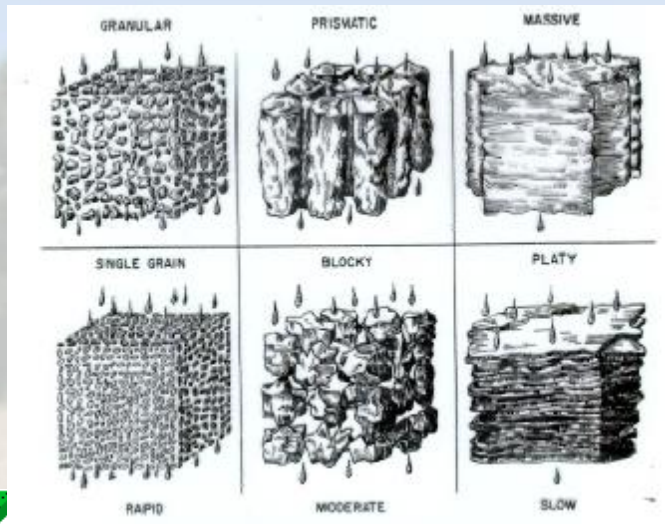
Planning the repair strategy

Check & confirm effectiveness of treatments

Adjust to suit conditions prevailing.

Soil Structure

- Soil structure – movement of water & nutrients



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Soil Structure: basic indicators



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Soil Structure – compaction indicators



Soil Structure – visual indicators



Soil Structure – visual indicators



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Tine Loosening & Cultivation

**Sub-Surface:
Tine Critical Depth.**

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Alleviation of compaction

Sub-Surface: Critical Depth

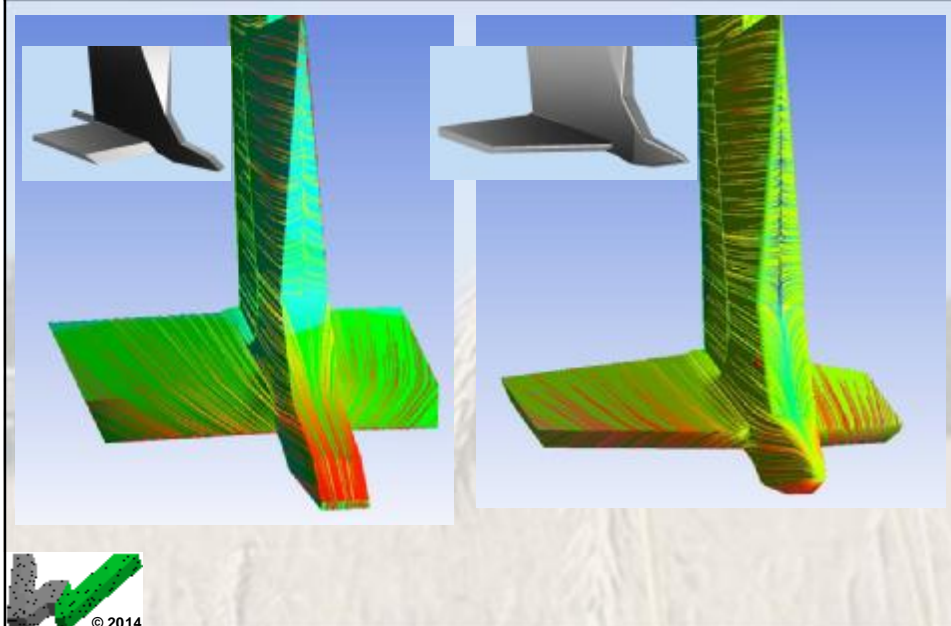
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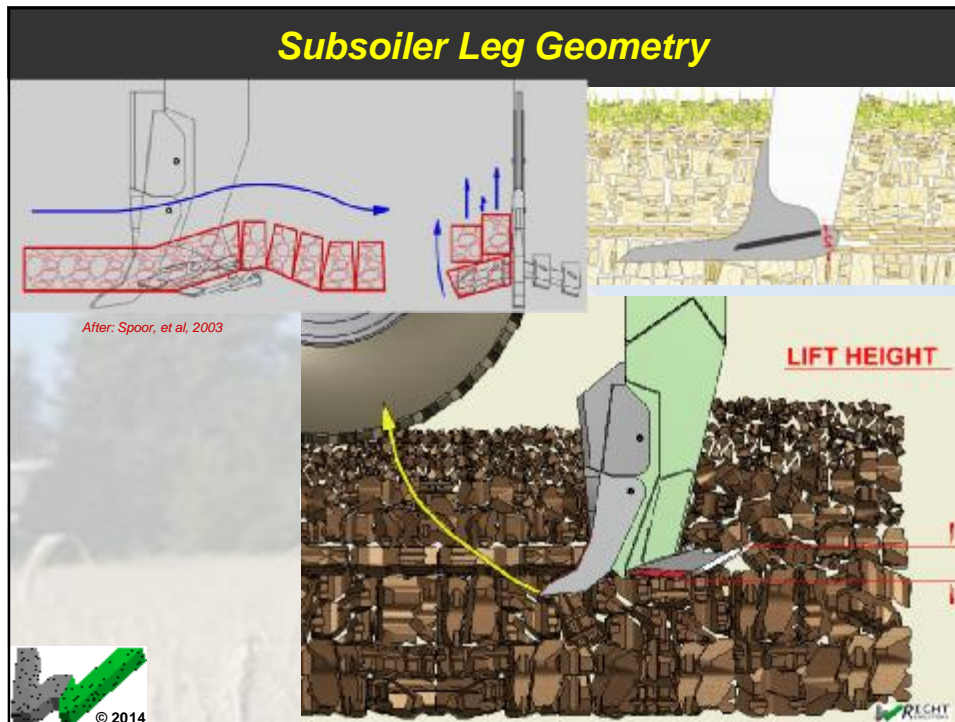
Alleviation of compaction

Sub-Surface: Critical Depth – maintaining effectiveness



Effectiveness of loosening





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Repair & Remediation.

- Identification & assessment of structure problems
- Planning the repair strategy
- Check & confirm effectiveness of treatments**
- Adjust to suit conditions prevailing.



Alleviation of compaction

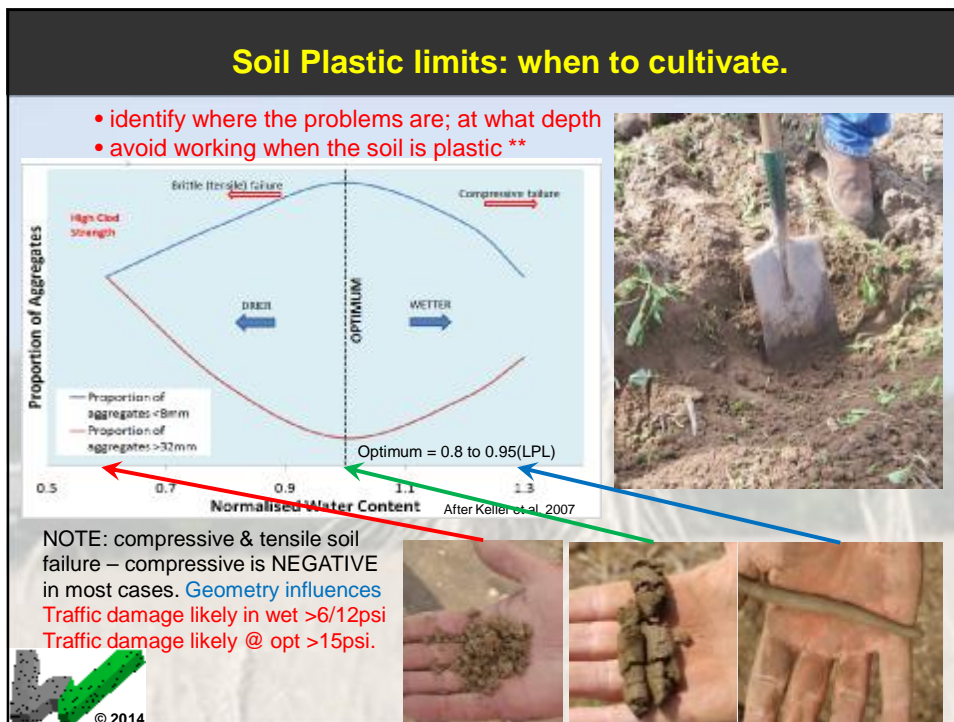
Sub-Surface: Critical Depth – maintaining effectiveness



Soil Structure – Good aggregation

- Good aggregation – this is not a direct result of soil loosening cultivations which shatter the compaction (clods on right)
- Once shattered, the resulting structure needs to weather, and new pores need to form naturally in the clods
- Increased biological activity, root growth and natural aggregation is needed to create the stable peds or aggregates (left).





Surface disturbance: avoid compromising sub-surface effectiveness.



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Repair & Remediation.

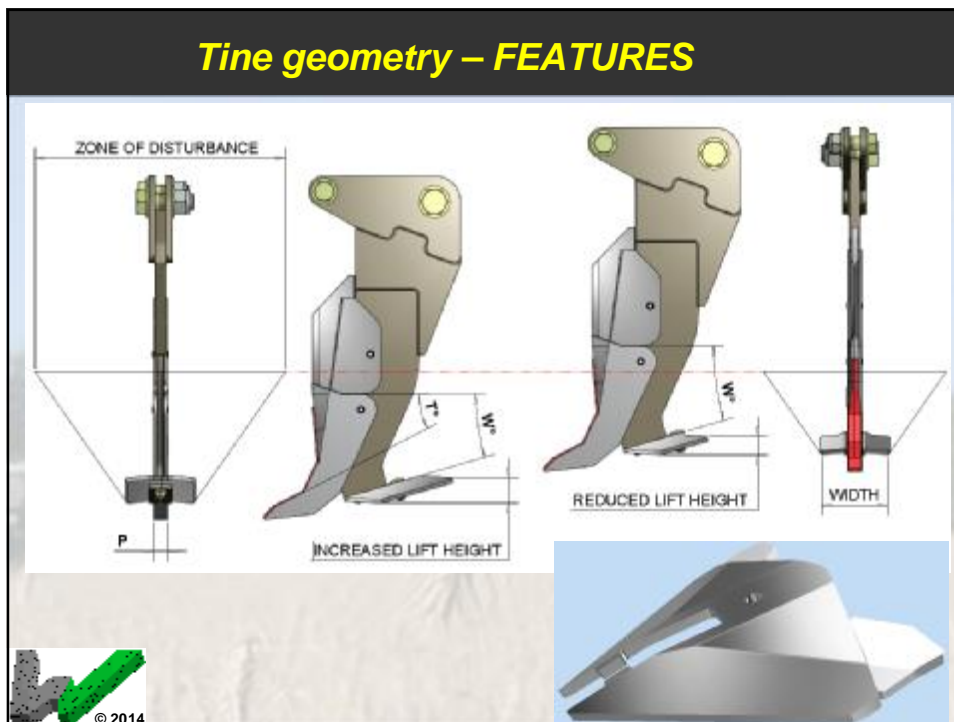
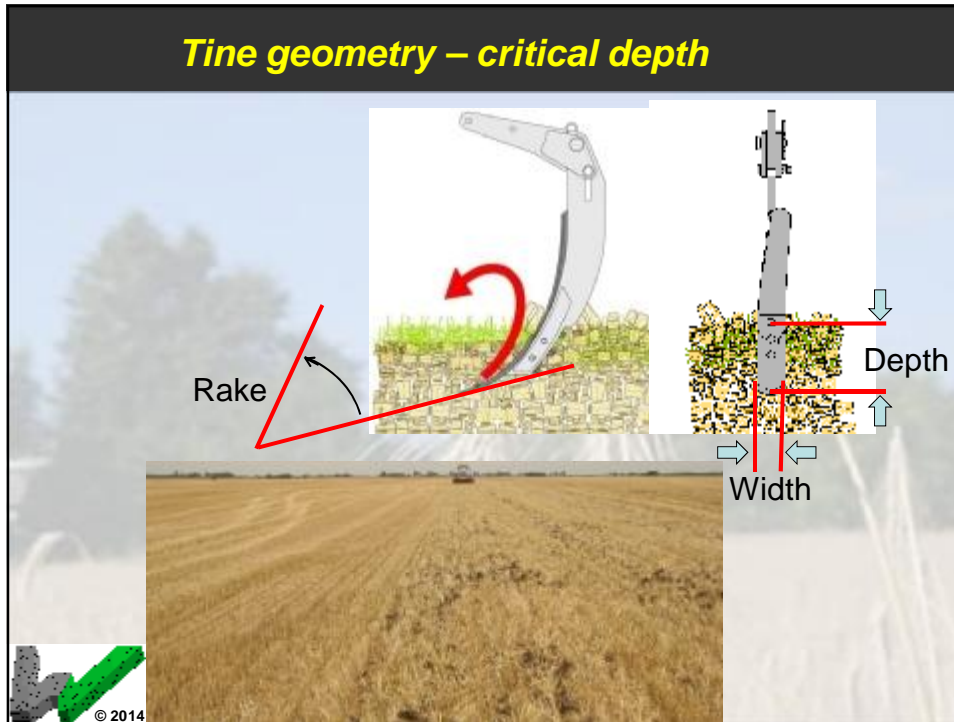
Identification & assessment of structure problems

Planning the repair strategy

Check & confirm effectiveness of treatments

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Multiple tine spacing

- Simple tines = 1.5 x depth of work
- Winged tines = 2.0 x depth of work
- Winged tines + shallow leading tines = 2.5 x depth of work

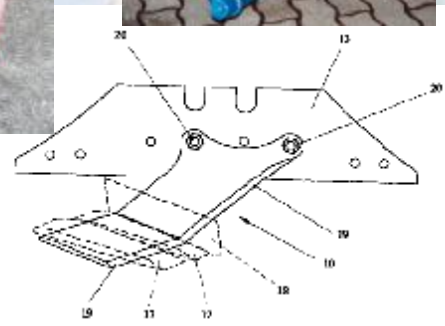
After: Spoor, & Godwin 1978

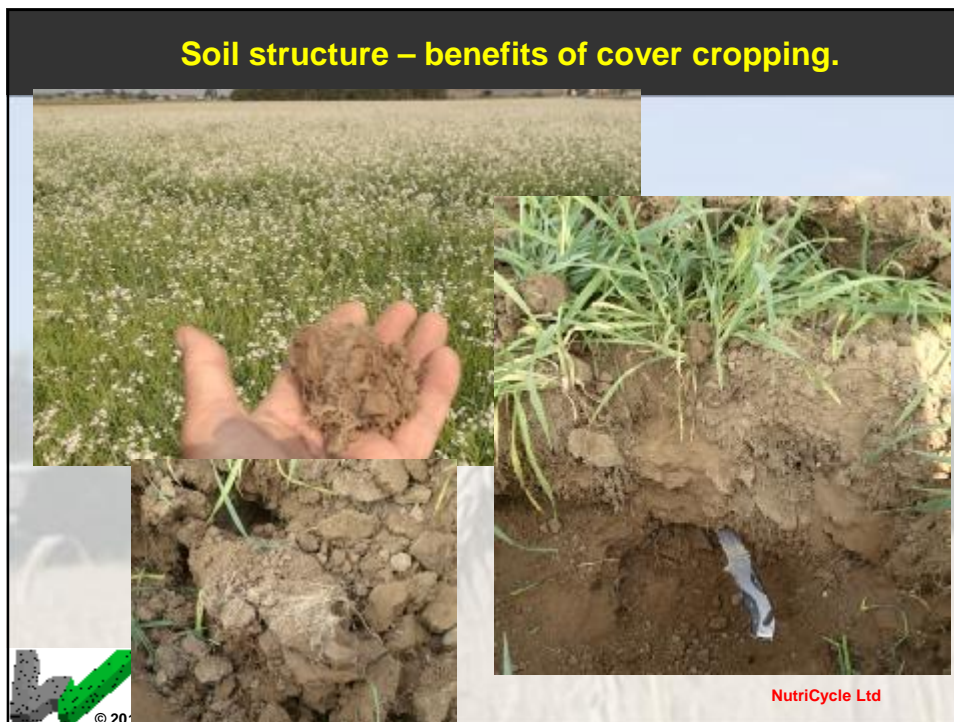
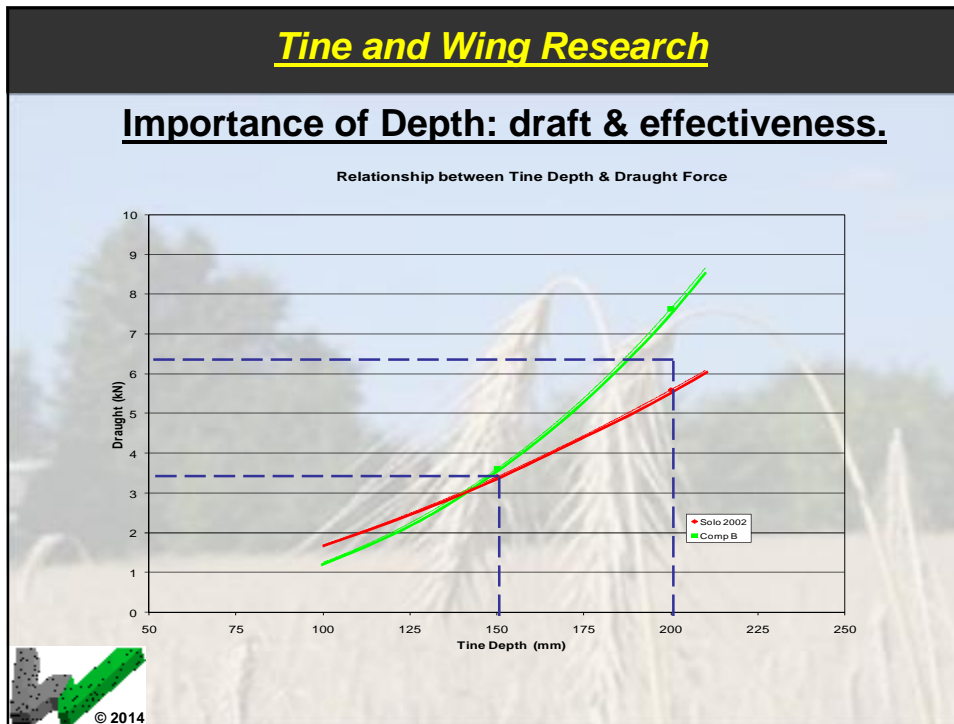
NOTE: shallow loosening effect can be by other means

NOTE: Tine draft:
70:30 [point:wing]



Ploughing can be pre-loosening





Soil structure – benefits of cover cropping.



- Field of failed W Wheat [drilled 09/12] on clay loam, severely compacted
- Phacelia established to remove moisture and restructure late Spring 2013
- Drilled Autumn 2013 by Versadrill with Wheat, fields with/without Phacelia
- Root restructuring and drier conditions when drilling evident 22/12/13

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Soil structure – benefits of cover cropping.



- Comparison of fields – with/without cover crop effect

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Soil structure – benefits of cover cropping.



- Cover crop effect – moisture removal reduces tine CD issues

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Soil Repair - Summary.

Be flexible - manage “outside the box” – even “Direct Drill” systems may need cultivations assistance!!

- Drainage – maintain, repair, outfalls, etc,
- Identify compacted areas, depths, extents
- Plan and prioritise; equipment choice, settings
- Consider cover crops if following
- Adapt if needed after harvest
- Check & confirm effectiveness– moisture levels.

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Discussion.

“A GOOD FARMER TAKES CARE OF THE FOLLOWING” :

DRAINAGE

MUCK

LIME

ROTATIONS

Key cornerstone
Organic Matter
pH & nutrient balance
Crops, **cultivations**



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As with all natural situations, remaining flexible and achieving a **balance** is vital!

