## Agenda

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<tr>
<th>Time</th>
<th>Session Title</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>10:00</td>
<td>Chair’s welcome &amp; AHDB update</td>
<td>Philip Dolbear</td>
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<td>10:15</td>
<td>Weed control – sanity versus vanity</td>
<td>Steve Harrison</td>
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<td>10:35</td>
<td>Companion, inter and cover cropping</td>
<td>Andy Howard – Farmer &amp; AHDB Cereals &amp; Oilseeds Nuffield Scholar</td>
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<td>11:25</td>
<td>Refreshment break</td>
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<td>11:45</td>
<td>Micronutrients – testing protocols &amp; economics</td>
<td>Ian Robertson</td>
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<td>12:30</td>
<td>Theory into practice, economically</td>
<td>Tim Lamyman</td>
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<td>13:20</td>
<td>Closing comments</td>
<td>Philip Dolbear</td>
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<td>13:30</td>
<td>Lunch</td>
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“But the truth is that if we try to avoid change, hold the future at bay and throw up barriers to progress then we don’t stop change coming, we simply leave ourselves less equipped to deal with change as it arrives.”
Some of our competitors are improving faster
UK Productivity is slow
Supply Chains
Rentals
Subsidies
Resistances
Chemical usage is under attack
Nutrient regulation
BREXIT
Public Perception
Environment
Supply chain
Climate change
“Having the ability to get the best from what you ALREADY have is a crucial part in achieving positive results”!

Supporting Each Other!
Problem Solving & Action Planning

- Why is it done like that?
- Why is action needed?
- Why is it happening?

- What do you do?
- What is the problem? S.W.O.T.?
- What are the goals?

- Who needs to be involved?
- Who will be responsible for the actions?

- When did the problem occur?
- When did it start happening start?

- How do we go forward?
- How long will it take?

- Where will you’ll sell your products?
- Where do I want my business to be in .....
Smarter Farming!

Digging deeper

Technology

Husbandry systems

Collaboration

Hard & Soft Skills

Grants
“It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to change.”

-Charles Darwin, 1809
‘Inspiring our farmers, growers and industry to succeed in a rapidly changing world’

1. Inspire farming to be competitive & resilient
2. Accelerate innovation & productivity growth
3. Help industry deliver what consumers will buy
4. Deliver leadership & horizon scanning

AHDB Strategy 2017 - 2020
Inspiring Success
Inspiring Farm Excellence

Development of business leaders who inspire improvements for the whole industry

Accelerated uptake of technical tools linked to increased productivity

Increased numbers benchmarking and using it to drive business improvement

Targeted improvement in key areas of technical importance
Weed Control – Sanity or Vanity?

Stephen Harrison, South West Agronomy
Living on a knife edge – one spray miss! Wild Oats in Wheat
Fat Hen in Maize
What is a weed?

• A plant considered undesirable in a particular situation.
• Need not be a “wild” plant, volunteer cultivated species are also weeds.
• In a seed crop admix of different varieties may be considered weeds.
• Can be indigenous species or foreign introductions, eg Himalayan Balsam and Japanese Knotweed.
• Some weeds parasitise their host plant eg Striga species in maize. Largely sub Saharan Africa.
• Weeds often precede crops on cultivated land and may be efficiently adapted to that environment.
Why control weeds?

• They compete with a crop for light, water, carbon dioxide and nutrients.
• They may interfere with harvest.
• They can act as a host for pests and diseases, e.g. green bridge for cereal aphids or ergot from blackgrass.
• Unchecked the seed bank is allowed to increase. Encourage weed germination out of crop. Prevent weed seed setting and shedding.
• They can contaminate the harvested crop reducing value (admix).
• We don’t like to see them and consider weeds a symptom of “bad farming”
Legislative requirements

- EU Sustainable use of Pesticides Directive requires farmers to adopt integrated pest management practises aiming to give priority to none chemical control methods. Actions for weeds should be to integrate:
  - Crop choice and rotation
  - Drilling date
  - Cultivation method
  - Herbicide use
  - Resistance management
  - Watercourse protection
Improving weed management.

• Get the most from cultural control.
• Keep weed populations low for the best weed and resistance management.
• Plan weed control across the full rotation.
• Map your weed populations.
• Hand rogue small populations. It is highly likely that blackgrass seeds in bought in straw will be resistant.
• Insist on scrupulous machinery hygiene especially contract balers and combines.
Another load of blackgrass seed heads west!
Table 1. Competitive ability of common arable weeds in wheat

<table>
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<tr>
<th>Competitive ability (number of plants/m² that would typically result in a 5% yield loss in wheat)</th>
<th>Weed (Species in italics have a high feed for seed-feeding birds and herbivorous insects)</th>
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<td>Very competitive (0·5)</td>
<td>Barren brome, cleavers, Italian rye-grass, wild-oat</td>
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<tr>
<td>Competitive (12·17)</td>
<td>Black-grass, black-bindweed, charlock, common poppy, creeping thistle, scentless mayweed</td>
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<td>Moderately competitive (up to 25)</td>
<td>Chickweed, fat hen, forget-me-not, redshank</td>
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<tr>
<td>Less competitive (50 and above)</td>
<td>Common fumitory, scarlet pimpernel, shepherd’s-purse, dove’s-foot crane’s-bill, red dead-nettle, annual meadow-grass, knot-grass, groundsel, common speedwell, field pansy</td>
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Know your enemy

- It is not always essential to turn the ground brown to culturally control weeds.
- Sterile Brome and Great Brome (Anisantha sp.) best cultivated into stale seedbed. Meadow, Soft and Rye Brome (Bromus sp.) should be left on the surface.
- Cultivating too deeply may encourage dormancy.
- Depending on weed species no stale seedbed cultivations may be necessary in dry conditions (natural degradation of seeds on soil surface)
- Warm dry weather reduces blackgrass dormancy, cold wet weather increase dormancy.
Factors affecting damage caused by weeds.

- Weed Species.
- Weed Density.
- Competitive ability of the crop.
- Growth stage when weeds compete. Small weeds easier to control but may be harder to hit.
Figure 1. Ease of control declines as weeds grow.
Why is weed control becoming more difficult?

- The range of active ingredients has declined.
- There are currently no new herbicide modes of action available
- Herbicide resistance is increasing. A strong link to the first two items.
- Herbicides are being found in water
Table 2. Non-chemical options for weed control

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<th>Potential to:</th>
<th>Decrease numbers</th>
<th>Increase number of species</th>
<th>Black-grass control in wheat*</th>
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<td>Spring crop</td>
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<td>Fallow</td>
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<td>70-80% per year (of seedbank)</td>
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<td>Rotational plough</td>
<td>+++</td>
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<td>Delayed drilling</td>
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<td>Higher seed rates</td>
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<td>Competitive variety</td>
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<td>Mechanical weed control</td>
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<td>Minimising weed dispersal</td>
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+++ high, ++ moderate, + low, ( ) limited experience

*from Lutman, Moss, Cook and Welham (2013)
Sanity, Vanity or Insanity – some crazy practices

- Glyphosate resistance exists in ryegrass in Australia.
- Repeated applications to RR crops means survivors are repeatedly exposed to the herbicide.
- Zero till means survivors not killed by cultivations.
- Widespread ALS and ACCase resistance means survivors are not killed by in crop herbicides.
- Currently no glyphosate resistance in UK blackgrass, to preserve this:
  - No more than two glyphosate applications pre drilling
  - Always use at least 540g/ha glyphosate ai. (some populations may not be well controlled by sub optimal doses)
  - Illegal, none approved practices such as in crop glyphosate band spraying must be avoided.
Sanity, Vanity or Insanity – some crazy practices

• Late 20\textsuperscript{th} century advice on crop management instrumental in propagating weed problems.
• Low seed rates and reliance on tillering gave weeds a head start.
• Early drilling meant soils were dry and residual herbicides were often ineffective.
• Abuse of highly selective herbicides such as fenoxaprop quickly selected for resistance.
• IPU and CTU strongly influenced by seed bed conditions. IPU was however effective on Chickweed and Mayweed.
• ALS resistance in Chickweed, Poppy and Scentless Mayweed came about through repeated use of Sulfonyl Ureas with no alternative group mixture.
In summary

• The weed problem is not getting any easier
• Total control is not always the answer and may not always be necessary.
• Some species eg. Blackgrass require at least 98% control year on year if populations are to be reduced.
• Use all options (including hand rogueing) to eliminate a new problem at its occurrence.
• Understand weed biology to plan control programmes.
• Remember the five types of weed control. Preventative (eg. certified seed with low seed burden), cultural, mechanical, biological (eg. sheep to eat out ragwort) and chemical.
Acknowledgements

John Cussans, Weed Biologist, NIAB TAG
The Effects of Cover Crops and Companion crops on Weeds

By Andrew Howard
My Family Farm

• 330ha arable cropping
• No-till for 7 years
• Crops: wheat, beans, oats, linseed, barley, grass-seed and Peola
• 11ha Solar Farm
Design a Farm system that can thrive with minimal human and outside inputs
Philosophy

No-till → Cover crops → Livestock Integration → Companion crops → Soil Health → No-till

- Cover crops
- Livestock Integration
- Companion crops
- Soil Health
- No-till
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<th>Common Name</th>
<th>Scientific Name</th>
<th>Ca</th>
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<th>K2O</th>
<th>Mg</th>
<th>Mn</th>
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<td>Broadleaf Signalgrass</td>
<td>Brachytrilia platystyla</td>
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<td>Brome, Downy</td>
<td>Bromus tectorum</td>
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<td>Carolina Falseheandelon</td>
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</tbody>
</table>
What does your plant need?

Bare Parent
Material
100% bacterial

Cyanobacteria
True Bacteria
Protozoa
Fungi
Nematodes
Microarths
F:B = 0.01

“Weeds”
- high NO3
- lack of oxygen
F:B = 0.1

Conifer, old-growth forests
F:B = 100:1 to 1000:1

Soil Foodweb Structure Through Succession, And Increasing Productivity

Early Grasses
Bromus, Bermuda
F:B = 0.3

Mid-grasses, vegetables
F:B = 0.75

Deciduous Trees
F:B = 5:1 to 100:1

Shrubs, vines, Bushes
F:B = 2:1 to 5:1

Late successional grasses, row crops
F:B = 1:1
Soil biological succession causes plant succession

Bacteria ... A few Fungi ...... Balanced ....... More Fungi ...... Fungi

<table>
<thead>
<tr>
<th>Bacteria:</th>
<th>10 µg</th>
<th>100 µg</th>
<th>500</th>
<th>600 µg</th>
<th>500 µg</th>
<th>700 µg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fungi:</td>
<td>0 µg</td>
<td>10 µg</td>
<td>250</td>
<td>600 µg</td>
<td>800 µg</td>
<td>7000 µg</td>
</tr>
</tbody>
</table>
Definition of Intercropping

“The growing of two or more crop species where part or all of their crop cycle overlaps temporally and/or spatially, where one or more of the component species is taken to harvest”
Cover crop or Intercrop?

Do weeds know the difference?
How do Cover Crops and Companion Crops affect Weeds?

• allelopathy

• Shading (competition for radiation)

• Competition for nutrient and water

• Encourage/protect weed seed predators

• Improve soil characteristics (change microbial communities)
Mustard

- Very fast growing, shades weeds
- Release allelopathic chemicals to reduce weed seed germination
- Can be sown late. Some frost hardy
- Cheap seed
- Can become weed and cause issues to following crop establishment
Caliente Mustard

- Destroy 2 weeks after flowering has started
- Incorporate within 20 minutes of mowing
- Controls weeds, soil borne pests and diseases
- Used for specialist uses in fruit, root crops and horticulture
Buckwheat for Grassweed Control

- 65% suppression of couch grass – allelopathy or shading?

- Need high seed rates – 150-170kg/ha. Very expensive

- 80% reduction of blackgrass seed germination using buckwheat extract

- Best in mixes – early vigorous growth, early die back
Catch Crops
Alternative Methods For Terminating Cover Crops

This field lab is investigating alternatives to ploughing or glyphosate for terminating cover crops. The group are trialling a range of techniques including roller crimpers.
• No need for pre-em herbicide

• Cranesbill suppression: reduced biomass from 285g/m² to 86g/m²

Temporary Intercropping
• Velcourt trialled oats with wheat and saw a 20% lowering of Blackgrass pressure
Full Season Intercropping
Spring Bean-Oat Intercropping Trial

Bean-Oat 15% higher yield
Living Mulch
Living Mulch Spring Oat Trial

Undersown plot with no herbicide - +0.75t/ha
Micro-Clover

2kg/ha = £15/ha
Welcome to the OSCAR Living Mulch and Cover Crop Toolbox; providing tools to help improve knowledge and drive the use of Conservation Agriculture practices and subsidiary cropping systems throughout Europe.

The aims of the Toolbox are to:
- Make scientific literature and technical information on cover crops and living mulches widely available
- Promote the current knowledge and impact of innovative subsidiary cropping systems and potential solutions to ecological problems

The Toolbox will help you:
- Identify suitable cover crop and living mulch species and varieties and appropriate species mixtures
- Locate and access information on appropriate machinery
Options for Maize
Pasture Cropping
Residue
RECENT RESEARCH
Effect of drought on weed emergence and growth vary with the seed burial depth and presence of a cover crop – Stephane Cordeau et al (2018)

• Tested eight different weed species

• Unburied seeds had 26% lower emergence

• Cover crop reduced emergence by 17% overall

• Unburied seeds under drought stress had 45% less emergence compared to buried seeds with no drought stress

• All weed growth measurements decreased in the presence of a cover crop
• Undersowing Mammoth Red Clover in wheat reduced brome by 98%
• Some weed species only germinate when nitrate levels are around 50ppm
• 20% inclusion of barley in a legume/cereal intercrop reduces weed pressure by 90%
• Weeds were x3 worse in pea sole crop compared to pea/barley intercrop
• Weed diversity reduces in intercrops (filling niches)
• Intercrops can reduce solar radiation reaching the soil by upto 30%
- Intercrops can compete for nutrients and water more efficiently
- Adding nitrogen to an intercrop can turn legumes into a weed
- High seed rates can turn certain species into weeds
- Can use herbicides, mowing and grazing to prevent mulches becoming weeds
- When intercropping cereals and legumes there are more benefits to the legumes in terms of weeds
• Weed seed predators like rodents and beetles prefer shelter/cover

• Fields with covers have 3-4 times more weed seed elimination
• Ideal for livestock production

• Grazing or wholecrop (remove seed heads before maturity)

• Balanced diet for animals

• Low risk due to diversity

• Can be for whole season (more chances to control weeds)
Things to Consider

• Bigger is not always better
• Effect of CC species on following crop
• Avoid viable seeds being produced from a Cover crop
• Termination timing
• Herbicide choices can be restricted
• Every year in different (Diversity for weather risk management)
• Don’t believe all the hype!
Thank you
Ideas

- Vetch – strong allelopathy on weeds. Vetch insunflowers in Canada and winter osr
- Phacelia – good potassium scavenger
- Buckwheat – kills couch grass (innovative farmers field lab)
- Caliente mustard – ethylene gas, effect weeds?
- Black oat vs normal oat
- Forage rye/ cereal rye – crimping for maize and pumpkins
- Nyger plus forage peas in Switzerland
- Ethiopian mustard – good for shading weeds
- Crimson clover – weed suppressant
- Work on subterreanean clover
- Living mulch effects
- Mammoth red clover
- Bean/oat trial
- Conyer trial
- Look through cover crop edition 3 plus stephen briggs book
- Relook at Nuffield research papers
- Nutrient balance biologically from healthy soil
- Cranesbill suppression with OSR companions
- Oats with wheat – velcourt (alleopathy)
- Weed predators
- Micro clover
- Roller crimper
Refreshment Break
Micronutrients – testing protocols & economics

Ian Robertson

Content to follow
Tim Lamyman
Lamyman Worlaby Farms

- World Oilseed Rape Record 6.7 t/ha
- Worlaby Dried Pea Record 6.47 t/ha
- Former World Wheat Record 16.50 t/ha
- YEN Gold Award for highest grain yield in 2014, 2015 and 2017
- YEN Silver Award for achieving 79% of Potential Grain Yield
- Yen Special Award for extraordinary consistency in the production of record yields
Background

- Two farms 600 ha Grade 2 to 4 Lincolnshire chalky wold land near Louth and 120 ha pure blow away sand 20 miles away at Tumby
- 200 ha winter wheat
- 200 ha spring barley
- 120 ha winter oilseed rape
- 50 ha spring beans
- 50 ha game cover
- 30 ha permanent pasture
- 20 ha fallow
- 50 ha woodland and ponds
Background

• I started running the farm in 1997
• Two farms 600 ha Grade 2 to 4 Lincolnshire chalky wold land near Louth and 150 ha pure blow away sand 20 miles away at Tumby
• The challenge – taking LWF farming practices to the next level
• Originally improving the seed beds the farm produced
• Discovering the plough was not the way forward for level seed beds
• Compaction levels halved in depth going to minimum tillage
• Speed of drilling/land work operations improved
Soil Cultivations

• Worlaby Flat Lift Press

• 2 x Lemkin Terra Disc – For records table top level required

• Vaderstad Carrier for wheat or Power Harrow for Rape

• Vaderstad Rapid Drill

• Roll
The Next Stage

• How to control weeds effectively
• Black grass, meadow grass, wild oats, cleavers and poppies
• Black grass – Topic, Lexus, Atlantis, Defy, Liberator and Pendimethalin
• The number one yield killer – Resistant Black grass – No effective control for resistance apart from an integrated management plan of spring cropping or fallow being introduced heavily into the cropping programme.
• At the moment all other weeds mentioned are controllable
Drilling date and seed rate

• For winter wheat on or before 15\(^{th}\) September – understandable those with black grass will be later

• After this date in wheat you are limiting the grain set capacities of the ear

• Raise seed rate the later you drill

• For Oilseed rape on or before 15\(^{th}\) August

• This gives the rape plant plenty of time to put down large tap roots and form a canopy large enough to withstand the winter or pigeons
Variety Choice

• What to look for
• High Yielding
• Fits into your growing types – Milling, biscuit, soft or hard feed wheat
• Good to excellent standing power
• Maturity date
• High disease resistance
• Good hectolitre weight
• Plant and leaf architecture
Winter Wheat Variety


• LG123 and Marsden (2018)

• Short, stiff, good disease resistance (at the time of planting), early and high yielding

• Varieties unique in their growth habit with very prostrate stems and smaller virtually 45 degree angled leaves are ones that interest me most
Disease Control

• Septoria, Yellow Rust, Brown Rust, Mildew and Eyespot
• Over the years each of the above have been major problems in wheat
• Losing any amount of green leaf area to disease will limit the capacity of the plant to absorb radiation.
• Having a proactive approach to stopping disease in wheat is a major way to increase the yield
Winter Oilseed Rape Variety

• Variety – Sparrow – 2018

• Good standing power, reasonable disease package

• Medium maturity and high yielding

• Conventional or Hybrid
Dried Peas

• Large Blue – LG Stallion – 250 kg/ha

• Ploughed, Lemkin T.D., Carrier, Drill and Rolled

• Drilled first week of April

• PGRO 2017 Guide

• Good growing season
## Wheat – Variable Costs

<table>
<thead>
<tr>
<th></th>
<th>Record Crop £/ha</th>
<th>Farm Av. £/ha</th>
<th>High Input £/ha</th>
<th>Low Input £/ha</th>
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</thead>
<tbody>
<tr>
<td>Muck averaged at once every 2 years</td>
<td>£50</td>
<td>£50</td>
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<tr>
<td>Seed costs</td>
<td>£40</td>
<td>£30</td>
<td>£30</td>
<td>£20</td>
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<tr>
<td>Insecticides and Herbicides</td>
<td>£150</td>
<td>£130</td>
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<tr>
<td>Fungicides and Slug Pellets</td>
<td>£160</td>
<td>£140</td>
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<tr>
<td>Nutrition</td>
<td>£150</td>
<td>£100</td>
<td>£50</td>
<td>£10</td>
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<tr>
<td>Nitrogen Fertiliser at £200/t</td>
<td>£250</td>
<td>£200</td>
<td>£200</td>
<td>£120</td>
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<td>P &amp; K Fertiliser at £300/t</td>
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<td><strong>Total Variable Costs</strong></td>
<td><strong>£800</strong></td>
<td><strong>£650</strong></td>
<td><strong>£600</strong></td>
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# Wheat – Gross Margin and Profit

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<th>Wheat at £140/t</th>
<th>Wheat Record 16.5 t/ha</th>
<th>Wheat farm av. 13 t/ha</th>
<th>Wheat high input 11 t/ha</th>
<th>Wheat low input 8 t/ha</th>
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<tr>
<td>Crop output</td>
<td>£2310</td>
<td>£1820</td>
<td>£1540</td>
<td>£1120</td>
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<tr>
<td>Variable costs</td>
<td>£800</td>
<td>£650</td>
<td>£600</td>
<td>£375</td>
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<tr>
<td>Gross margin</td>
<td>£1510</td>
<td>£1170</td>
<td>£940</td>
<td>£745</td>
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<tr>
<td>Fixed costs</td>
<td>£400</td>
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<td>£350</td>
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<tr>
<td>Profit before rent and finance</td>
<td>£1110</td>
<td>£770</td>
<td>£540</td>
<td>£395</td>
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<td>Rent and finance</td>
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<tr>
<td><strong>Net Profit</strong></td>
<td><strong>£610</strong></td>
<td><strong>£270</strong></td>
<td><strong>£40</strong></td>
<td><strong>-£105</strong></td>
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</table>
## Oilseed Rape – Gross Margin and Profit

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<tr>
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<th>O. S. Rape World Record</th>
<th>O. S. Rape farm av. 5.4 t/ha</th>
<th>O. S. Rape high input 5 t/ha</th>
<th>O. S. Rape low input 3.2 t/ha</th>
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<tr>
<td><strong>Crop output</strong></td>
<td>£2010</td>
<td>£1610</td>
<td>£1500</td>
<td>£960</td>
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<tr>
<td><strong>Variable costs</strong></td>
<td>£700</td>
<td>£600</td>
<td>£550</td>
<td>£400</td>
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<tr>
<td><strong>Gross margin</strong></td>
<td>£1310</td>
<td>£1020</td>
<td>£950</td>
<td>£560</td>
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<tr>
<td><strong>Fixed costs before rent and finance</strong></td>
<td>£400</td>
<td>£400</td>
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<td>£400</td>
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<tr>
<td><strong>Profit before rent and finance</strong></td>
<td>£910</td>
<td>£620</td>
<td>£550</td>
<td>£160</td>
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<tr>
<td><strong>Rent and finance</strong></td>
<td>£500</td>
<td>£500</td>
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<td>£500</td>
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<tr>
<td><strong>Net Profit</strong></td>
<td>£410</td>
<td>£120</td>
<td>£50</td>
<td>-£340</td>
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</table>
2013 UK Wheat Record Kielder at 14.31t/ha
Maximum Field Yield Potential

Maximum yield potential

Delta & 1-4-ALL

Standard Agronomy

Fertiliser only

$\text{t/ha}$
Fertilizer

• Moving with the times?
• Splitting applications – Splitting the risk from leaching
• Three or four evenly split applications of Nitrogen
• Early applications of N with Sulphur?
• P and K applications or holidays?
• Surely that is all that is relevant
Nutrition

• Manganese, Magnesium, Zinc, Copper, Iron, Molybdenum, etc.

• Liebig's Law States

• “That yield is proportional to the most limiting nutrient, whichever nutrient it may be”

• Ignore this at your peril!
Smart Nutrition

• Using a targeted approach to identifying and helping the plant not suffer stress is the way forward
• If you have high PH soils you may have plenty of nutrients but most of them are locked up and unavailable to the plant
• Using smart nutrition can help unlock this problem
• Standing power and tillering capacity can be dramatically improved with smart nutrition
Treated Vs Untreated Rape 2
Standard Nitrogen

• Comparison between Delta and standard Nitrogen.

• The plant absorbs standard nitrogen in the NO3 form. A lot of this can be lost due to Volatilisation and leaching before it enters the plant.

• Standard Nitrogen takes 12 times as much energy for the plant to use it than Delta Nitrogen.

• Standard Nitrogen creates auxin growth in a plant.

• Auxin growth from standard Nitrogen causes apical dominance, elongated stems, small roots and less tillering.

• This type of growth habit needs a lot of growth regulators to create better roots and stronger stems.
Delta Nitrogen

• Delta Nitrogen does not leach or volatilise into the atmosphere. The special formulation blocks the bacterial and chemical break down.

• The plant uses 12 times less energy to absorb the Delta Nitrogen because it stay in the NH2 form and is instantly useable by the plant. This allows you to spray it on in freezing ground conditions.

• Delta Nitrogen makes the plant produce cytokinin growth.

• Cytokinlin growth from Delta produces shorter stem internodes, stronger stems and a much larger fibrous root system.

• Plants that have had multiple applications of Delta generally do not show visible symptoms of nutrient deficiencies, but can still be found to be short by tissue analysis.
Winter Barley
Tower
Nutrition – Autumn to Spring

1. DELTA (Stabilised N) + 1-4-ALL (Trace Elements)
   • Increased Root Mass
   • Increased Tillering
   • Stronger Stems
   • Reduced Disease Pressure
   • Foliar Applied and Tank Mixable
1-4-ALL

- A unique blend of micro-nutrients formulated with “Lightning Technology” to enhance the plant’s metabolic activity. Specifically designed to accompany Delta Nitrogen.
- **Contains:** 0.5% Copper, 1.5% Iron, 1.5% Manganese, 2.0% Zinc, 0.5% Magnesium, 2% Nitrogen.
- 1-4-ALL is light years ahead in micro-nutrient technology.
- The rates of nutrients in the blend seem small but the results of applying 1-4-ALL are outstanding in balancing up the deficiencies in the plant.
- A plant visually showing manganese deficiency does not mean it is not short of other nutrients.
Treated Vs Untreated Rape 1
**Stress free farming**

- TipTop, 1-4-ALL and Delta Nitrogen combination.

- The plant stress free solution to farming!

- Increasing the plant’s natural ability to fight disease.

- Larger roots to anchor the plant and scavenge more water and nutrients.

- Shorter stronger stems with larger leaves to absorb more sunlight.

- More tillers per plant.
Nutrition – Late Spring to Summer

1. Tip Top (20:20:20 + Trace Elements)
   • Help to Reduce Stress in the Growing Plant
   • Addressing Nutrient Deficiencies
   • High Potassium Demand from GS32-59
   • Light Interception
   • Foliar Applied and Tank Mixable
   • TipTop Pulse (0:30:40 + Trace Elements)
• **CalFlux and Rainbow Wave.**
  - Specifically designed to help a plant at flowering.
  - Calcium is a notoriously bad distributor round a plant. Most plants will not test deficient in Calcium but the plant will struggle to distribute it to the correct areas. The addition of Rainbow Wave (Boron and Molybdenum) to CalFlux helps with flower colour, pod survival and seed size.
  - In rape, peas and beans we have seen longer pods, a lot less abortion sites and generally a much greater yield with CalFlux applications.

• **Xstress**
  - 1-4-ALL with extra stress relief for the plant – Fruit, Vegetables and pulses best area for use, instead of 1-4-ALL
Thoughts to take away

• Cultivation, Seed Rate, Drilling Time
• Field Evenness
• Smart Nutrition
• Growth Habit
• Plant Health
• High K Demand
• Yield Potential
• Weather
• Leave no stone unturned for maximising yield
Closing Comments

Philip Dolbear
Thank you!
Enjoy lunch and safe journey home