

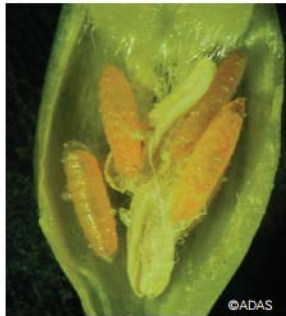
syngenta

Genetic pest resistance in wheat ~ is it possible?

Tracy Creasy, Conventional Cereal Asset Manager, Europe North



OWBM – a success story



Orange wheat blossom midge larvae



Orange wheat blossom midge damage



Orange wheat blossom midge laying eggs

Resistant varieties



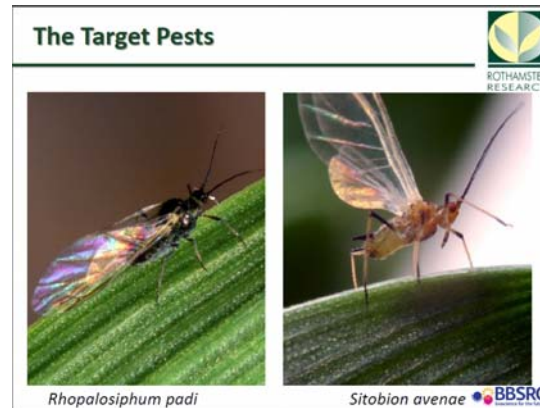
Wound plugs in developing grain of resistant variety

| YIELD, AGRONOMY AND DISEASE RESISTANCE | | | | | | | | | | | | | | |
|---|-------------|---------------|------------|------------|-------|--------------|-----------|-------|----------|--------|------------|------------|--------------|-------------|
| | RECOMMENDED | C | C | NEW | NEW | | NEW | C | | | | | | |
| | AHDB | Skyfall | KWS Barrel | KWS Basset | Zulu | LG Sundance | LG Motown | Leeds | Viscount | Myriad | KWS Kerrin | Reflection | KWS Santiago | KWS Crispin |
| End-use group | | nabim Group 3 | | | | Hard Group 4 | | | | | | | | |
| Scope of recommendation | UK | UK | UK | UK | UK | UK | UK | UK | N | N | E&W | UK | E&W | UK |
| Fungicide-treated grain yield (% treated control) | | | | | | | | | | | | | | |
| United Kingdom (10.7 t/ha) | 101 | 103 | 100 | 99 | 104 | 103 | 102 | 100 | 99 | 106 | 103 | 103 | 103 | 103 |
| East region (10.8 t/ha) | 100 | 102 | 101 | 99 | 103 | 103 | 102 | 99 | 99 | 106 | 103 | 104 | 103 | 103 |
| West region (10.7 t/ha) | 101 | 102 | 99 | 98 | 104 | 102 | 100 | 99 | 98 | 105 | 105 | 102 | 104 | 104 |
| North region (9.9 t/ha) | 101 | 109 | 101 | 102 | [102] | [104] | 104 | 103 | 103 | [110] | 104 | 104 | 98 | |
| Untreated grain yield (% treated control) | | | | | | | | | | | | | | |
| United Kingdom (10.7 t/ha) | 82 | 74 | 76 | 76 | 90 | 89 | 71 | 71 | 70 | 84 | 76 | 69 | 88 | |
| Agonomic features | | | | | | | | | | | | | | |
| Resistance to lodging without PGR (1-9) | 8 | 8 | 7 | 6 | 7 | 6 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 7 |
| Resistance to lodging with PGR (1-9) | 8 | 8 | 8 | 7 | 7 | 7 | 8 | 7 | 7 | 7 | 8 | 7 | 7 | 7 |
| Height without PGR (cm) | 82 | 83 | 85 | 89 | 87 | 84 | 86 | 81 | 89 | 84 | 81 | 86 | 85 | |
| Ripening (days +/- JB Diego, -ve = earlier) | 0 | +1 | +1 | +1 | +1 | -1 | +2 | 0 | +1 | +1 | -1 | +1 | +1 | |
| Resistance to sprouting (1-9) | 4 | [6] | [6] | [6] | 6 | - | - | 6 | 5 | [6] | - | [5] | 5 | [5] |
| Disease resistance | | | | | | | | | | | | | | |
| Mildew (1-9) | 6 | 6 | 5 | 7 | 6 | 8 | 3 | [7] | 6 | 7 | 6 | 5 | 9 | |
| Yellow rust (1-9) | 6 | 8 | 8 | 5 | 9 | 9 | 6 | 6 | 4 | 7 | 3 | 6 | 9 | |
| Brown rust (1-9) | 9 | 6 | 5 | 4 | 6 | 7 | 5 | 8 | 5 | 7 | 9 | 5 | 5 | |
| Septoria nodorum (1-9) | [5] | [5] | [6] | [6] | [6] | [6] | [6] | [6] | [5] | [6] | [5] | 5 | [6] | |
| Septoria tritici (1-9) | 6.0 | 4.4 | 5.4 | 5.7 | 7.3 | 5.8 | 4.6 | 4.6 | 5.5 | 5.2 | 5.4 | 4.3 | 5.9 | |
| Eyespot (1-9) | 6@ | 4 | 5 | 4 | [3] | [3] | 4 | 5 | 5 | [5] | 5 | 4 | 4 | |
| Fusarium ear blight (1-9) | 7 | 6 | 6 | 6 | 6 | 6 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | |
| Orange wheat blossom midge | R | R | R | R | R | R | R | R | R | R | R | R | R | R |

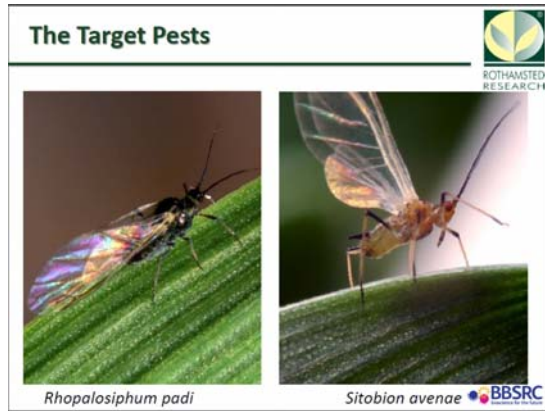
- Resistant varieties in all quality groups
- All varieties have same resistance gene
- Risk if pest overcomes resistance
- Integrated control required for susceptible varieties

Other genetic resistances present in modern wheat

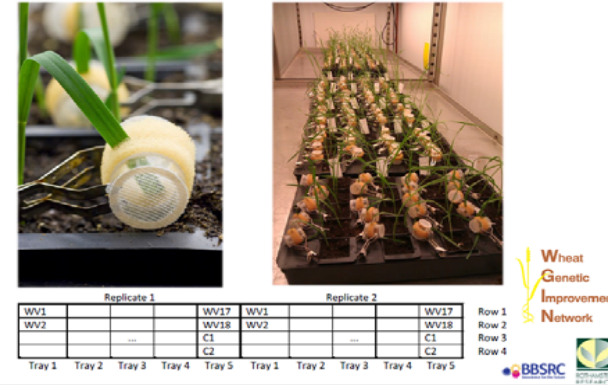
- Genetic resistance does exist for some other insect pests
 - Russian Wheat Aphid
 - Hessian Fly
 - Saw Fly
- There is no genetic resistance in modern wheat for two of the UKs most important pests



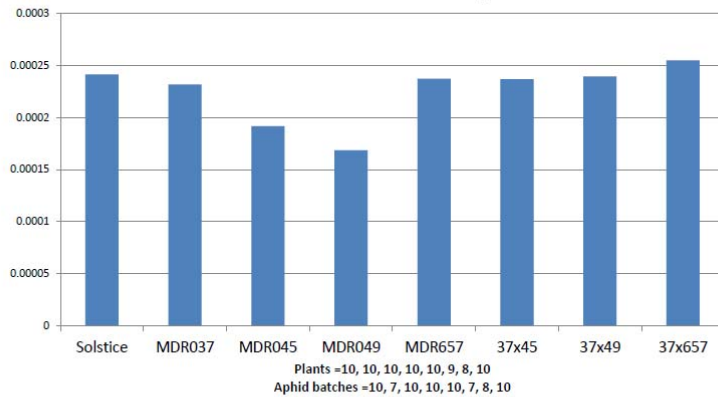
Aphid resistance – the challenge



- F1 generations of crosses, MDR037 x MDR045, MDR049 and MDR657, tested in the phenotyping screen against both aphid species



Rhopalosiphum padi mean nymph weight (mg) after 6 days on *T. monococcum* parental lines and F₁ crosses

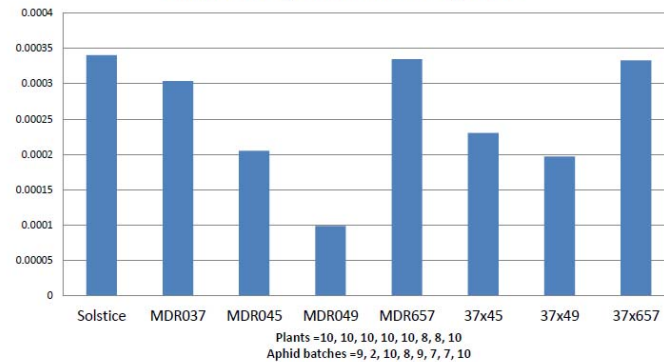


Nymphs produced on MDR045 and MDR657 – plants older?

Wheat Genetic Improvement Network



Sitobion avenae mean nymph weight (mg) after 7 days on *T. monococcum* parental lines and F₁ crosses



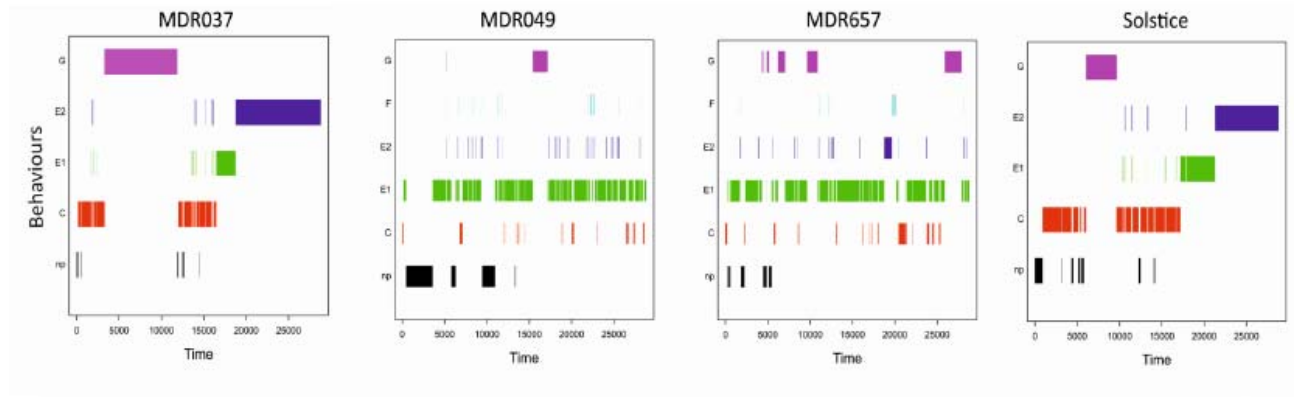
Wheat Genetic Improvement Network



Lower feeding and nymph production

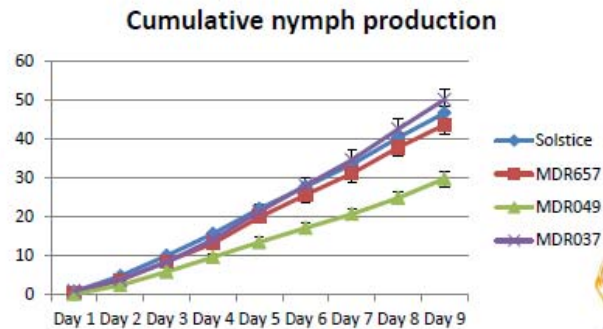
Reduced feeding by *R. padi* in EPG bioassays in WISP

Behaviours: np: not probing, C: pathway phase, E1: salivation, E2: phloem ingestion (feeding), F: derailed stylet mechanics, G: xylem ingestion (drinking)



Reduced fecundity of *R. padi*

no nymphs produced on MDR045



Summary

- Genetic resistance does exist in modern UK wheat to some insect pests
- Insect resistance is not currently perceived to be a priority when choosing which variety to drill
- Some element of aphid resistance is possible but not in the immediate future
- Possible resistances identified so far lead to reduced feeding and reduced nymph production – but does not stop feeding entirely
- Virus transmission will still be a key problem
- There is no ‘quick fix’ from conventional wheat breeding
- UK wheat growers will continue to require chemistry to ensure adequate wheat supply