

Can artificial intelligence be integrated into pest monitoring schemes?

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PESTS & AGRICULTURE

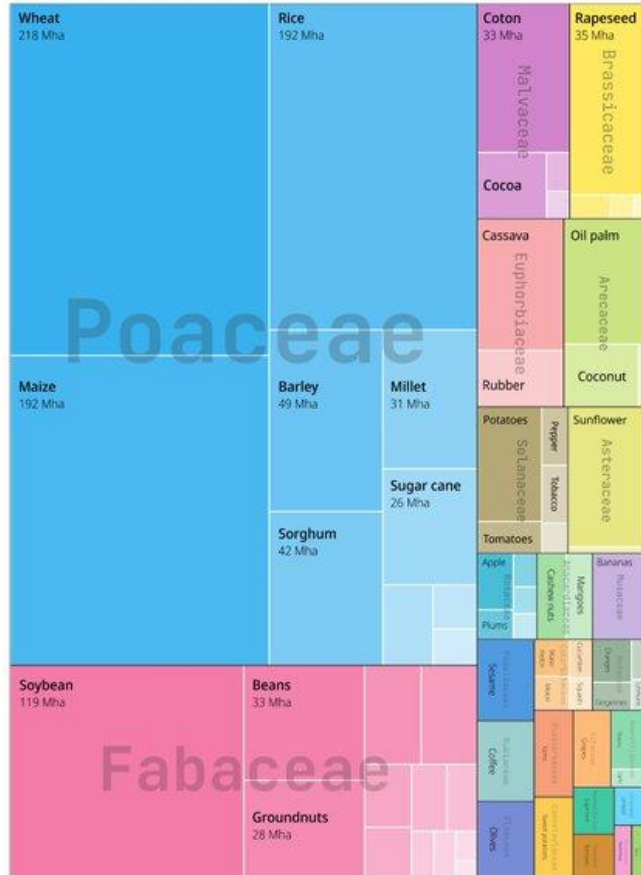


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Crops of the World

The size of each species is proportional to harvested area.



Data FAOStats (average from 2011 to 2021) | Plot Benjamin Nowak

Benjamin Nowak

- Wheat provides ~25% of daily calories in the UK
- Annual barley production adds ~£1.8bn to the UK economy
- Cereal crops are attacked by a range of insect pests
- Pests can reduce yields by 5-80%
- Reducing yield loss to pests is important for crop protection

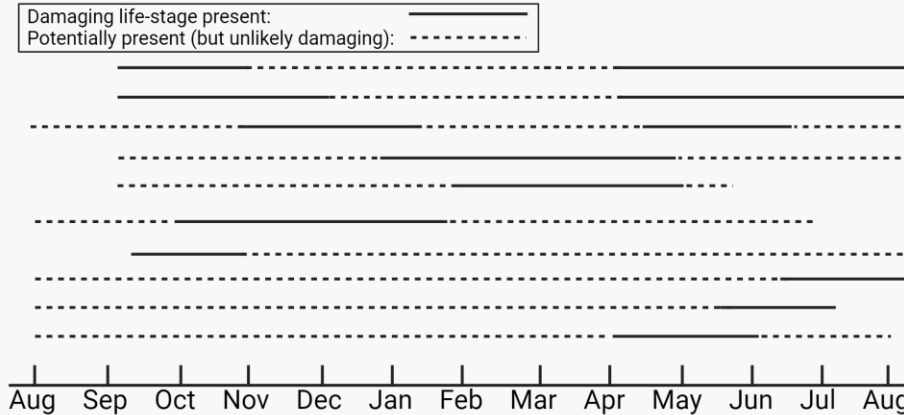
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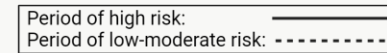
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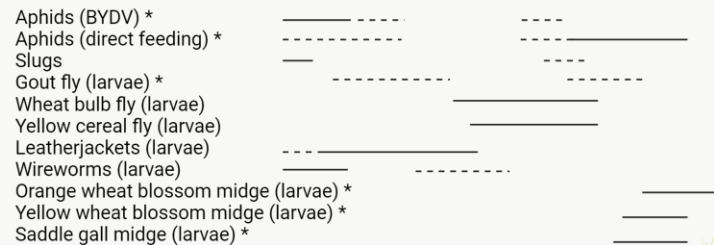
Main period of insect activity



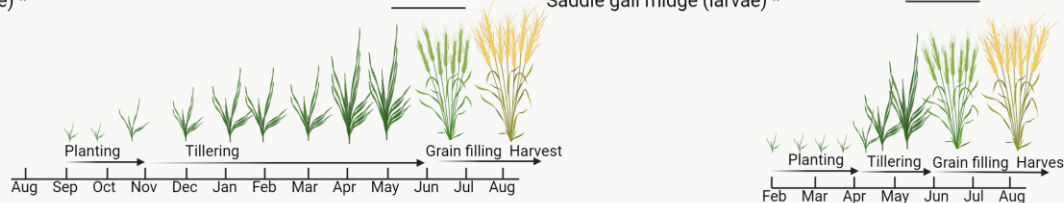
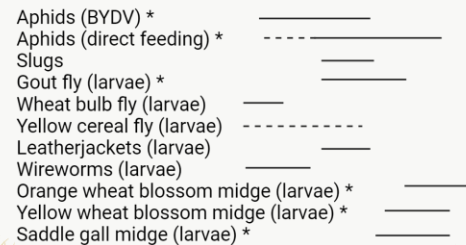
Main period of crop risk



Winter wheat



Spring wheat

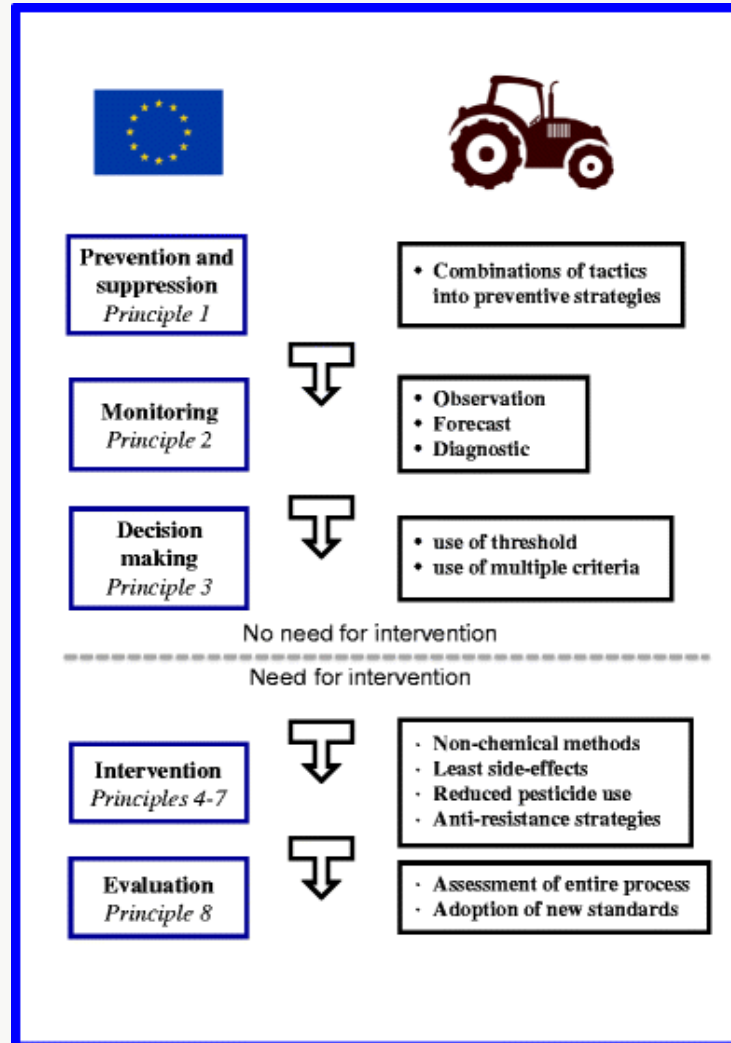


- Different pests are active at different periods throughout season
- Economic damage only occurs when pests reach certain density
- Crops can tolerate some pests through mature plant resistance
- All these interact to create a “risk window”

PESTS & AGRICULTURE: INTEGRATED PEST MANAGEMENT



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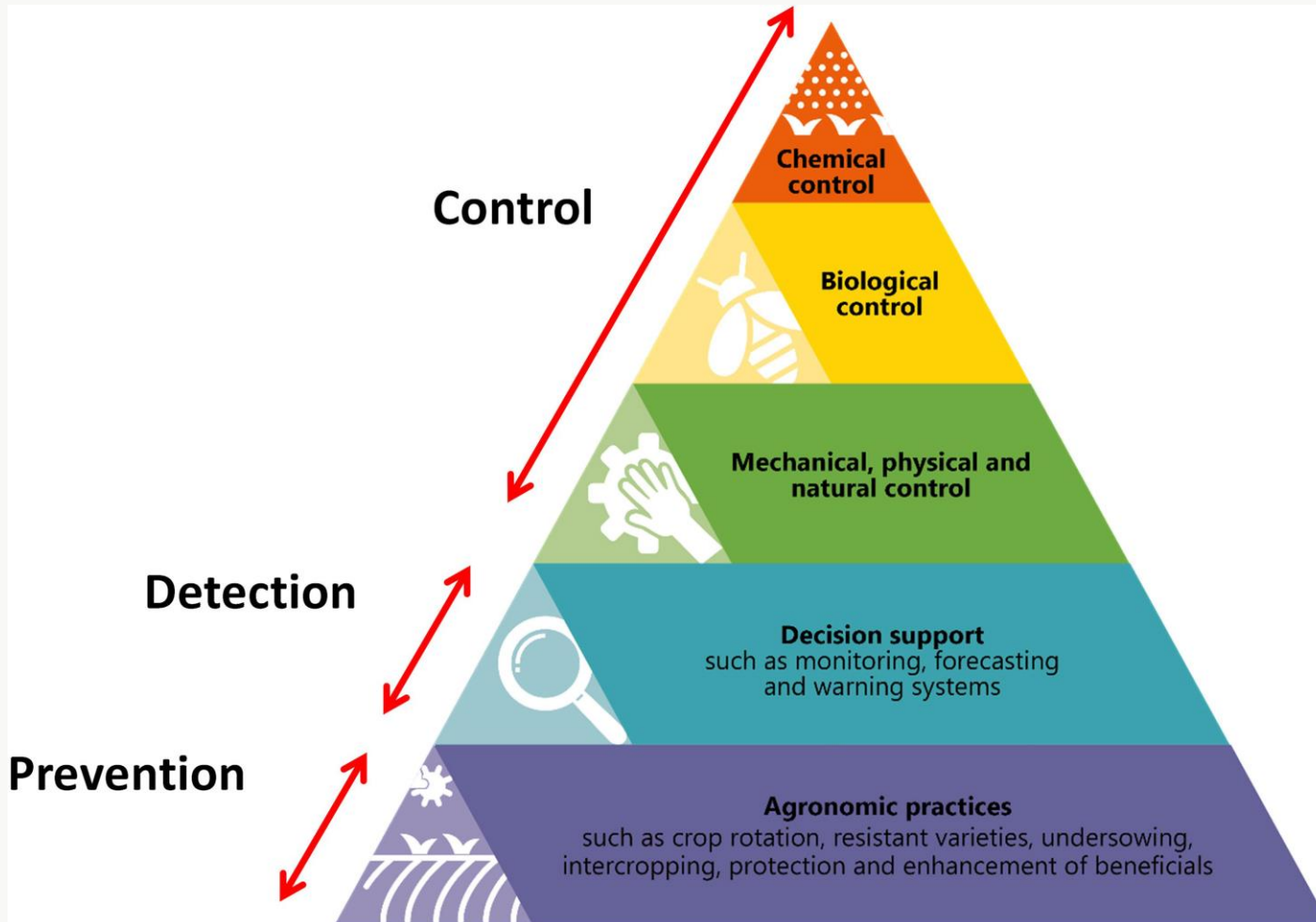


- Integrated pest management aims to increase sustainability
- Reduce reliance on chemicals through implementation of multiple techniques
- Eight core principles underpin this

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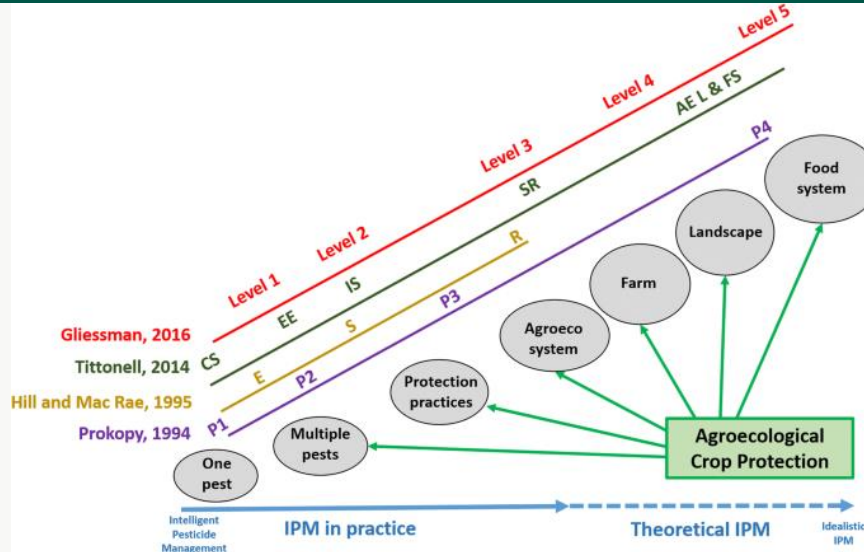


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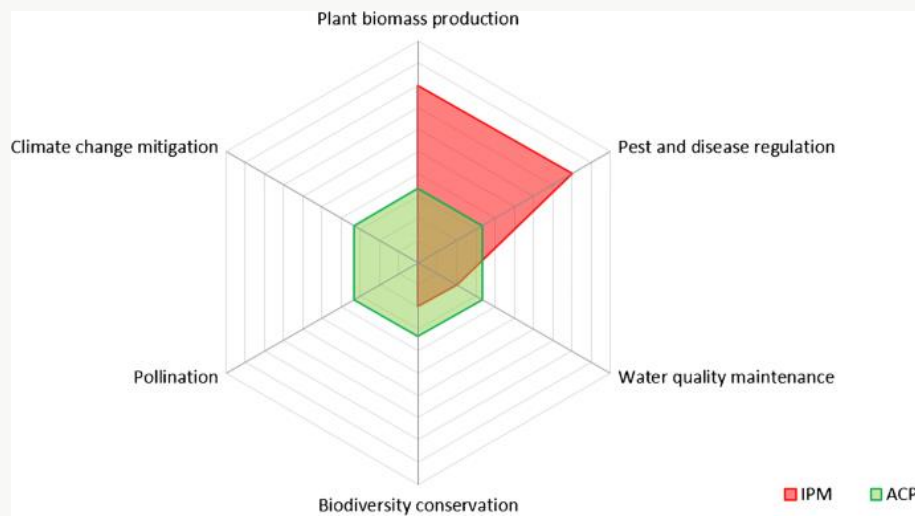
PESTS & AGRICULTURE: AGROECOLOGICAL CROP PROTECTION



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- IPM often only considered for individual pests – the best approach?
- Promotes crop protection via agroecological processes
- A more holistic approach that considers the entire agricultural system
- Interventions and strategies at each level will impact other levels (including pest management)

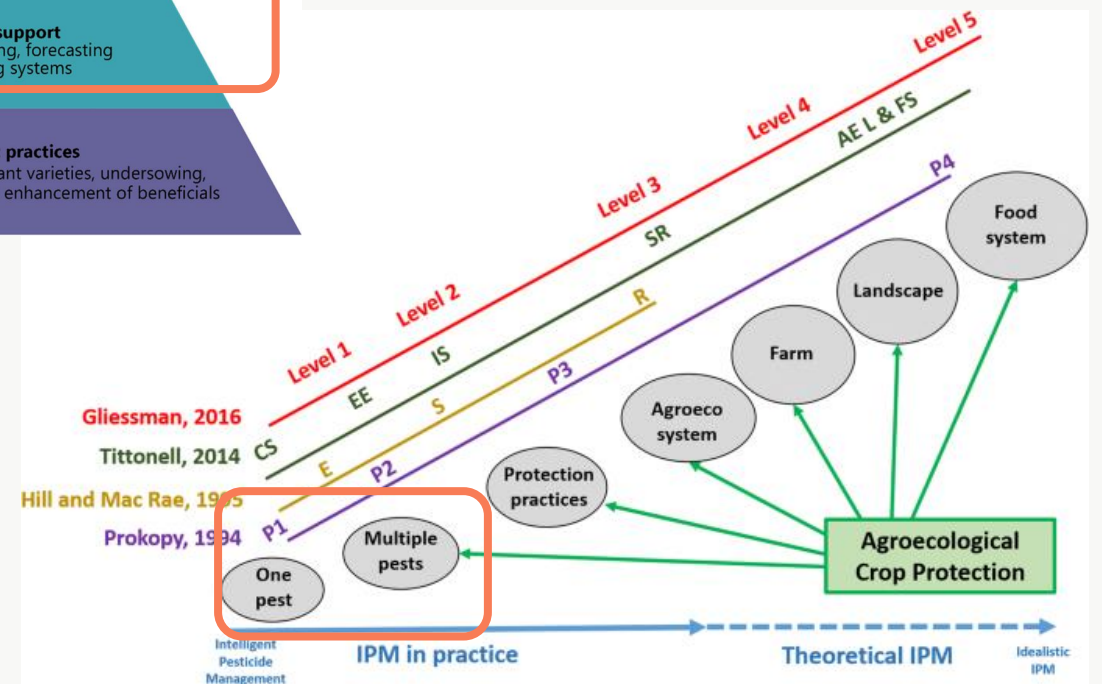
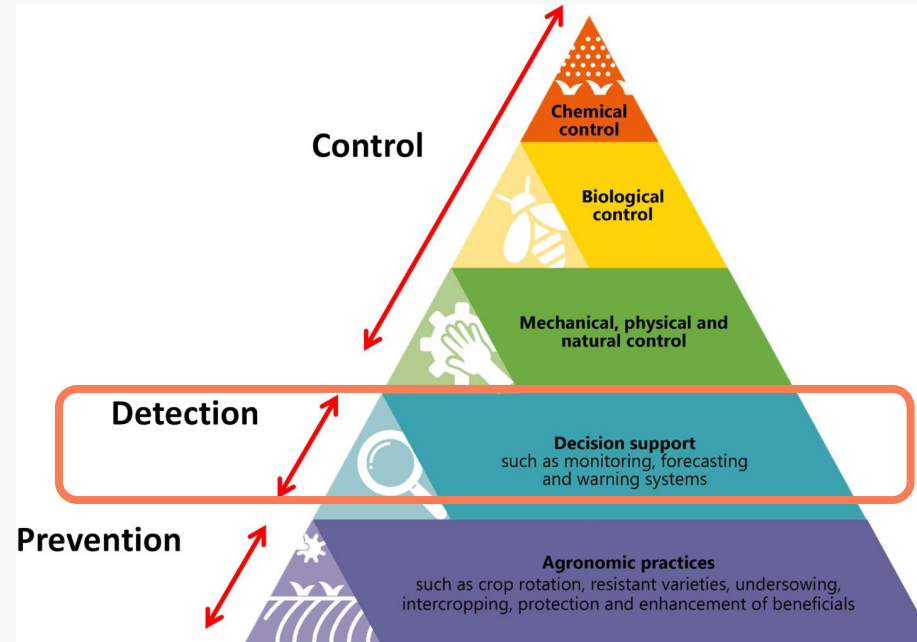
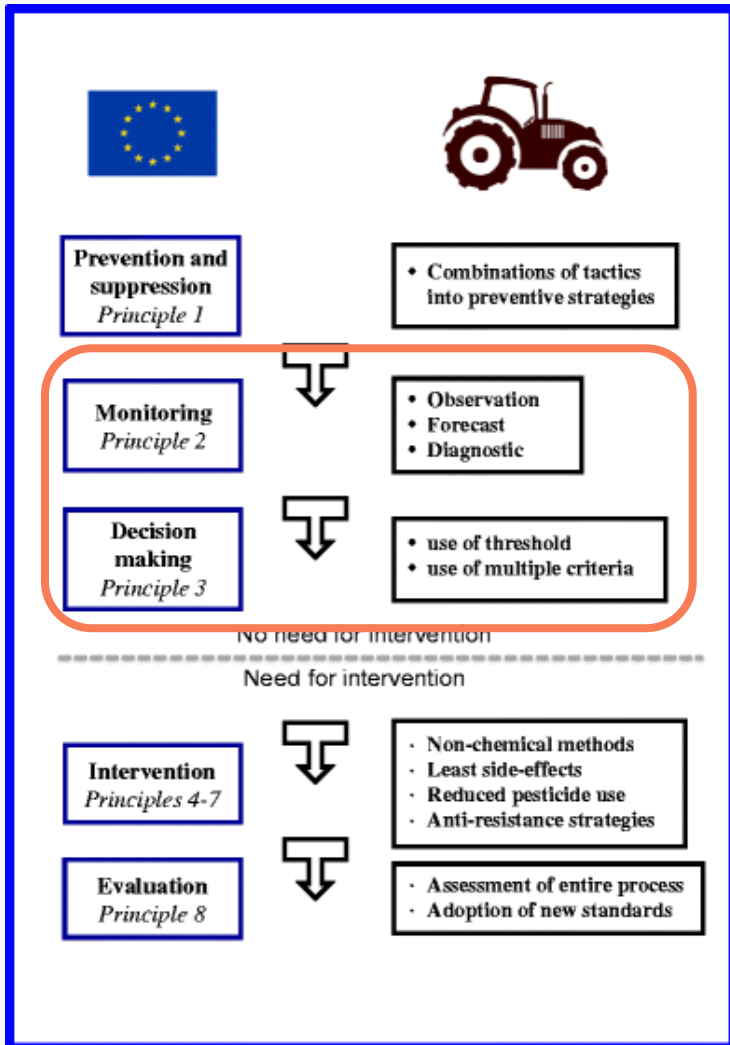


Deguine et al., 2021. *Agronomy for Sustainable Development*

USING AI TO SUPPORT PEST MANAGEMENT



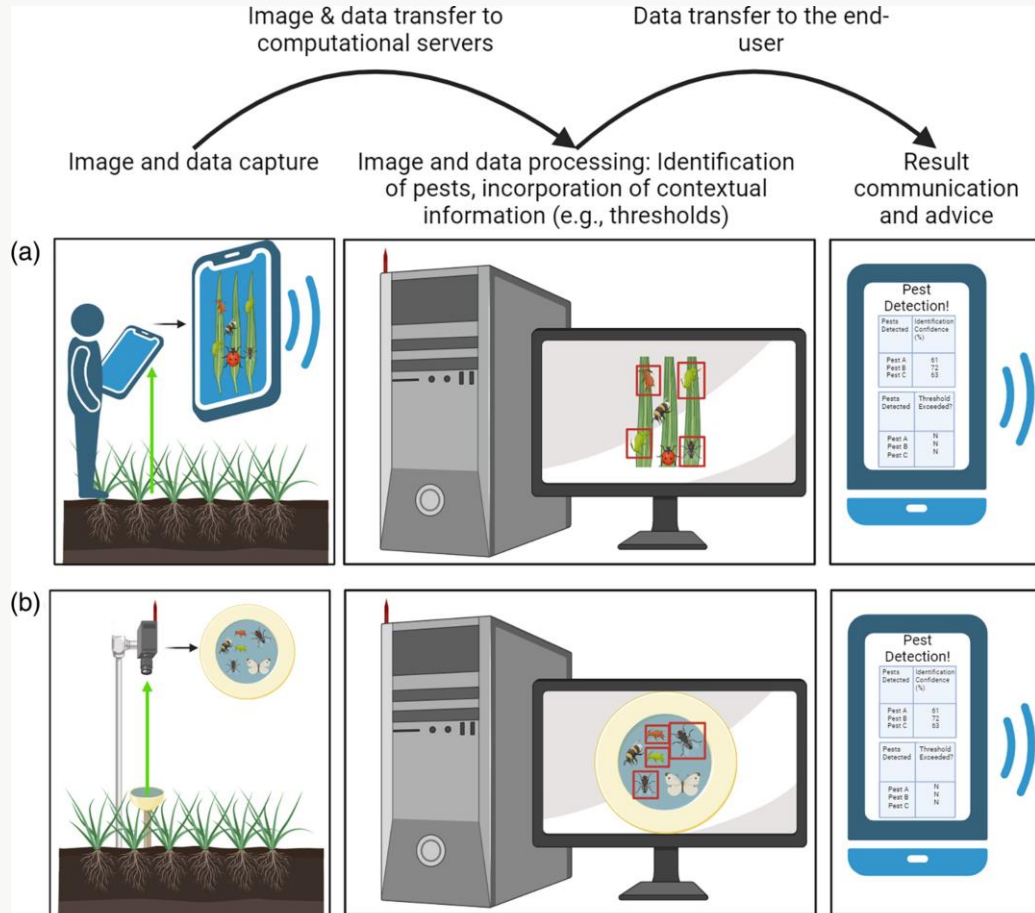
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USING COMPUTER VISION TO SUPPORT PEST MANAGEMENT



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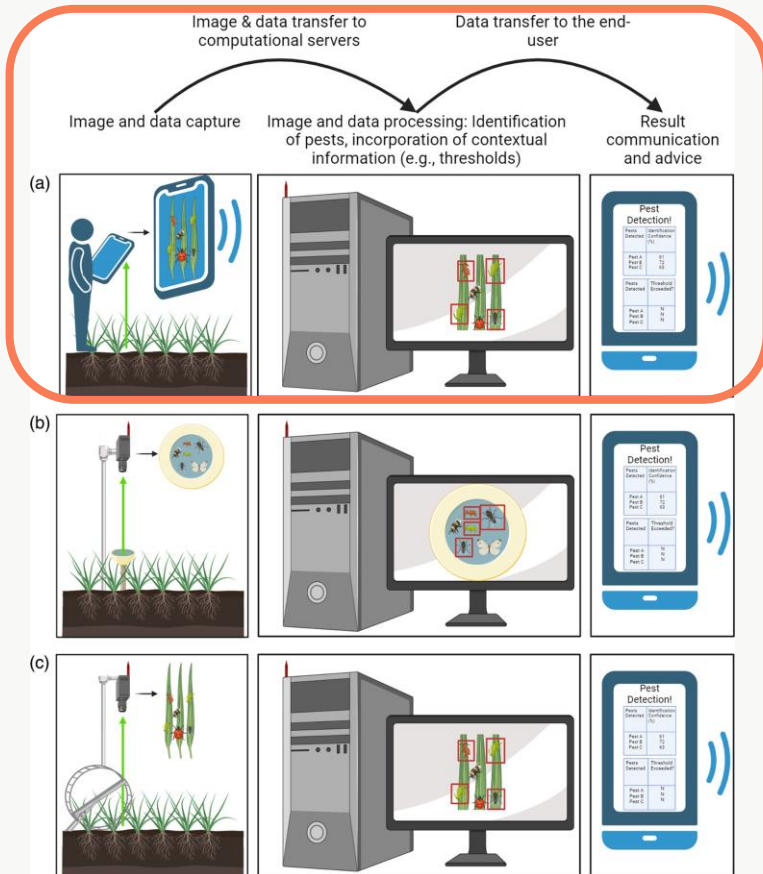
Imaging and AI for real-time on-farm pest monitoring:

- Supports “detection” principle of IPM
- Quantification can support use of thresholds
- Integrating decision models can provide advisory element
- Additional contextual information can support management

USING COMPUTER VISION TO SUPPORT PEST MANAGEMENT



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Key obstacles:

1. Model effectiveness
2. Functionality under field conditions
3. Level of computational expertise and power needed
4. System mobility

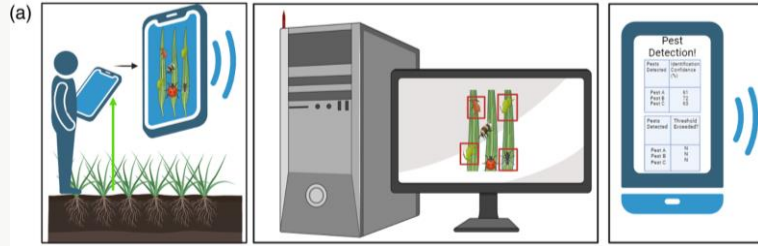
Four criteria for system development:

1. Based on accurate and precise models
2. Adaptable and useable under real-world scenarios
3. User-friendly, device-driven, low-cost
4. Mobile, deployable

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	IP102	AgriPest	Our dataset
Num. of samples	19,167	1000	4270
Num. of objects	22,284	6325	8303
Num. of classifications	97	2	11
Max. Num. of a category	2975	4755	5575
Min. Num. of a category	2	1570	3
Avg. object pixels pct.	37.27	0.08	0.13

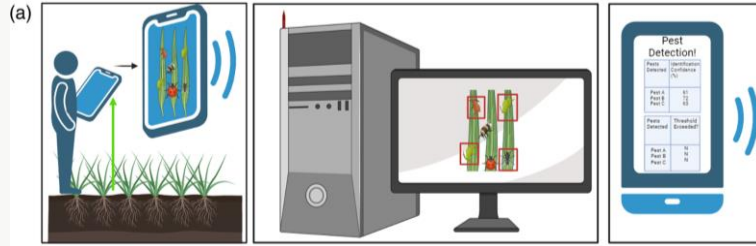
- ~73% model accuracy (Yolo v8-M)



USING COMPUTER VISION TO SUPPORT PEST MANAGEMENT

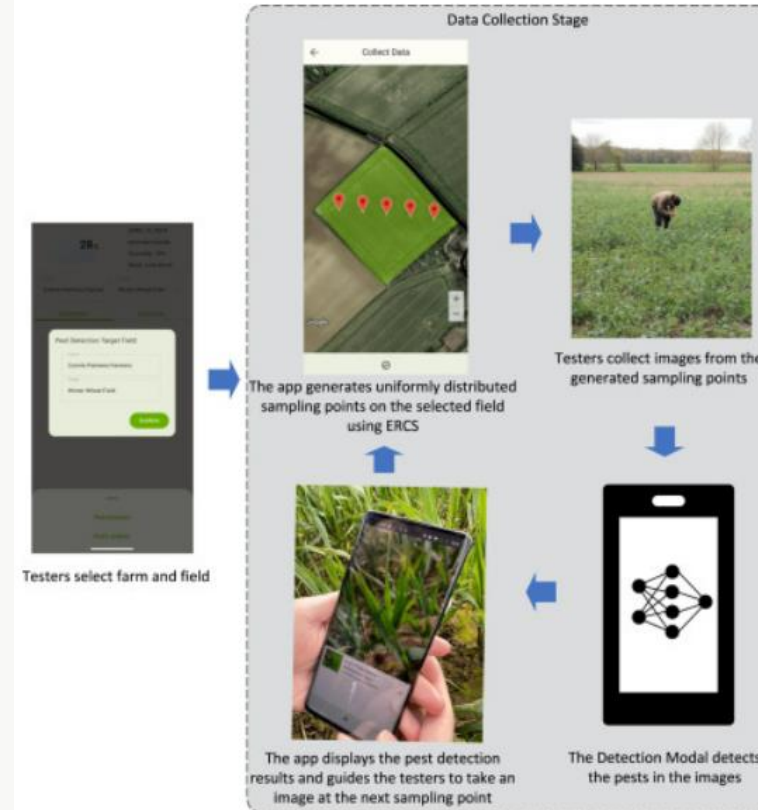


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Advice

Context Info

Location	Test Field 1
Pest Density	100/m ²
Crop Name	Winter Wheat
Crop Growth Stage	gs61
Advice Available	Yes

After assessing the pest density of the grain aphids in your cereal crop and considering the environmental conditions in the UK (temperate climate), management measures are necessary to prevent further damage to your crop.

Considering the moderate density of 100 grain aphids per square meter, integrated pest management (IPM) practices are recommended for sustainable control. Here are some control suggestions:

SUMMARY



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Can artificial intelligence be integrated into pest monitoring schemes?

- Yes – probably!



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