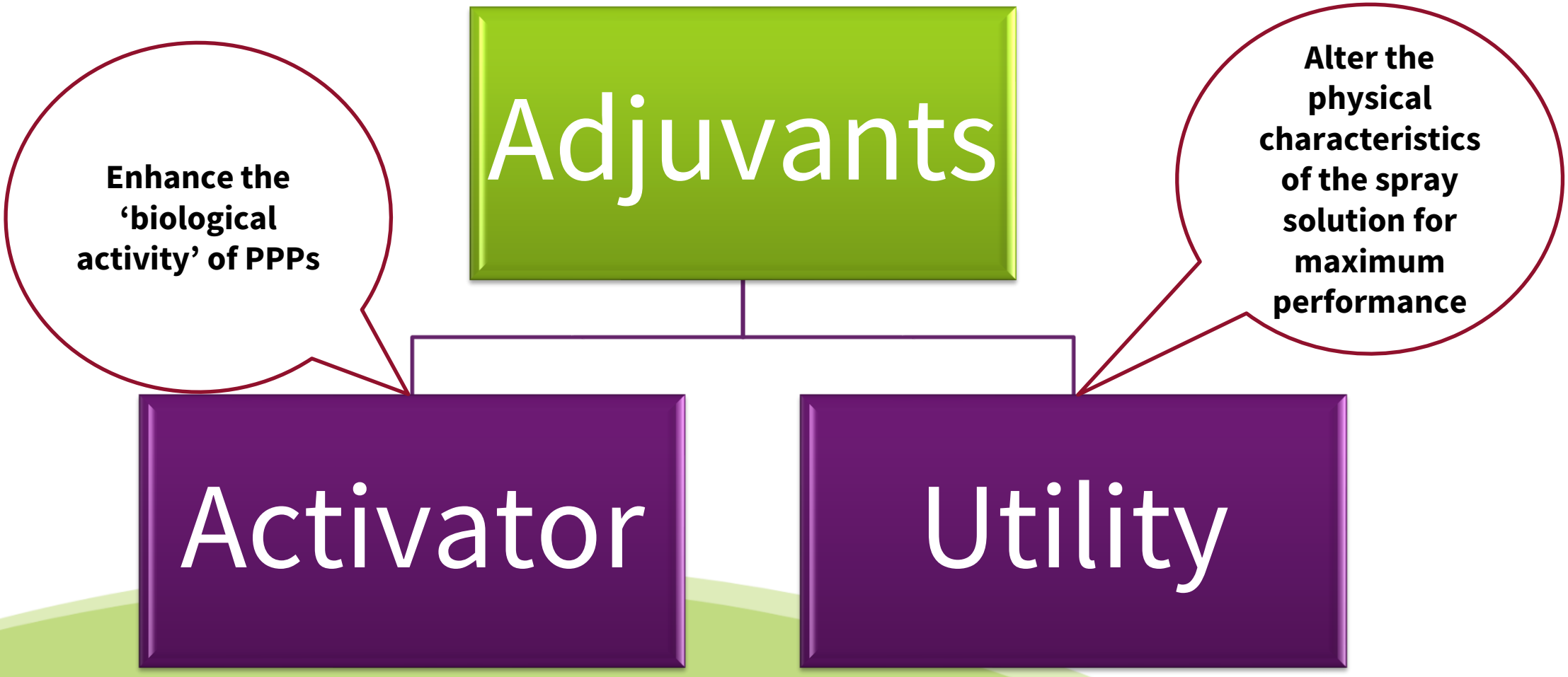
Types of adjuvants and their properties

Selchuk Kurtev, Zest Sustainable ICM

What I will cover

- **Adjuvant groups and types**
- **Adjuvant properties and adjuvant tree**
- **Surfactants and oils**
- **Examples of utility adjuvants**

Adjuvant groups



Adjuvant groups

Activators

Biological activity

Surfactants

- Non-ionic surfactants
- Organo-silicons
- Acidifying surfactants

Oils

- Mineral oil
- Vegetable oil
- Methylated Seed oil

Liquid fertilisers

-Urea

- Ammonium sulphate

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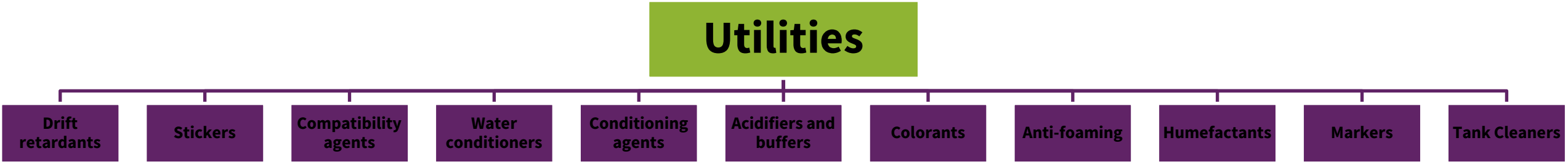
Adjuvant groups – utility adjuvants



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Adjuvant properties

Utility

Drift retardants – aid droplet size control

Stickers – improve retention and could aid with anti-transpiration

Compatibility agents – enables uniform mixing of liquid fertilisers and pesticides mixtures

Water conditioners – used to adjust water parameters according to pesticide needs, ion control

Conditioning agents – help pesticides with key physical parameters e.g. solubility, stability etc.

Acidifiers and buffers – reduce lock up of pesticides in hard water

Colorants - neutralise colouring potential of active substances

Anti-foaming – prevent foaming in tank and reduce diffusion at spraying nozzles

Humefactants – reduce evaporation from sprayed surface to retain activity for longer

Markers - help with recognition of sprayed vs unsprayed areas as well as identify coverage

Tank Cleaners – prevent active substance binding to sprayer parts

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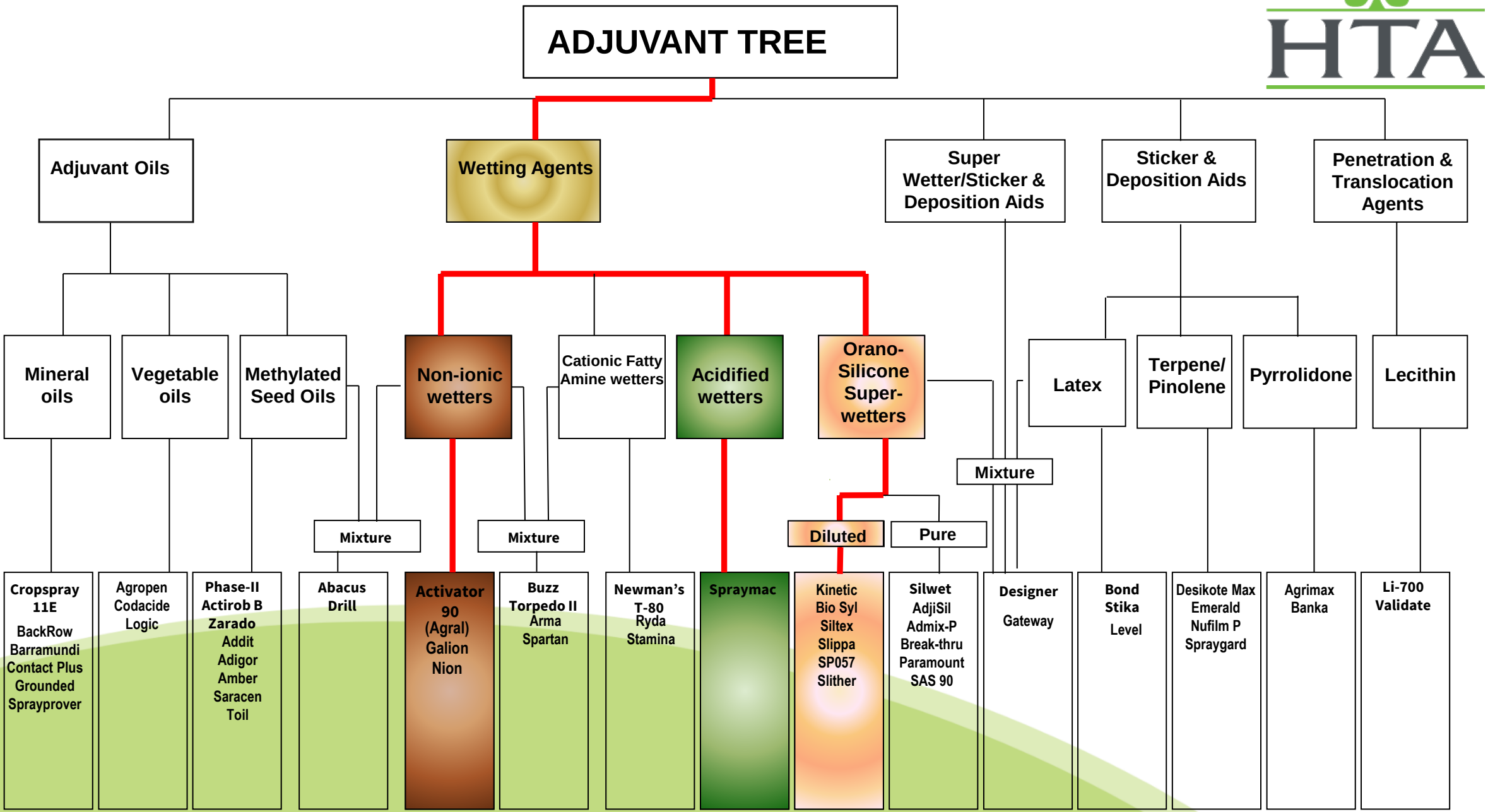
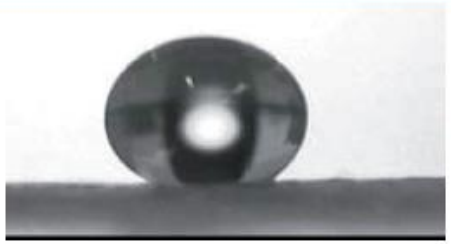
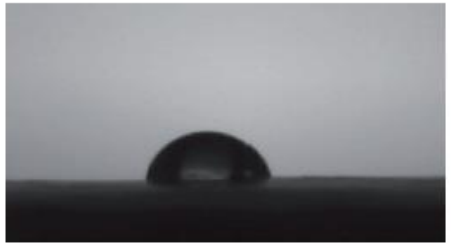
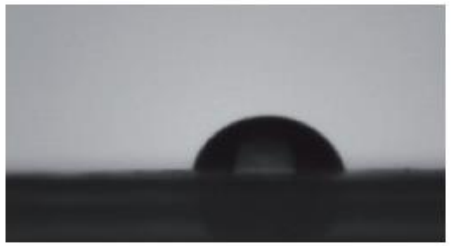
ADJUVANT TREE

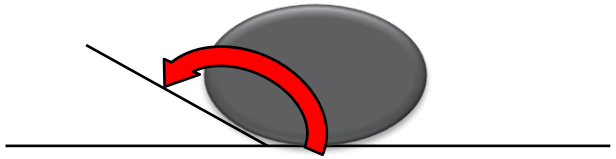


Spray droplets

Plant organ and species	Average contact angle with pure H_2O (°)	Drop image
Adaxial side of *Eucalyptus globulus* leaf	140	
Adaxial side of *Ficus elastica* leaf	83	
'Calanda' Peach (*Prunus persica* L. Batsch)	130	
Apple (*Malus domestica* L. Borkh) fruit surface	84	

contact angle

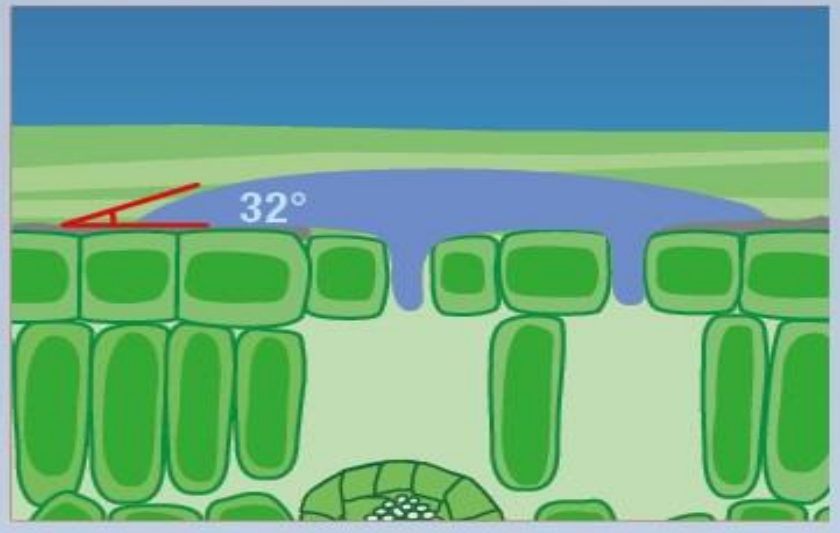
e.g. 140°



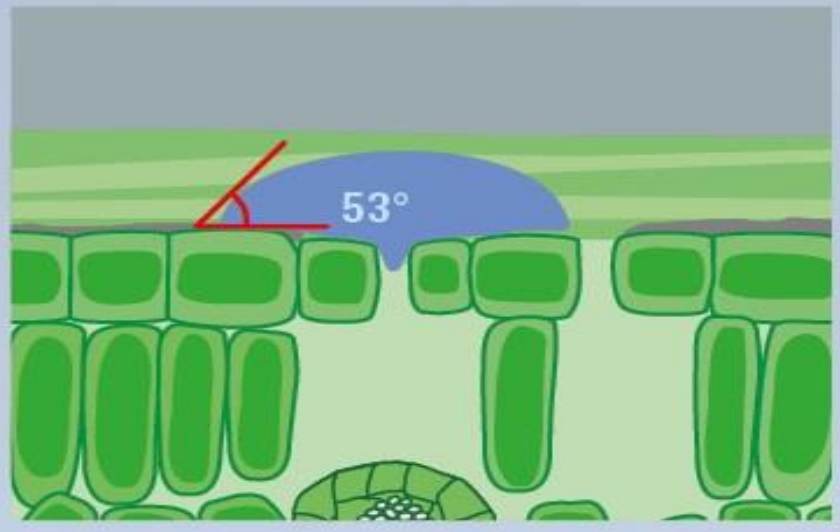
Surfactants – activator adjuvants

Surfactants:

With surfactants



Without surfactants



Surfactants increase the covered surface area, reduce the contact angle of the spray droplet and promote penetration of nutrients and active ingredients.

BENEFIT: Better coverage, better efficiency of foliar fertilizers and pesticide

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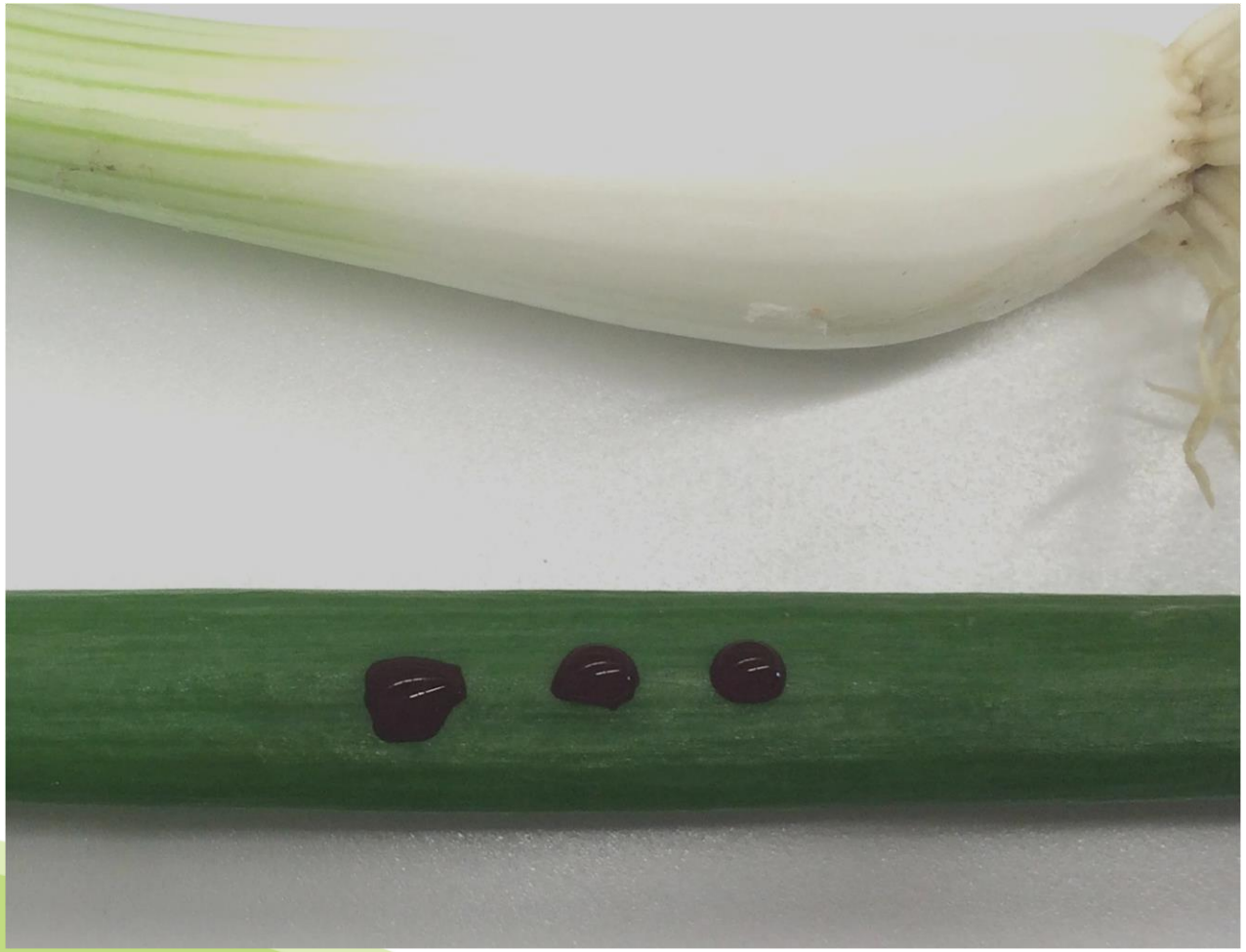
Surfactants – activator adjuvants



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Surfactants – activator adjuvants

Non-ionic

- Activator 90
- Transact
- Mixture B NF
- Intracrop Questor
- Intracrop Saturn
- Planet
- Solar
- Spraymac and X-Wet

Cationic

- Jogral
- Ryda

Organo-silicones

- Kinetic
- Bio Syl
- Siltex
- Slippa
- SP057
- Slither
- **Silwet – L77**
- **AdjiSil**
- **Admix-P**
- **Break-thru**
- **Paramount**
- **SAS 90**

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Surfactants – organo-silicones

Can you explain this? – time for an experiment….

☺

Adjuvant oils

Mineral

- Cropspray 11E
- Newman Cropspray Oil 11 E
- BackRow
- Barramundi
- Contact Plus
- Grounded
- Sprayprover

Vegetable

- Agropen
- Codacide
- Logic

Methylated

- Phase-II
- Actirob B
- Zarado
- Addit
- Adigor
- Amber
- Saracen
- Toil

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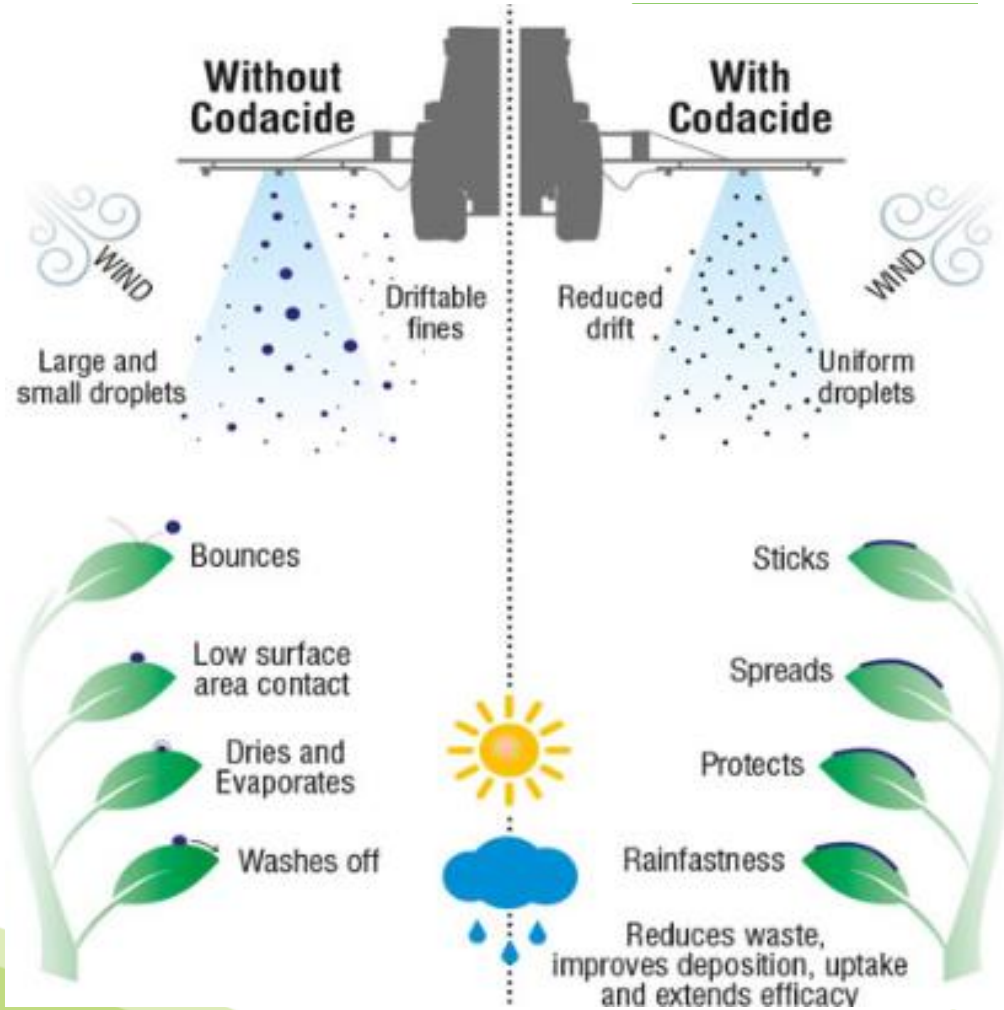
Adjuvant oils

- Often cheaper solutions
- Some risk on ornamentals, especially in protected crops
- Very good with pre-emergence herbicides
- Methylated and mineral oils useful with insecticides
- Can leave shiny deposits
- Exposure to windy conditions can result in damage
- Caution when fungicides based on minerals used afterwards



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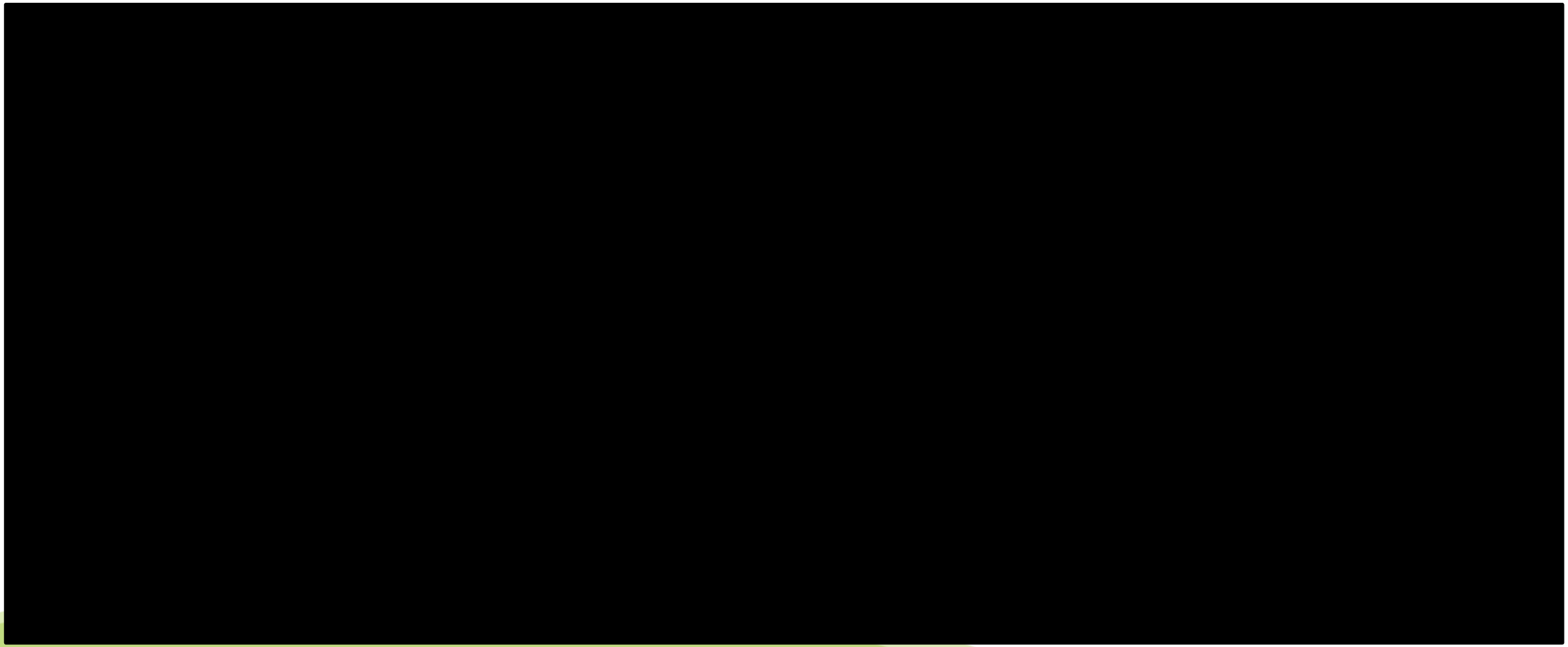
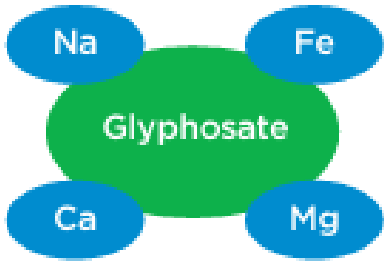
Adjuvant oils



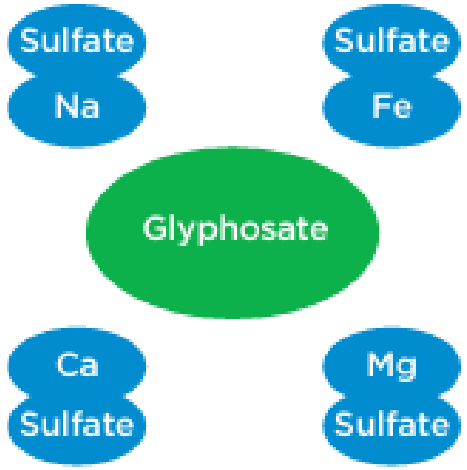

Surfactant
Ampersand

Utility adjuvants

- Aimed at the sprayer operator
- These tend to be forgotten but make a huge difference to product performance
- Knowledge is required to utilise their potential
- Most commonly used are markers, anti-foaming agents, tank cleaners
- Not recommended by agronomists often
- In ornamentals - concerns over the phytotoxicity



Without a water conditioner, calcium, sodium, iron and magnesium ions are tied up with the glyphosate, rendering the glyphosate useless.



When adding a water conditioning agent such as AMS, the sulfate in ammonium sulfate ties up hard water ions, allowing the glyphosate to be free, attaching to a nitrogen, creating glyphosate N, and easily taken up by the plants.

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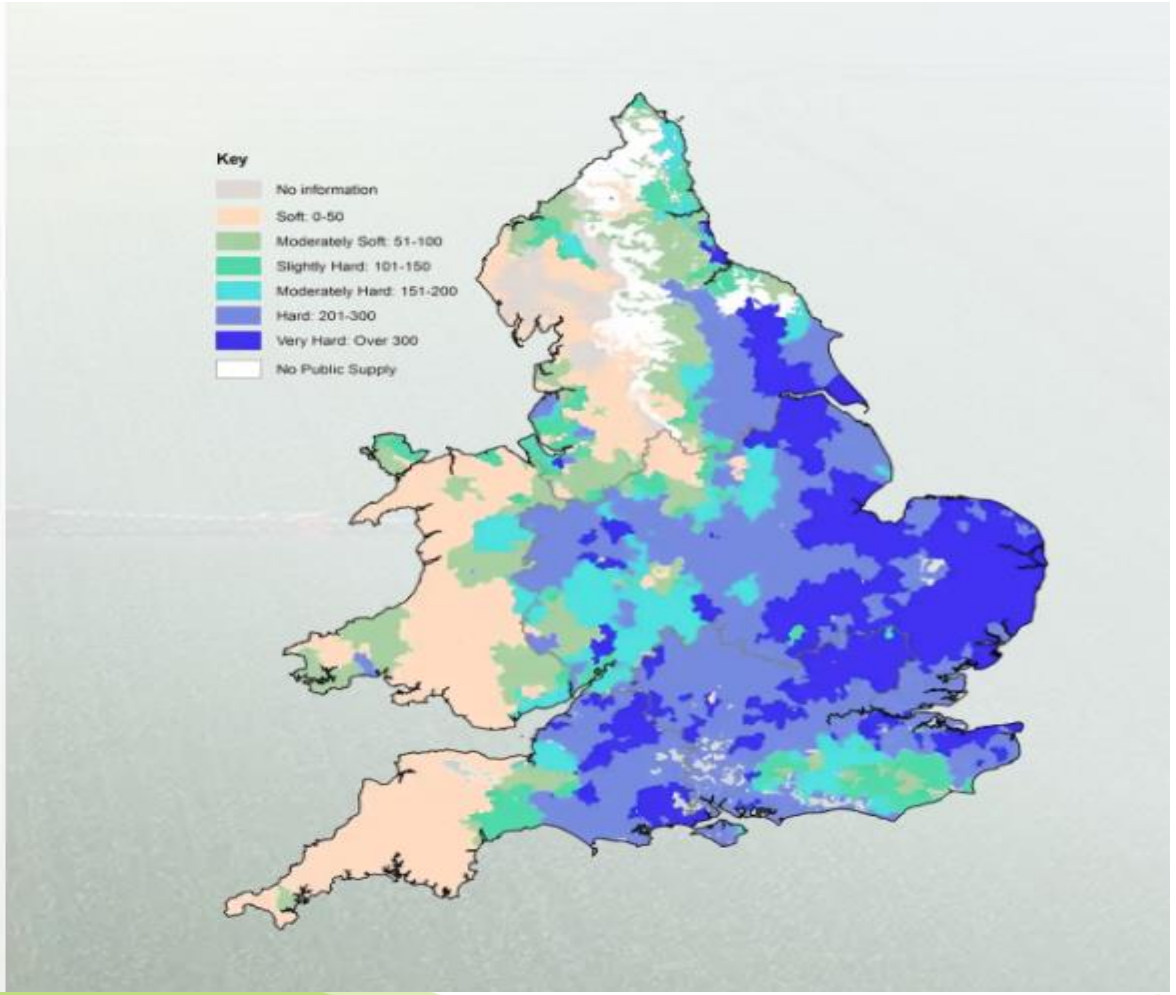
Utility adjuvants – water conditioners

Dissolved Minerals in Hard Water

Hard water has a high concentration of dissolved minerals. Water gains the property of hardness as it percolates through the soil profile and its parent material dissolving the minerals present into their constituent ions .

Where the ion carries a negative charge they are known as anions. Where the ion carries a positive charge they are know as cations, and it's the presence of calcium (Ca^{2+}) and magnesium (Mg^{2+}) that give the greatest contribution to water hardness.

Many areas of the UK have a hard water supply, and these areas correlate with the main combinable crop production regions of the UK. This is also the area that the greatest % of crop protection products are used and why water hardness is so important to consider.



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Utility adjuvants – water conditioners

X-Fusion

DE SANGOSSE

Solutions of FLiPPER

Water Hardness = 300 ppm CaCO3 equivalent

FLiPPER (de-ionised water)

pH = 9.62

FLiPPER (hard water (200ppm CaCO3 equivalent))

pH = 9.81

FLiPPER (hard water (300ppm CaCO3 equivalent))

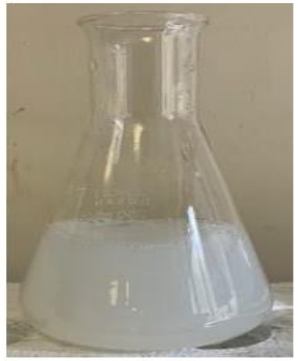
pH = 9.71

FLiPPER + X-Change 0.1% v/v

pH = 8.23

FLiPPER + X-Change 0.25% v/v

pH = 7.24



FLiPPER + X-Fusion 0.1% v/v

pH = 9.69

FLiPPER + X-Fusion 0.25% v/v

pH = 9.83

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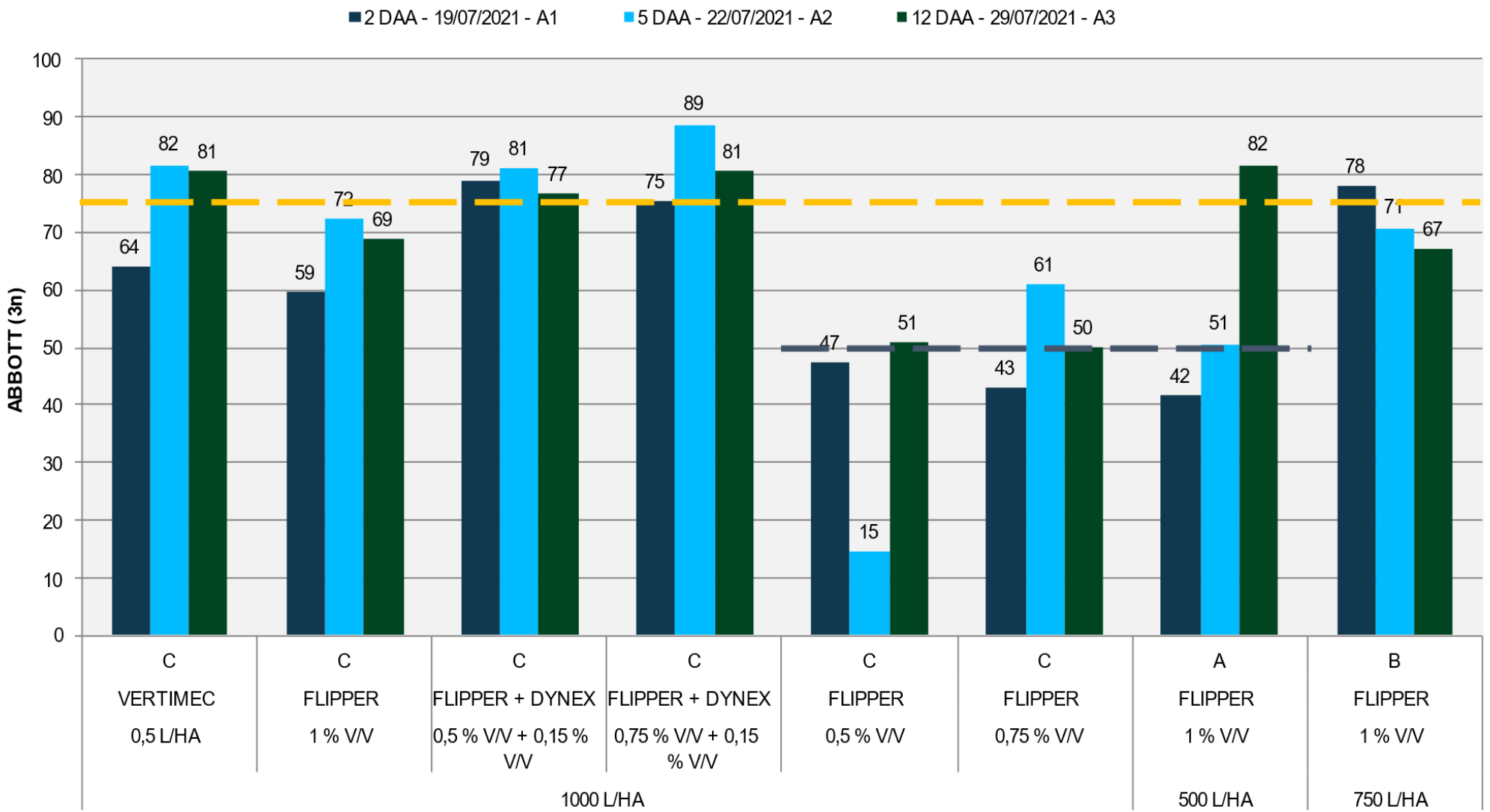
Efficacy of Flipper against VASASD in apple

IP21NLDAP2P005 (IP21EUR03CRR) Internal

efficacy on Aculus schlechtendali (apple rust mite), count number of motile adults on 20 leaves

In soft water situation, ~10 – 20% uplift in efficacy of FLiPPER with the addition of Dynex / X-Fusion v's 1% FLiPPER solo



APPLICATION DATA
ABC: BBCH 75 (17 -jul)

FIELD, CROP DATA
MABSD (ELSTAR)

UNTREATED (VASASD)
MOTILE LIVING
COUNT NUMBER (20 LEAF)
-2 DAA: 207
2 DAA: 350
5 DAA: 341
12 DAA: 421

SUMMARY

- There is no magic adjuvant for every purpose!
- Testing adjuvants on a small scale is important
- Read product labels and adjuvant advice
- The correct use of adjuvants requires knowledge
- Know the chemical characteristics of the water used for spraying
- Regular checks with monitoring tools is essential to choose correct adjuvant
- Many adjuvants combine more than one benefit, but not necessarily safe to crops
- Adjuvants are there to help you

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