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Alkyl Polyglucosides (APG) in agrochemical applications

August 2025

Agenda

1 | Introduction

2 | Properties

3 | SL formulations

4 | SC formulations

5 | Conclusions

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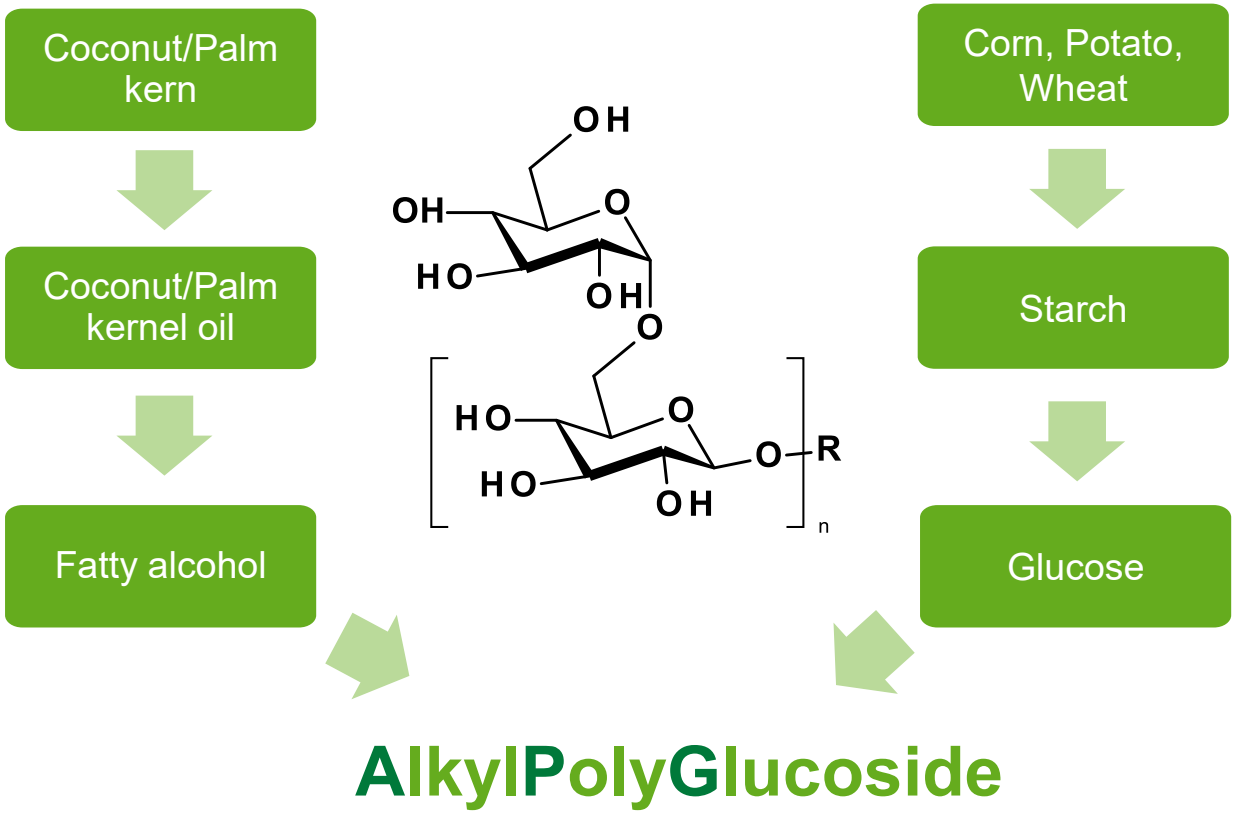
Alkyl Polyglucosides
Raw materials & Sustainability

Sustainability performance

- Based on renewable resources
- RSPO grades available
- Readily biodegradable

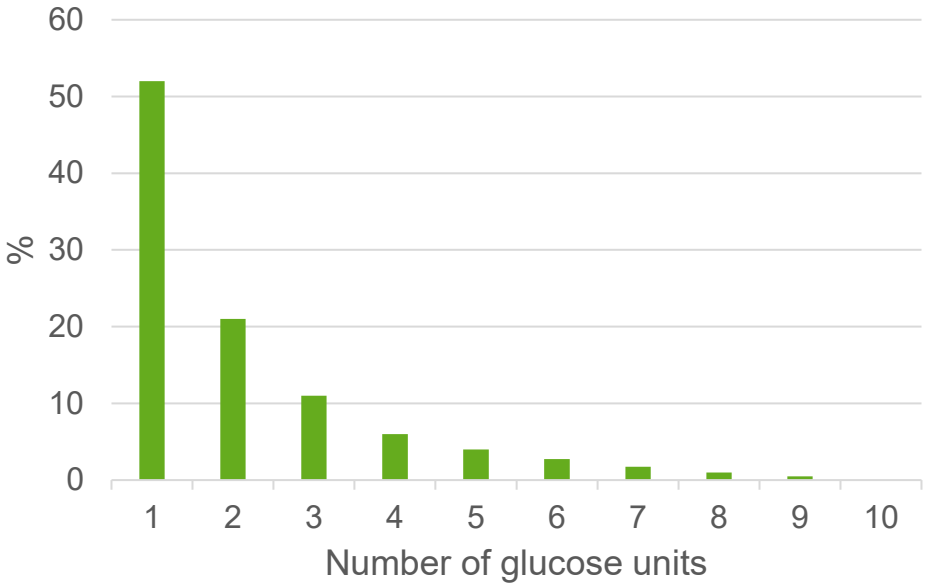
Tox & ecotox properties

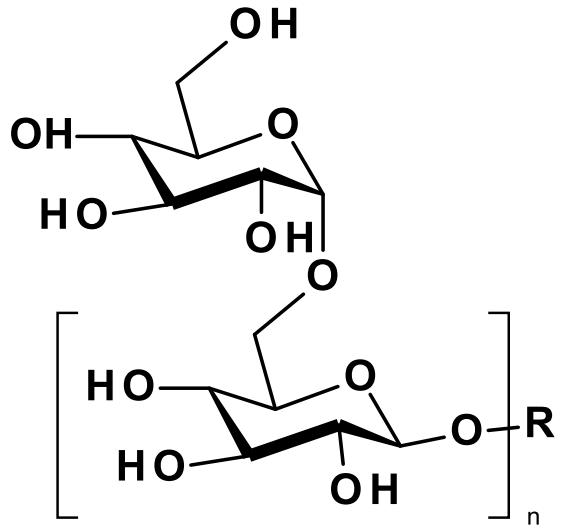
- Excellent ecotox profile
- Dioxane and formaldehyde free



Alkyl Polyglucosides
Chemical nature

- Non-ionic surfactants based on fatty alcohol and oligosaccharides
- Fatty alcohol: natural / petrochemical
- Oligosaccharides:
  - Predominately monoglucoside
  - Degree of polymerisation (DP) varies typically between 1.4 and 1.7
  - Three smallest oligomers account for 84% of distribution





n = 0 - 8
DP ~1.4 – 1.7
R = C_8-C_{16} fatty or petrochemical alcohol

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Alkyl Polyglucosides

Properties:

- Exceptional high **electrolytic tolerance**
  - Outstanding compatibilizers e.g. salts, brine, fertilizer
- Strong foaming, foam stability depends on alkyl structure
  - APGs give foam with uniform small bubbles
  - With Agnique® PG 8102, we have an alternative generating moderate foam
- **Easier handling and formulating**
  - Very stable over pH ranges from 3.0 to 13.0
  - No adverse cloud point issues at low temperatures
- **Low CMC**: Extremely efficient surfactants
  - Excellent wetting agents

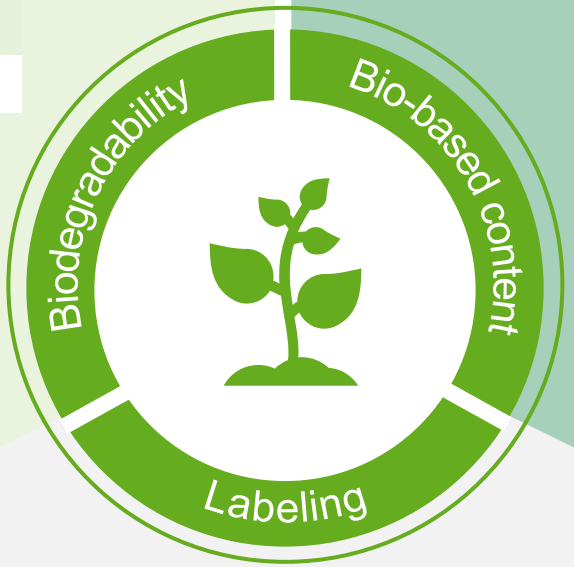
Registration:

- REACh registered
- EPA exempt
- CAS# is on list 4B
- Not OMRI eligible

Sustainablility profile of AgChem portfolio
Icons used for portfolio characterization

Biodegradability

Biodegradability[a)]	Icon
Readily biodegradable	
Not readily biodegradable	



Bio-based content

Product classification[b)]	Bio-based carbon [X% of total C]	Icon
Wholly bio-based	X ≥ 95	
Majority bio-based	95 > X >50	
Minority bio-based	50 ≥ X >5	
Non bio-based	X ≤ 5	

Labeling

Labeling[c)]	Icon
Label-free according GHS EU criteria	
Labeled according GHS EU criteria	

[a)] According to OECD 301. In case of mixture all organic components are readily biodegradable
[b)] According to the EN17035 surfactants classification
[c)] Status of October 2022. Please check the latest MSDS

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Product portfolio overview

Product	Sustainability profile	Carbon Chain	Polymeric Degree	H phrases a/t EU MSDS**	Registration / Exemption		
					REACH	TSCA	EPA***
Agnique® PG 8102		C_8	Proprietary	H318	●	●	NL, 920
Agnique® PG 8105-G		$C_{8/10}$	1.5	H318*	●	●	910
Agnique® PG 8107-G		$C_{8/10}$	1.7	H318	●	●	910
Agnique® PG 9116 UP		oxo C_{9-11}	1.6	H318	●	●	910
Glucopon® 650 EC		$C_{8/10/12/14/16}$	1.5	H315 / H318	●	●	910
Glucopon® 600 CSUP		$C_{10/12/14/16}$	1.4	H315 / H318*	●	●	910

Available with RSPO mass balance certification

* if the APG is the only component with eye irritancy in a formulation and its concentration is below a certain concentration, the formulation may not be subject to H318 or H319. Please contact us.
** Please check the latest MSDS
*** NL: trade name not listed

Excellent sustainability profile

Physical-chemical properties

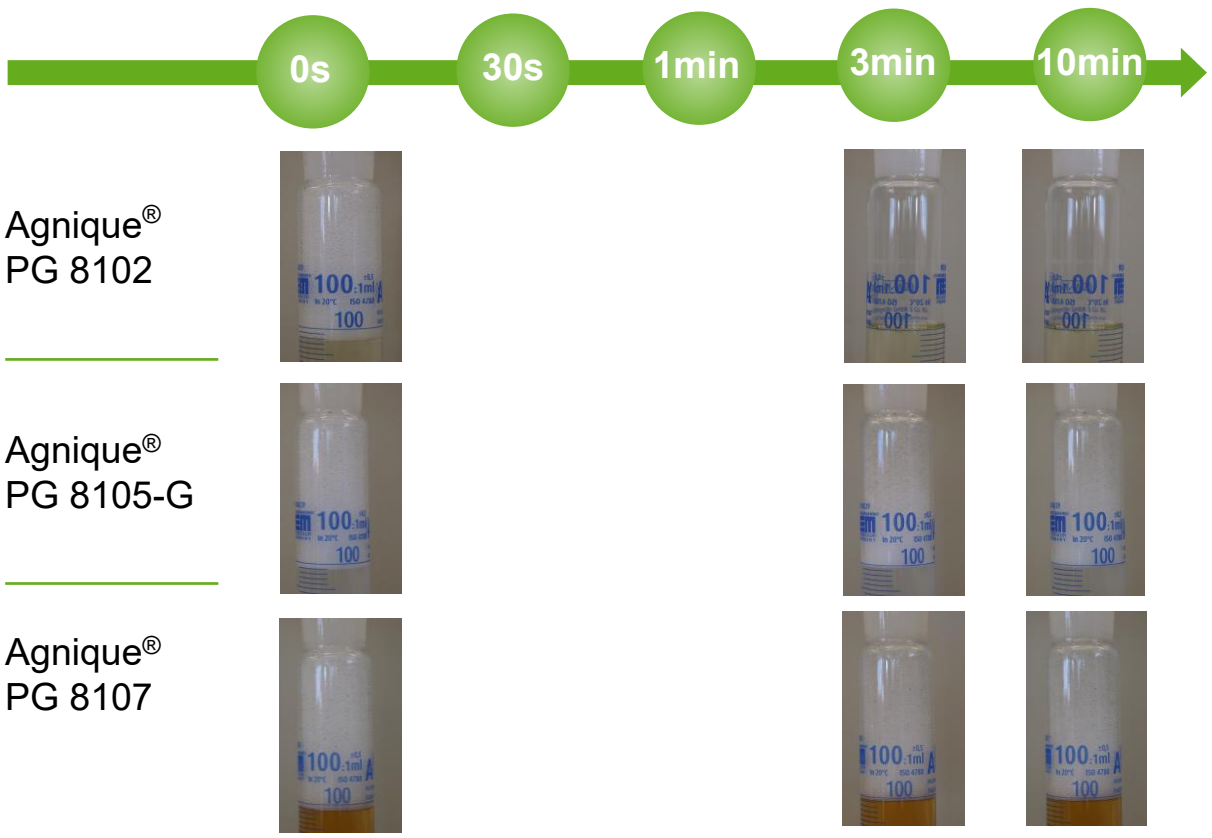
Product	Appearance	Active content*, (%)	Preser-vative	pH-value**	Viscosity***, (mPa·s)	Foam height, 5% aq. solution (cm)****
Agnique® PG 8102	Yellow liquid	~62	no	6 - 9	360	55/5
Agnique® PG 8105-G	Yellow liquid	~63	no	11.5 – 12.5	2000	55/55
Agnique® PG 8107-G	Dark brown liquid	~70	no	7.0 – 9.5	3000	55/55
Agnique® PG 9116 UP	Yellow liquid	~50	no	11.5 – 12.5	4000	55/55
Glucopon® 650 EC	Yellow cloudy liquid	~52	no	~12	1750	55/55
Glucopon® 600 CSUP	Yellow liquid	~53	no	~12	15000	45/34 at 1%

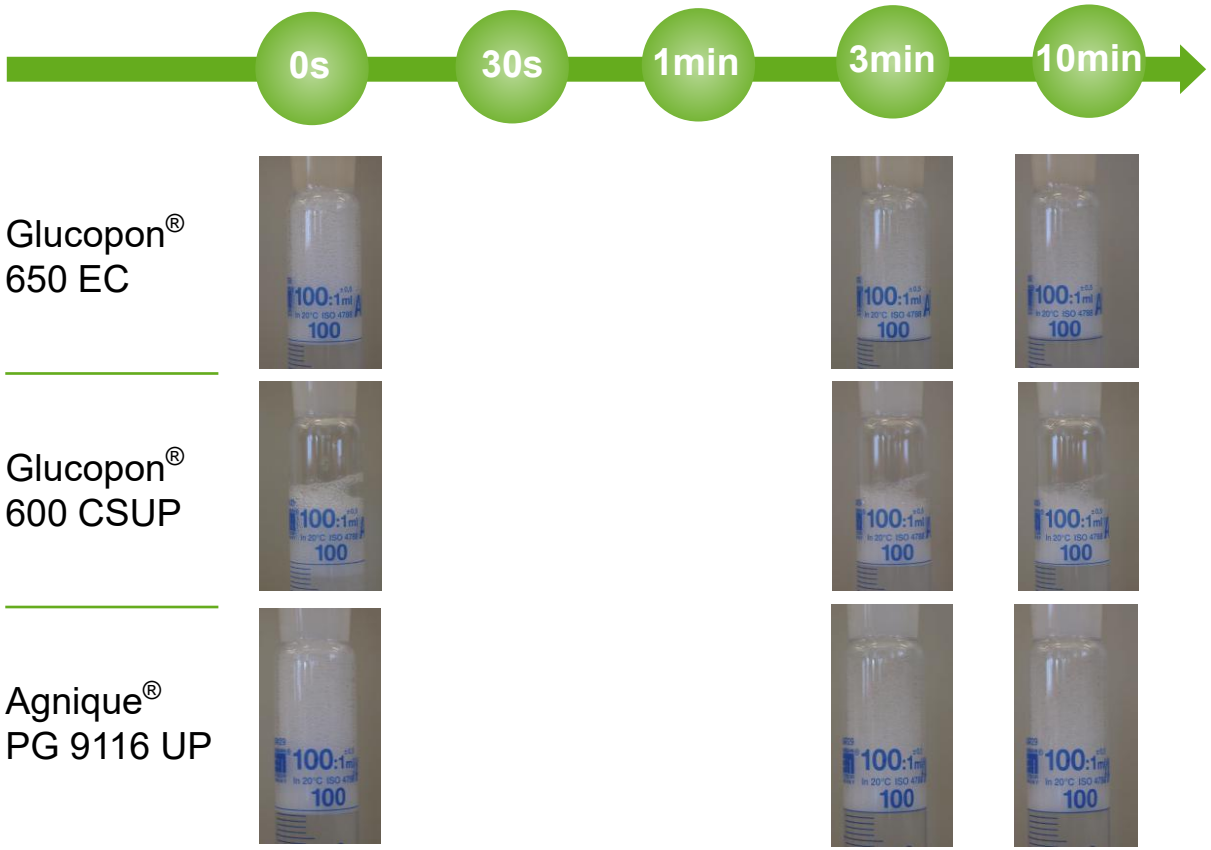
*Aqueous solution
**10% active in DI water
***Brookfield viscosity, 24 °C
**** initial and after 1 min, CIPAC MT 47.1 in CIPAC water D

APGs differ in color, active matter, pH, and viscosity
Bleached version is available

Foaming: Alkyl Polyglucosides

CIPAC MT 47.1 in CIPAC water D, 5% aqueous solution





Except for Agnique® PG 8102, APG form strong and stable foam

Alkyl Polyglucosides
Surface properties at 0.05%

Product	CMC (g/L)	SST, (mN/m)	DST at 0.1s, (mN/m)	Ratio elasticity/ viscosity*	Contact angle at 0.05%, 1 s (°)		
					Parafilm	ABUTH	Wheat
Water					107	89	126
Agnique® PG 8102	0.45	44.4	65.4	~5	81	102	132
Agnique® PG 8105-G	0.54	33.6	62.8	~5	77	58	130
Agnique® PG 8107-G	0.40	37.7	63.9	>2	77	77	108
Agnique® PG 9116 UP	0.29	28.3	51.9	>1	57	65	117
Glucopon® 650 EC	0.05	28.6	60.1	~1	60	62	116
Glucopon® 600 CSUP	0.02	28.6	67.3	<1	56	64	95

- The longer the alkyl chain, the better static surface tension & wetting, and the lower the CMC.

*Ravera *et al.*, **2010**, Current Opinion in Colloid & Interface Science (15), 217

Alkyl Polyglucosides are good wetting agents, whose property are governed by alkyl chain lengths

Agnique® PG products as compatibilizer
Highly electrolyte tolerant

- Compatibility with ammonium sulfate
  - Agnique® PG 8107-G gives a storage stable mixture in a blend with ammonium sulfate (40% aq. solution) at room temperature
- Use in Glyphosate SL formulations
  - Agnique ® PG 8107-G allows highly concentrated Glyphosate SL, both potassium and isopropylamine salts
  - Agnique® PG 8107-G is a sustainable alternative to tallow amine ethoxylates, banned in the EU
  - For more than two decades, APGs have been used in commercial Glyphosate SL on all continents
- Use in Glufosinate SL
  - Showing decent adjuvancy, Agnique® PG 8102 allows access to low foaming formulations

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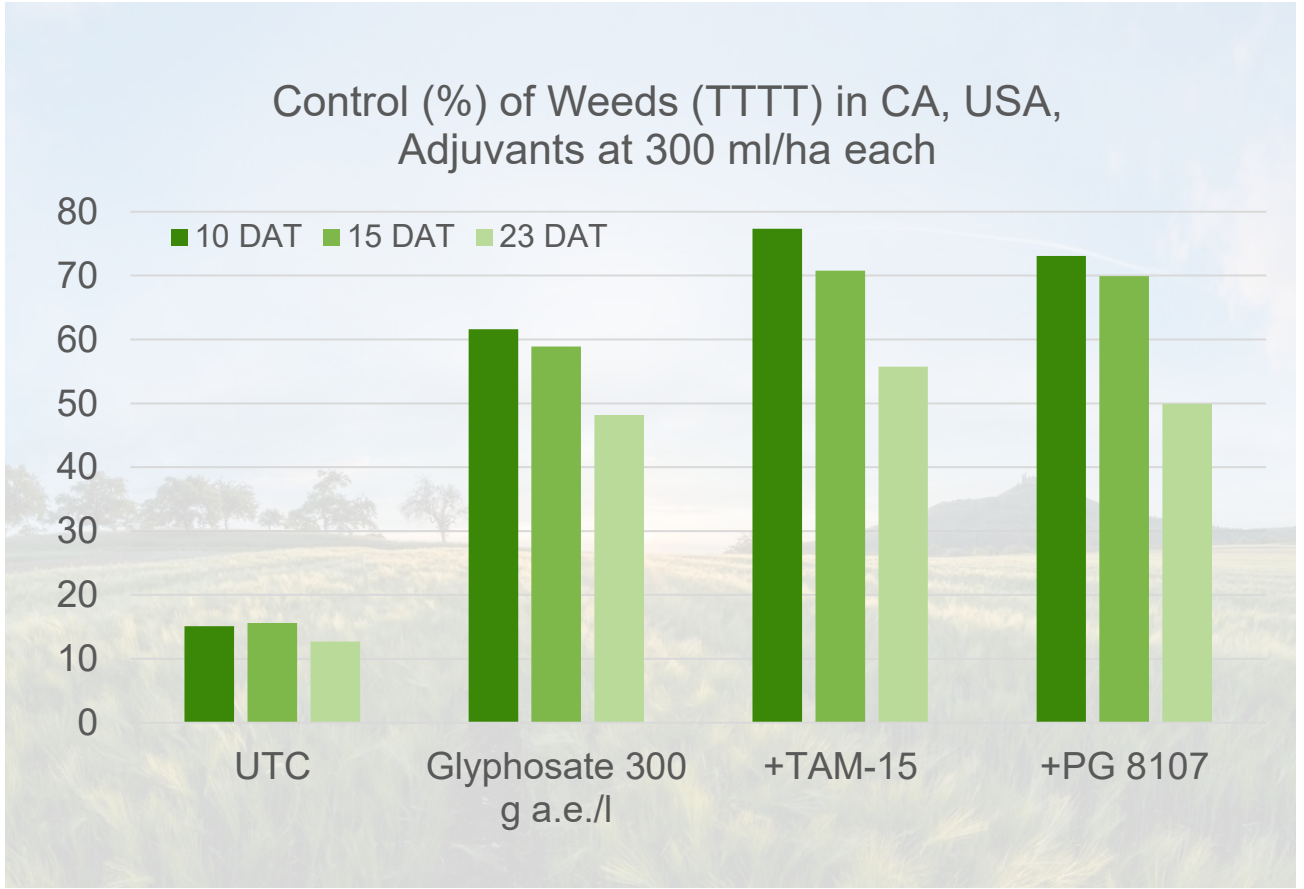
APGs replaced TAM EO in Glyphosate formulations

Comments

- **Glyphosate needs an adjuvant** for better uptake
- In this field trial, low Glyphosate concentration chosen to show differences
- After EU ban of tallow amine ethoxyates (TAM-EO), **APG have become new industry standard**
- Labelling of APG significantly better than TAM-EO
- Excellent compatibility to salts
  - APGs are compatible with SL 500, both IPA and K
  - Allow a much higher load of IPA and K salt
  - Form stable formulations with fertilizers and micronutrients

Agnique® PG 8107 improves weed control of Glyphosate

Field trial results, USA



UTC – untreated control
TTTT – all weeds

Formulation examples: Glyphosate SL test formulations

SLK-T02 Glyphosate SL 450 g a.e./l, IPA salt

Component	Function	% w/w
Glyphosate-IPA (62% aq.)	Active	82.0
Agnique® PG 8107	Adjuvant	12.0
Water	Solvent	6.0

SLK-T05: Glyphosate SL 480 g a.e./l, K salt

Component	Function	% w/w
Glyphosate-K (58% aq.)	Active	82.0
Agnique® PG 8107-BL	Low foaming adjuvant	10.0
Water	Solvent	8.0

***Note**:*
Concentrations are given in weight by weight. Please adjust for weight by volume taking the density into account. Although storage stability was evaluated under standard laboratory conditions, the formulation must be further assessed to achieve various registration requirements. Moreover, biological performance was not investigated.

Formulation example: Glufosinate SL test formulation

SLH-P10 Glyphosate SL 200

Component	Function	% w/w	% w/v
Glufosinate, ammonium salt (50% active)	Active	36.0	39.5
Agnique® PG 8102	Adjuvant	16.1	17.7
Water	Solvent	47.9	52.5

A clear, yellowish SL was obtained with a low viscosity i.e. 8 mPa·s (Sp. 61 at 100 rpm) and a density of 1.097 g/ml at 23 °C.
A 2% aq. dilution develops moderate foam.

***Note**:*
Although storage stability was evaluated under standard laboratory conditions, the formulation must be further assessed to achieve various registration requirements. Moreover, biological performance was not investigated.

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Formulation examples: Storage stable SC

SCD-K10 Azoxystrobin 250 g/L

Component	Function	% w/w
Azoxystrobin	Active ingredient	25.5
Agnique® CP 72 L	Dispersant	3.6
Sokalan® CP 10	Dispersant	3.5
Agnique® PG 8107-G	Wetting agent	8.0
Plurafac® LF 900	Penetrant	15.0
In-can preservative	Preservative	0.1
Propylene glycol	Antifreeze	4.0
Foamaster® UDB	Antifoam	0.6
Water		39.7

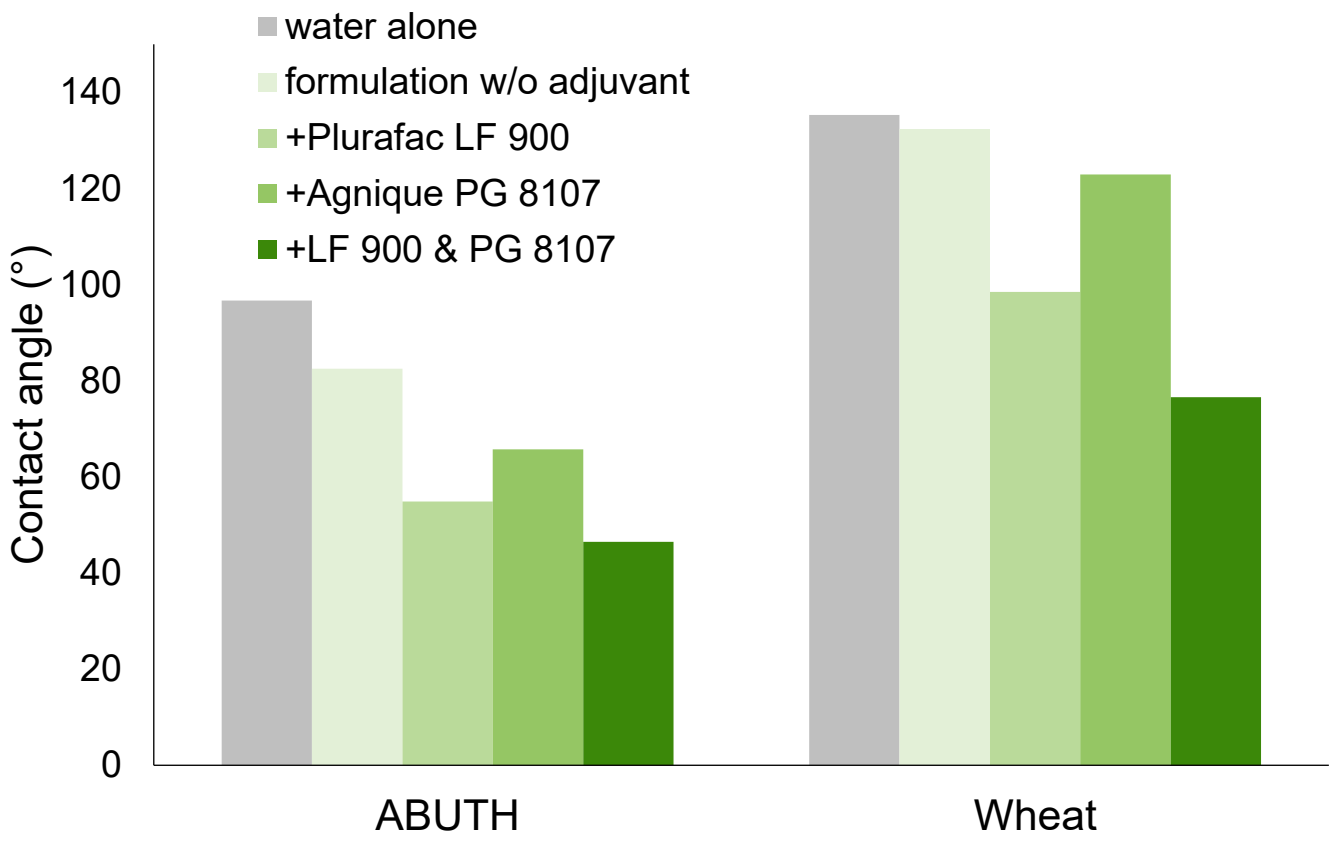
Synergistic addition of Plurafac® LF 900 and Agnique® PG 8107 on reduction of contact angle.

Variations of SCD-K10

Azoxystrobin SC formulations without adjuvant, with each, and both.

Results

- Plurafac® LF 900 with lowest contact angle on ABUTH and wheat
- However, lowest contact angles with combination of both, Plurafac® LF 900 and Agnique® PG 8107



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Formulations with APG
Considerations

- APGs have high viscosities
  - Does not affect aqueous solubility, but often requires heat during handling
- APGs contain significant amounts of water i.e. 30- 50 %
- APGs can have a significant color (PG 8107-G vs. PG 8107-B)
  - Bleached versions available i.e. Agnique® PG 8107 B
- APGs act as great compatibilizers
  - Highly suitable for salts e.g. Glyphosate SL, both IPA and K salts
- APGs are also suitable for SC formulations
- APGs are known to be strong foaming agents
  - Low foam version available Agnique® PG 8102

Conclusion

1. **APGs** have excellent **sustainability profile**
   - Wholly and majority bio-based surfactants
   - Readily biodegradable
2. **APGs** are stable in **high electrolyte** conditions and can act as **compatibilizer**
3. **APGs** have **adjuvant properties** and are good **wetting agents**
4. **APGs** are used in several formulation types
5. **Foam** of **APGs** can be managed by defoamer

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