

PRODUCT RANGE

# Silicone Surfactants for Agriculture

Organosilicone spray adjuvants for herbicides, insecticides, fungicides, plant growth regulators and foliar fertilizers

www.silfluosilicone.com

Silfluo

INTRODUCTION

# Organosilicone adjuvants from Silfluo

Silfluo supplies trisiloxane silicone surfactants that help spray solutions wet, spread over and enter plant leaves – as tank-mix adjuvants and as components of formulated crop protection products.

Five grades are polyether-modified trisiloxanes: nonionic, 100% active liquids based on heptamethyltrisiloxane. At 0.1 wt% in water they lower surface tension to about 21 mN/m; conventional hydrocarbon surfactants reach 28–32 mN/m at the same concentration.

At this level, droplets spread on waxy leaf surfaces and can enter open stomata, so water-soluble actives reach the leaf interior quickly and are less easily washed off by rain.

The grades differ in polyether end group and type, and with that in foam, spreading and compatibility. LA-13, an alkyl-modified trisiloxane, is oil-soluble and serves oil-based EC, OD and ULV systems.



**~21 mN/m**
surface tension at 0.1 wt% in water, polyether grades

**Up to 30%**
less spray water at the same active dose per hectare

**15–30 min**
to rainfastness under field conditions (LA-11, LA-12, LA-14)

**0.015–0.15%**
tank-mix rate, by weight of the spray solution

## Contents

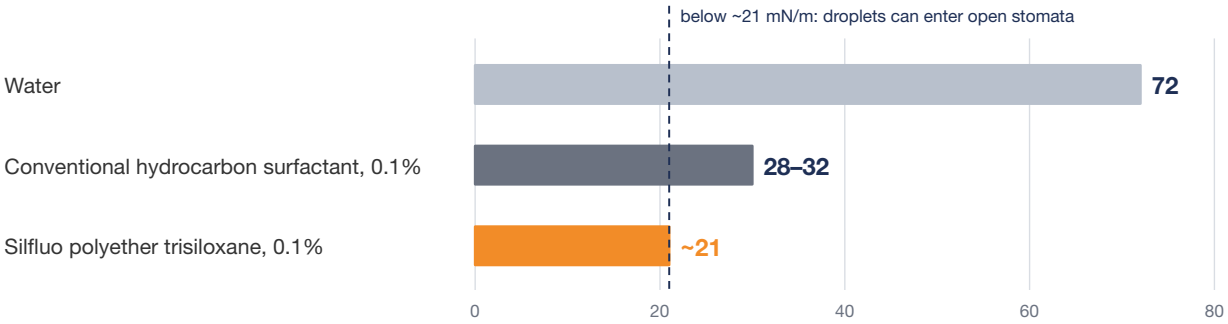

| | | |
|---|---|---|
| 01 | How organosilicone adjuvants work | p. 3 |
| 02 | Selection guide | p. 4 |
| 03 | Product range | p. 5 |
| 04 | Recommended use rates | p. 7 |
| 05 | Application guidelines | p. 8 |
| 06 | Applications | p. 9 |
| 07 | Quality control | p. 10 |
| 08 | In-can formulation, packaging and storage | p. 11 |
| 09 | Selecting a grade and contact | p. 12 |

TECHNOLOGY

# How organosilicone adjuvants work

Spray efficacy is decided in the first minutes after a droplet lands: whether it stays on the leaf, how far it spreads and how quickly the active ingredient gets in.

**Surface tension at 25 °C (mN/m)**




Water: textbook value. Surfactant values: Silfluo TDS.

## 01

### Spreading

The trisiloxane backbone takes a compact “T-shaped” form at the air–water interface. Surface tension falls to about 21 mN/m, the contact angle on wax-coated leaves drops and each droplet wets a larger area, also on vertical and waxy leaves and in dense canopies.

## 02

### Stomatal infiltration

Below about 21 mN/m, droplets can enter open stomata (pore width typically 3–15 µm) by capillary flow and bypass the cuticular wax. Water-soluble actives reach the sub-stomatal cavity – relevant for systemic herbicides, plant growth regulators and foliar micronutrients.

## 03

### Rainfastness

Uptake through the stomata is fast, so deposits become rainfast within 15–30 minutes under field conditions (LA-11, LA-12, LA-14). Uptake depends on crop species, stomatal density, time of day and temperature.

### Oil-based systems: LA-13

The alkyl-modified trisiloxane LA-13 acts at the oil–cuticle interface instead of the air–water interface. It lowers the interfacial tension between oil carrier and leaf wax, so oil droplets spread over a larger area and lipophilic actives penetrate the cuticle over more of the leaf. LA-13 is insoluble in water and is not used in aqueous tank mixes.

## In the field

**Up to 30%**

less spray water at the same active dose per hectare; confirm in field trials

**pH 6.0–8.0**

for the spray solution; use it within 24 hours, as trisiloxanes hydrolyse outside this range

**Low foam**

LA-11 and LA-14 limit foam during tank agitation, for steady pump pressure and spray pattern

# Selection guide

| Grade | Chemistry | Surface tension 0.1% aq. (mN/m) | Viscosity 25 °C (mPa·s) | Tank mix | In-can | Oil-based | Comparable to* |
|---|---|---|---|---|---|---|---|
| **LA-10** | Polyether trisiloxane, hydroxyl-terminated | 20.8 ± 0.5 | 25–45 | ● | ● | | Silwet 408, DOWSIL 67 Additive |
| **LA-11** | Polyether trisiloxane, methoxy-capped, lower foam | <21.0 | 10–30 | ● | ● | | Silwet L-77 |
| **LA-12** | Polyether trisiloxane | <20.5 | 10–30 | ● | ● | | Silwet L-77 |
| **LA-14** | Polyether trisiloxane, acetate-capped, low foam | 21.0 ± 1.0 | 20–40 | ● | ● | | SYLGARD OFX-0309 |
| **LA-15** | EO/PO polyether trisiloxane | 21.0–22.0 | 20–45 | ● | ● | | Silwet 806, BREAK-THRU S 240 |
| **LA-13** | Alkyl-modified trisiloxane, oil-soluble | insoluble in water | 2.5–3.5 | | ● | ● | – |

● suitable use. Tank mix = adjuvant added to the spray solution; in-can = component of a formulated product; oil-based = EC, OD, ULV and COC/MSO.

## Which grade for which task?

| | | |
|---|---|---|
| 01 | Tank-mix spreader for most water-based sprays | **LA-10 · LA-12** |
| 02 | Less foam when filling and agitating the tank | **LA-11 · LA-14** |
| 03 | Less droplet bounce on hydrophobic cuticles; systemic uptake | **LA-15** |
| 04 | Component of formulated products (in-can) | **LA-10 · LA-11 · LA-12 · LA-14 · LA-15** |
| 05 | Oil-based EC and OD formulations, ULV sprays, COC/MSO adjuvants | **LA-13** |

All grades: clear, colorless to pale yellow liquids, supplied 100% active (LA-13 and LA-14 solvent-free). Shelf life 24 months in unopened containers.



* Comparable grades are given for orientation only and do not mean identical composition or performance; suitability must be confirmed by application testing. Trademarks are the property of their respective owners.

PRODUCT RANGE

# 01 Polyether trisiloxanes for water-based sprays

Nonionic superspreaders based on polyalkyleneoxide-modified heptamethyltrisiloxane, used as tank-mix adjuvants and as in-can components of formulated products. Keep spray solutions at pH 6.0–8.0 and use them within 24 hours.



## LA-10

Agricultural silicone surfactant
Polyether-modified trisiloxane, hydroxyl-terminated

COMPARABLE TO*

Momentive Silwet 408, Dow DOWSIL 67 Additive

Silfluo LA-10 is a hydroxyl-terminated polyether-modified trisiloxane, a 100% active nonionic surfactant based on polyalkyleneoxide-modified heptamethyltrisiloxane. At 0.1 wt% it lowers surface tension to 20.8 ± 0.5 mN/m, so droplets spread on waxy leaves and enter open stomata, and spray water volume can typically be cut by up to 30%. Used at 0.015–0.15% in sprays of herbicides, insecticides, fungicides, plant growth regulators and fertilizers.

CAS No.
**67674-67-3**

Viscosity, 25 °C
**25–45 mPa·s**

Specific gravity, 25 °C
**1.01–1.03**

Surface tension, 0.1% aq., 25 °C
**20.8 ± 0.5 mN/m**

Cloud point, 1.0% aq.
**<10 °C**

Tank-mix rate
**0.015–0.15%**

In-can loading
**0.5–8.0%**

## LA-11

Agricultural silicone penetrant
Polyether-modified trisiloxane, methoxy-capped

COMPARABLE TO*

Momentive Silwet L-77

Silfluo LA-11 is a methoxy-capped polyether-modified trisiloxane, a 100% active nonionic superspreader with a viscosity of 10–30 mPa·s. At 0.1 wt% it lowers surface tension below 21.0 mN/m, allowing stomatal infiltration and rainfastness within 15–30 minutes; the capped end group gives less foam during tank agitation. Used at 0.015–0.15% of spray volume with herbicides, insecticides, fungicides, growth regulators and fertilizers.

CAS No.
**27306-78-1**

Viscosity, 25 °C
**10–30 mPa·s**

Refractive index, 25 °C
**1.440–1.450**

Surface tension, 0.1% aq., 25 °C
**<21.0 mN/m**

Cloud point, 1.0% aq.
**<10 °C**

Tank-mix rate
**0.015–0.15%**

In-can loading
**0.5–8.0%**

## LA-12

Foliar wetting agent
Polyether-modified trisiloxane

COMPARABLE TO*

Momentive Silwet L-77

Silfluo LA-12 is a polyether-modified trisiloxane, a 100% active nonionic organosilicone wetting agent based on polyalkyleneoxide-modified heptamethyltrisiloxane. At 0.1 wt% it reduces surface tension below 20.5 mN/m, so droplets wet waxy cuticles and enter open stomata, with rainfastness within 15–30 minutes. Used at 0.015–0.15% of spray volume with herbicides, insecticides, fungicides, plant growth regulators and foliar micronutrients.

CAS No.
**27306-78-1**

Viscosity, 25 °C
**10–30 mPa·s**

Refractive index, 25 °C
**1.440–1.450**

Surface tension, 0.1% aq., 25 °C
**<20.5 mN/m**

Cloud point, 1.0% aq.
**<10 °C**

Tank-mix rate
**0.015–0.15%**

In-can loading
**0.5–8.0%**

* Comparable grades are given for orientation only and do not mean identical composition or performance; suitability must be confirmed by application testing. Trademarks are the property of their respective owners.

## 01 Polyether trisiloxanes for water-based sprays (continued)

### LA-14

Low-foam silicone spreading agent
Polyether-modified trisiloxane, acetate-capped

COMPARABLE TO*

Dow SYLGARD OFX-0309

Silfluo LA-14 is an acetate-capped polyether-modified trisiloxane, a 100% active nonionic spreading agent with a viscosity of 20–40 mPa·s. At 0.1 wt% it lowers surface tension to 21.0 ± 1.0 mN/m for stomatal infiltration, and its low foam reduces air entrainment in tank agitation, keeping pump pressure steady. Used at 0.015–0.15% as a tank-mix adjuvant and at 0.1–5.0% as an in-can additive for herbicides, insecticides, fungicides and fertilizers.

CAS No.
**125997-17-3**

Viscosity, 25 °C
**20–40 mPa·s**

Surface tension, 0.1% aq., 25 °C
**21.0 ± 1.0 mN/m**

Cloud point, 1.0% aq.
**<10 °C**

Tank-mix rate
**0.015–0.15%**

In-can loading
**0.1–5.0%**

### LA-15

Cuticular penetrant
EO/PO-modified trisiloxane

COMPARABLE TO*

Momentive Silwet 806, Evonik BREAK-THRU S 240

Silfluo LA-15 is an EO/PO polyalkyleneoxide-modified trisiloxane, a 100% active nonionic organosilicone adjuvant with a viscosity of 20–45 mPa·s. At 0.1 wt% it lowers surface tension to 21.0–22.0 mN/m, which reduces droplet bounce on hydrophobic cuticles, widens the wetted area and aids stomatal uptake. Used in tank mixes of herbicides, insecticides, fungicides, bactericides and foliar fertilizers, and at 0.5–8.0% in in-can formulations.

CAS No.
**134180-76-0**

Viscosity, 25 °C
**20–45 mPa·s**

Density
**1.01–1.03 g/cm³**

Surface tension, 0.1% aq., 25 °C
**21.0–22.0 mN/m**

Cloud point, 1.0% aq.
**<10 °C**

Tank-mix rate
**0.015–0.15%**

In-can loading
**0.5–8.0%**

## 02 Alkyl trisiloxane for oil-based systems

Oil-soluble, solvent-free spreader for oil carriers: mineral oils, methyl oleate (MSO) and aliphatic hydrocarbons. Insoluble in water – not for aqueous tank mixes.

### LA-13

Oil-soluble agricultural adjuvant
Alkyl-modified trisiloxane

Silfluo LA-13 is an alkyl-modified trisiloxane, a 100% active, oil-soluble silicone adjuvant with a viscosity of 2.5–3.5 mPa·s that is insoluble in water. It is miscible with mineral oils, methyl oleate and aliphatic hydrocarbons and lowers the interfacial tension between oil carrier and leaf wax, so oil droplets spread over a larger area. Used in EC and OD formulations at 0.1–10.0%, in ULV oil carriers and in COC/MSO tank-mix adjuvants.

CAS No.
**17955-88-3**

Viscosity, 25 °C
**2.5–3.5 mPa·s**

Specific gravity, 25 °C
**0.82–0.85**

Refractive index, 25 °C
**1.412**

Solubility
**insoluble in water, miscible with hydrocarbons**

EC / OD, in-can
**0.1–10.0%**

ULV oil carrier
**0.1–5.0%**

COC / MSO
**0.01–5.0% of oil carrier**

* Comparable grades are given for orientation only and do not mean identical composition or performance; suitability must be confirmed by application testing. Trademarks are the property of their respective owners.

USE RATES

# Recommended use rates

Rates in % by weight of the spray solution. Start trials at 0.1% and reduce to the lowest rate that gives the required effect for the active ingredient, crop and application method. Higher rates do not improve spreading in proportion and can damage sensitive crops.

## Tank mix, by agrochemical class

| Agrochemical class | LA-10 | LA-11 | LA-12 | LA-14 | LA-15 |
|---|---|---|---|---|---|
| **Plant growth regulators** | 0.025–0.1 | 0.025–0.05 | 0.025–0.05 | 0.025–0.05 | 0.025–0.05 |
| **Herbicides** | 0.025–0.15 | 0.025–0.15 | 0.025–0.15 | 0.025–0.15 | 0.025–0.15 |
| **Insecticides** | 0.025–0.1 | 0.025–0.1 | 0.025–0.1 | 0.025–0.1 | 0.025–0.1 |
| **Fungicides** | 0.015–0.1 | 0.015–0.05 | 0.015–0.05 | 0.025–0.15 | 0.015–0.1 |
| **Foliar fertilizers, micronutrients** | 0.015–0.1 | 0.015–0.1 | 0.015–0.1 | 0.015–0.1 | 0.015–0.1 |

## From percent to grams

| Rate | per 20 L | per 100 L | per 200 L | Dilution |
|---|---|---|---|---|
| **0.015%** | 3 g | 15 g | 30 g | 1 : 6 700 |
| **0.025%** | 5 g | 25 g | 50 g | 1 : 4 000 |
| **0.05%** | 10 g | 50 g | 100 g | 1 : 2 000 |
| **0.1%** | 20 g | 100 g | 200 g | 1 : 1 000 |
| **0.15%** | 30 g | 150 g | 300 g | 1 : 670 |

Water-based spray solutions: 1 L ≈ 1 kg. Example: 50 g of LA-11 in 200 kg of spray solution = 0.025% (1 : 4 000).

## In-can loading

| Grade | % of formulation | Formulation pH |
|---|---|---|
| **LA-10** | 0.5–8.0 | 6.5–7.5 |
| **LA-11** | 0.5–8.0 | 6.5–7.5 |
| **LA-12** | 0.5–8.0 | 6.5–7.5 |
| **LA-14** | 0.1–5.0 | 6.5–7.5 |
| **LA-15** | 0.5–8.0 | 6.0–8.0 |

Check stability before launch: 40 °C / 75% RH, at least 3 months (see page 11).

## LA-13 in oil-based systems

| Application | Loading |
|---|---|
| EC and OD formulations, in-can | **0.1–10.0% by weight of the formulation** |
| ULV sprays (0.5–5.0 L/ha), oil carrier additive | **0.1–5.0% by weight of the oil carrier** |
| COC and MSO tank-mix adjuvants | **0.01–5.0% of the oil carrier volume** |

Start at mid-range and check spreading by contact angle on leaf wax or an artificial cuticle.



APPLICATION

# Application guidelines

## Tank mixing sequence

1. Fill the tank with 80% of the water
2. Add the agrochemicals and agitate until fully dissolved or dispersed
3. **Add the silicone adjuvant**
4. Top up to 100% and mix; agitate gently to limit foam

Do not premix the adjuvant with undiluted agrochemical: at high concentrations this can cause incompatibility or precipitation.

## Spray conditions

| | |
|---|---|
| **pH of the spray solution** | 6.0–8.0. Trisiloxanes hydrolyse at pH ≤5.0 or ≥9.0 and lose their surface activity. |
| **Use after mixing** | Within 24 hours of preparation. |
| **Temperature** | 10–35 °C. Below 10 °C stomata may be closed, so the stomatal pathway is lost. |
| **Nozzles** | Flat-fan or hollow-cone nozzles with a small tip (<0.3 mm) for fine droplets (VMD 150–250 µm) and good canopy penetration. |
| **Water volume** | Up to 30% less than in standard applications at the same active dose per hectare. |

Reductions in water volume must be confirmed in field trials before commercial use.

### Precautions

- Test on the target crop at the intended rate before commercial use: overdosing can cause phytotoxicity on sensitive crops.
- Check compatibility with the specific products in the tank mix before use.
- LA-13 is insoluble in water: use it only in oil-based systems.
- Wear suitable protective equipment when handling the concentrate; see the SDS of each grade.

# Applications



## Herbicides

Wetting of narrow, upright and waxy weed leaves and faster uptake of systemic herbicides. Typical rate 0.025–0.15%.

GRADES

**LA-10 · LA-12 · LA-14 · LA-15**



## Insecticides and fungicides

Even coverage of the leaf surface and better droplet distribution in dense canopies, with less spray water. Insecticides 0.025–0.1%, fungicides 0.015–0.15%, depending on grade.

GRADES

**LA-10 · LA-11 · LA-12 · LA-14 · LA-15**



## Foliar fertilizers and growth regulators

Uniform deposits and stomatal uptake of foliar nutrients, micronutrients and plant growth regulators. Fertilizers 0.015–0.1%, growth regulators 0.025–0.05% (LA-10: up to 0.1%).

GRADES

**LA-10 · LA-11 · LA-12 · LA-15**



## Low-volume, aerial and oil-based sprays

Less spray water per hectare for ground and aerial application; low-foam grades for fast tank filling. LA-13 for ULV oil carriers (0.5–5.0 L/ha), EC and OD formulations and COC/MSO adjuvants.

GRADES

**LA-11 · LA-14 · LA-13**

QUALITY

# Quality control

Silfluo's quality management system is certified to ISO 9001. Each batch is tested before release, and each delivery comes with a certificate of analysis (COA).

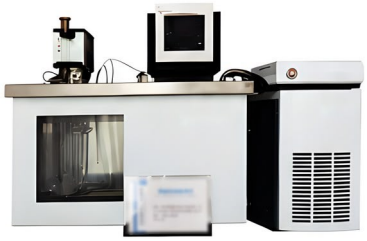
## Test items

| Test item | Condition | Grades |
|---|---|---|
| **Appearance** | Visual, under standard light | All grades |
| **Viscosity** | 25 °C, rotational viscometer | All grades |
| **Specific gravity / density** | 25 °C | LA-10, LA-13, LA-15 |
| **Refractive index** | 25 °C | LA-11, LA-12, LA-13 |
| **Surface tension** | 0.1 wt% in water, 25 °C | LA-10, LA-11, LA-12, LA-14, LA-15 |
| **Cloud point** | 1.0 wt% in water | LA-10, LA-11, LA-12, LA-14, LA-15 |

## Laboratory



Temperature-controlled rotational viscometer



Automated viscometer



Density meter



Abbe refractometer



FTIR spectrometer



Standard light booth

**COA**
with each delivery

**TDS**
for each grade

**SDS**
for each grade

# In-can formulation, packaging and storage

## Building the adjuvant into the formulation

| | |
|---|---|
| **Loading** | 0.5–8.0% of the formulation weight (LA-10, LA-11, LA-12, LA-15); 0.1–5.0% (LA-14); LA-13 0.1–10.0% in EC and OD. |
| **pH** | Buffer the formulation to pH 6.5–7.5 (LA-15: 6.0–8.0). Hydrolysis accelerates at pH ≤5.0 or ≥9.0. |
| **Compatibility** | Trisiloxanes can interact with some emulsifiers, co-solvents and ionic actives. Test compatibility in the actual formulation. |
| **Stability test** | Store at 40 °C / 75% RH for at least 3 months and measure surface tension at 0, 1, 2 and 3 months before commercial launch. |

## Packaging



**20 kg**
plastic drum



**200 kg**
plastic drum



**1000 kg**
IBC

Other packaging on request.

## Storage and transport

| | |
|---|---|
| **Storage** | Cool, dry and ventilated, away from direct sunlight and ignition sources, in the original closed containers. |
| **Shelf life** | 24 months from the date of production in unopened containers. After this date, check the properties required for the application before use. |
| **Transport** | LA-10, LA-11, LA-12, LA-14 and LA-15 are not regulated as dangerous goods for transport (ADR/RID, IMDG, IATA). Handling: see the SDS of each grade. |

Silfluo

TECHNICAL SUPPORT

# Selecting a grade

To recommend a grade and rate, our technical team needs a few details about your application:

01 Agrochemical type and active ingredient

02 Use: tank-mix adjuvant or component of a formulated product

03 Formulation type, for example SL, SC, EC, OD or ULV

04 Target crop and growth stage

05 Application: knapsack, boom sprayer or aerial; spray volume per hectare

06 pH of the formulation or spray solution

07 Limits on foam during tank filling

08 Reference adjuvant used today (optional)

Technical data sheets, safety data sheets and samples are available on request.

CONTACT

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