FROST PROTECTION

WITH THE PULSFOG FOGGING METHOD

pulsFOG®
AEROSOL SYSTEMS

HARVEST WITHOUT FROST DAMAGE

Frost damage is damage that is caused to cultivated plants by cold temperatures. This can differ a great deal, ranging from growth disruptions to crop failures and even the dieback of the plants.

Frost often occurs suddenly and can destroy the entire crop and thus the farmer's hard work in just a couple of hours. Crop damage due to frost occurs not only in the field, as in fruit cultivation or viticulture, for instance, but also in the greenhouse.

HOW FROST WORKS

Frost damage occurs above all on cold, cloudless nights in which the soil and plants give off a great deal of energy via thermal radiation. Plants, above all, act like true radiators, radiating heat into the atmosphere on the one hand and at the same time absorbing heat from the air by convection on the other. The cooler, denser air generated in this way forms a layer close to the ground (thermal ground inversion), which can lead to damage in valleys in particular, but also on level terrain. The air temperatures close to the ground thus drop much faster on nights when the sky is clear than when it is cloudy. The effect is further exacerbated by low humidity, because the latent heat (water vapour) otherwise contained in humid air is lacking when the weather is dry. This results in the air temperatures dropping even faster. Above all, the foliage present on the plants, which provides for energy absorption during the day, leads to their downfall during a frosty night. The plant tissue is undercooled due to the high radiation and at the same time low air warmth and is damaged as a result.

IN RELATION TO THE SEASONS, TWO TYPES OF FROST CAN BE DISTINGUISHED:

Winter frost

Even in subtropical and tropical climatic zones, cold fronts in the winter months – especially at night – can lead to unusually low temperatures, often with severe consequences for agriculture. A classic example of this is coffee cultivation, in which frost can cause entire fields to die back. As a result, farmers suffer crop losses lasting several years, because young coffee plants only bear fruit again after a period of some years.

Spring frost

Of particular importance in temperate zones such as Central and Eastern Europe is the so-called spring frost. This is usually not fatal for crops, but can cause serious damage to flowers and shoots, result in crop reductions or crop failures and thus drive farmers to ruin.

VEGETATION CHANGES IN THE CLIMATE CHANGE ERA

Due to the increasingly frequent mild winters, which lead to vegetation beginning prematurely, perennial crops such as fruit often already exhibit advanced development at the start of spring. Then, when frosty nights occur during the spring, devastating damage can occur, with buds, flowers, young fruits or shoots being lost.

LATE FROST DAMAGE, WHICH CAN OCCUR MORE AND MORE FREQUENTLY IN THE CONTINENTAL CLIMATE DUE TO CLIMATE CHANGE, WILL POSE A MAJOR CHALLENGE FOR MANY BUSINESSES IN THE FUTURE.

The frost and thus the loss of flowers and fruits also has consequences for the coming harvest year. Due to the poor crop on account of frost damage, fruit trees react with increased flowering. This must be thinned out accordingly in the following year, which causes additional costs for farmers. If expectations tend towards above-average harvests in the current year, correspondingly lower prices are to be expected. It is therefore high time to take action and specifically counteract the onset of frost.

THE PULSFOG FOGGING METHOD EFFICIENT AND COST EFFECTIVE APPLICATION AGAINST FROST

PULSFOG IS ONE OF THE PIONEERS OF THE FOGGING METHOD. SINCE THE 1950S OUR FOUNDER, DR K.H. STAHL, HAD BEEN INVOLVED IN THE DEVELOPMENT OF TRENDSETTING DEVICES THAT WERE SOON IN OPERATION WORLDWIDE.

With the realisation that the fogging method has great advantages over the spraying process, pulsFOG was able to set significant developments in motion even at that time, to which we owe today's Top Standard.

With the pulsFOG fogging method, the crop is blanketed by an artificial water mist. The fog acts like an emulated cloud and reduces the radiation and heat loss from the soil and plants, so that the latter are protected against hypothermia and thus against damage.

The fog can be formed using hot or cold fogging machines. It is important that the fog consists of small drops, so that firstly a high drop density is created, i.e. a visible fog that darkens the atmosphere, and secondly the fog floats over the field for as long as possible.

Fog blanket artificially generated by pulsFOG fogging machine over crops at sunrise

ADVANTAGES OF THE PULSFOG FOGGING METHOD

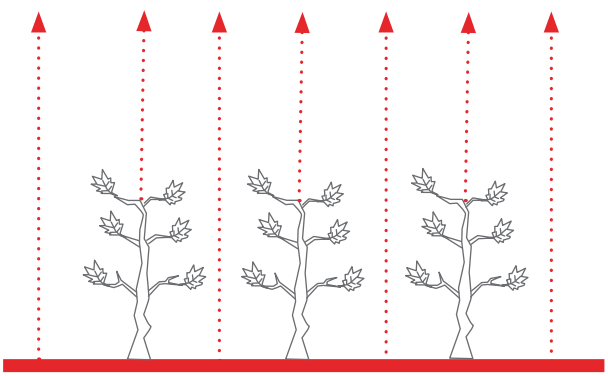
- COST-EFFECTIVE METHOD – IN TERMS OF BOTH PURCHASE AND APPLICATION
- HIGHLY EFFECTIVE AGAINST DAMAGE CAUSED BY RADIATION FROST
- LOW ENVIRONMENTAL IMPACT, NO RESIDUES
- LOW ENERGY REQUIREMENT
- LOW WORK REQUIREMENT

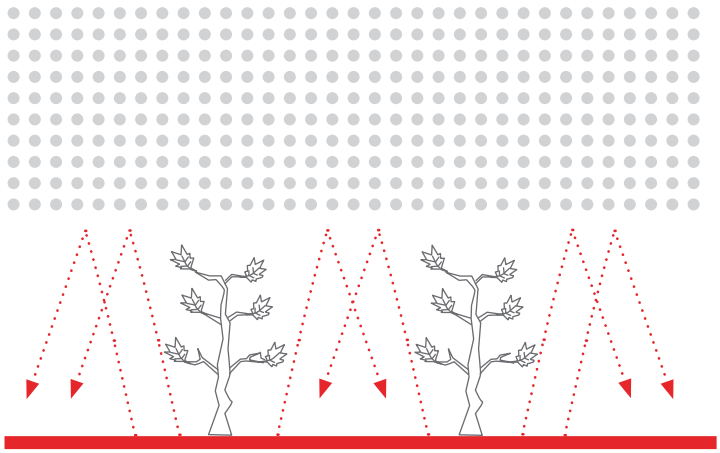
IT'S AS SIMPLE AS THIS

With our pulsFOG devices, an artificially generated fog is produced that lies over the plants to protect them. Millions of tiny droplets thus blanket the plants with a sort of insulating layer. This prevents the heat that is present in the soil and plants from radiating. The plants are protected against frost damage.

Artificially generated fog

Thermal radiation





WHEN, WHERE AND HOW TO FOG

For a successful application of fog against frost, the area to be treated must remain blanketed with a protective layer of fog as far as possible without interruptions during the critical frost phase. The treatment must be started in good time, as long as the soil and plants still contain enough heat, and should continue until temperatures rise again in the morning or until wind or clouds appear.

The generated fog consists of a glycerine-water mixture. The glycerine stabilises the fog by preventing the evaporation of the water even at low humidity. As a result, the fog can often linger for hours on the site. Depending on the size and nature of the site, several devices must be used at the same time. These can be stationary or moved with a vehicle (e.g. pickup or tractor) during the application.

For effective treatment, it is advisable to practise in advance for the “emergency”. All necessary operating fluids (fuel, glycerine, water) must be available and temperature control must be set up so that treatment can begin promptly.

NOTES ON THE PULSFOG FOGGING METHOD

IMPORTANT NOTES ON FROST PROTECTION APPLICATIONS

The fogging machine is only a tool that generates the fog to protect against frost. The purchase of a machine alone is no protection against frost damage. A whole range of factors must be taken into account so that the fogging method against frost actually works.

1. The entire process must be prepared, and the people involved must be trained and equipped.
2. Fog is extremely susceptible to drifting, therefore the positioning of the fogging machines must be determined or tested in advance so that the treatment also reaches the areas to be protected.
3. The same fogging machine should not be used for the simultaneous treatment of different areas, as this could impair the effectiveness and ultimately neither one nor the other area is effectively protected. The exception to this is protected cultivation, as the fog can last longer in closed greenhouses, for example, than in the field.
4. The fogging method is only effective when there is no wind. If it is windy, the fog in the field cannot remain over the area to be protected.
5. The fogging method cannot guarantee absolute protection against frost damage, as success depends on many factors. In addition, efficient treatment can cause a maximum temperature difference of between 2 °C and 5 °C on the crops. In extremely cold weather, therefore, damage can still occur despite fog treatment. pulsFOG accepts no liability whatsoever for damage caused by frost.
6. The fogging method of combating frost is more successful in some regions than in others, mainly depending on the topography and microclimatic conditions of each region. In general, the areas most suitable for frost protection treatment are also those that are more susceptible to frost damage (e.g. valleys).
7. The fog generated can drift over roads or nearby residential areas, where it may be perceived as a nuisance or a hazard (e.g. in traffic). Therefore, before a fog treatment against frost is considered, the responsible authorities (traffic authority, fire brigade) may therefore have to be consulted, so that any necessary signage, for example, can be set up in good time.
8. Only fogging agents recommended by pulsFOG may be used for fog applications against frost. Unauthorised fogging substances or additives can cause environmental damage and endanger the health of humans and animals. Preparation must take place according to the instructions from pulsFOG or its authorised representatives.

PULSFOG MACHINES FOR YOUR APPLICATION

SOME RECOMMENDED PULSFOG MACHINES FOR FROST PROTECTION APPLICATIONS	fuel consumption	recommended flow rate of fogging liquid*	difficult conditions for the application **	maximum fogging liquid volume/ hour	best conditions for the application***	minimum fogging liquid volume/ hour
TRACFOG 400 G/F 	PTO driven	30 liters/ hour	5 hectares	24 liters/ hectare	15 hectares	8 liters/ hectare
K-50 	14 liters/ hour	60 liters/ hour	10 hectares	24 liters/ hectare	30 hectares	8 liters/ hectare
K-30-20-BIO 	7 liters/ hour	30 liters/ hour	5 hectares	24 liters/ hectare	15 hectares	8 liters/ hectare
K-22-20-BIO 	3,5 liters/ hour	15 liters/ hour	2,5 hectares	24 liters/ hectare	7,5 hectares	8 liters/ hectare

Frost protecting applications have been carried out since many years. Experiences from Brazil, South Afrika, France and Poland showed that the duration of a typical application against frost is about 4 hours.

* The fogging liquid usually consists of a 50% glicerine solution in water
** air movement, small area- drift of the fog
*** no air movement, fog remains on the field

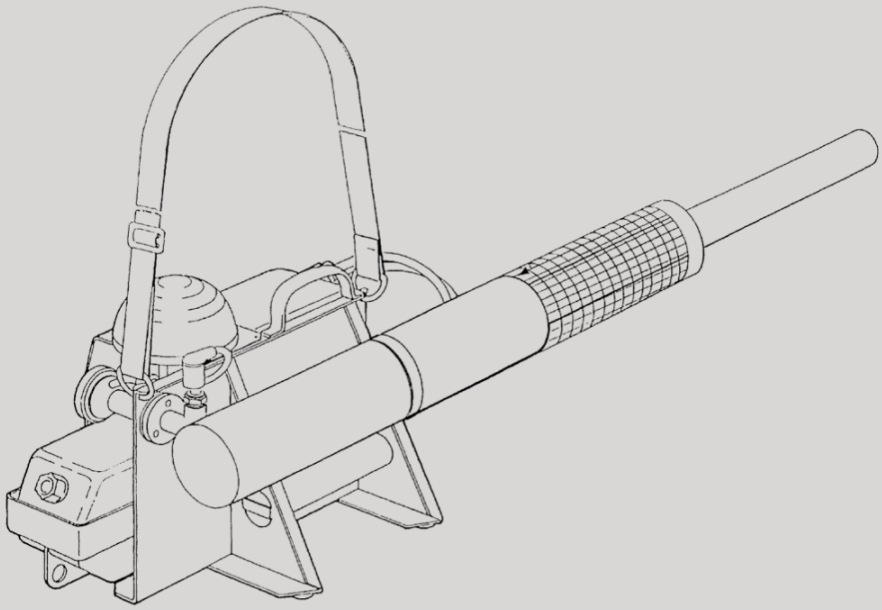
All available pulsFOG machines can be found in our sales brochure or at **www.pulsfog.de/fogging-products**

A GLOBAL PARTNERSHIP

We assume responsibility towards our partners and customers with far-sighted quality management.
The reliability, safety and effectiveness of our machines are regularly monitored by the JKI as well as by the Testing and Certification Body (PZ.LSV) and the World Health Organisation (WHO). pulsFOG is certified to DIN EN ISO 9001-2015.
As an international and leading manufacturer of thermal fogging machines, we offer our customers worldwide service. With our subsidiary in South America and licensed manufacturing in India, Egypt and the Netherlands, as well as dealers and service employees worldwide, pulsFOG is ideally networked and has been among the leading and future-oriented manufacturers of fogging machines for five decades.

OUR MACHINES ARE DESIGNED TO WORK SMOOTHLY EVEN UNDER DIFFICULT CONDITIONS. SHOULD THERE EVER BE DIFFICULTIES, THEY ARE EASY TO REPAIR AND THE PROCUREMENT OF SPARE PARTS IS SIMPLE.

The protection of people, animals and crops is our vision, which we implement worldwide. We also carry out educational work.



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