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EQUIPMENT FOR FOGGING OF REJEX-IT[®] TP-40.

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ABSTRACT

Considerable improvements have been made in the fogging application of Rejex-it[®] TP-40. Much has been learned about the type of fog generated by these machines and the resulting efficiency. Many foggers have been proven to deliver the product in the desired form, while others were only useful under special conditions, but no single piece of equipment is suitable for all situations. Generally, thermal foggers (e.g., *Golden Eagle*) produce the best fog with a good droplet size in areas where they can be employed. Their drawback for many operations by a trained technician is the noise they generate and the open flames during operation. Battery operated ULV foggers are quiet and can be fully automated, even in remote areas, which is a requirement for agricultural applications. Also, they tend to generate a fog that is less visible, so that birds cannot see the reason for the unpleasant experience. Newer machines with automation (e.g., *BICO 2000*) are not only capable to cover large areas with a minimum of product, but also can produce a fog that is nearly invisible and similar to thermal foggers in droplet size (e.g., *Birdhazer*).

INTRODUCTION

The fogging application of Rejex-it[®] TP-40 (Fog Force) has been shown to be an efficient method for the control of bird problems in many diverse situations (Dolbeer 1996, Vogt 1997, 1999). The method is now registered with EPA for indoor and outdoor use. It can be used for electrical substations, structures & buildings, trees & shrubs, airports and other open areas, turf, such as golf courses, lawns, sports fields and parks, but also for lakes & ponds and harbors & boat docks. The method uses far less product than direct application to any food source. Despite its effectiveness, birds learn very fast to recognize the noise of thermal foggers or the person operating the fogger manually and on second and third applications leave before they can be exposed to the product. If they cannot identify the source of the unpleasant experience, they associate the site with it, which increases the long-term effectiveness. In order to be effective for the season or even the lifetime of the birds, they have to be exposed several times to the fog to experience the unpleasant properties. Depending on the situation, this can be during the same day or over several days. However, frequently it is very difficult to reach the birds before they leave the problem area only to come back later when the disturbance is over.

FOGGING FOR THE CONTROL OF BIRD PROBLEMS

Fogging for the control of bird problems relies on the exposure of the mucous membranes of birds to the micro droplets of Rejex-it[®] TP-40 (TP-40), containing the active ingredient methyl anthranilate. A fog or aerosol with a droplet size of 5-20 microns is desired for good effects. This type of aerosol is generally classified as dry fog if the droplets are in the 1-10 micron range or wet fog when they are larger, such as from 10-50 microns. As the size of the droplets in the fog decrease, the number of droplets for a given amount of product increases, and at the same time, more of the fog is inhaled by the birds (Vogt 2001). With less product required for the same number of droplets bird control becomes more economical for automated and continuous applications for large areas.

TYPES OF AEROSOL GENERATOR (FOGGER)

There are many fog generators in the marketplace that are all adjusted for a specific application in mind. The majority is used for insect control. A fogger designed for water or aqueous solutions is not necessarily applicable for TP-40 without prior testing. Temperature, humidity and wind all play an important role in the application and its effectiveness. Most mosquito foggers are suitable for the use with TP-40, as long the machine is cleaned to remove any trace of the previously used toxic insecticide and the machine is adjusted properly for the change in viscosity and the desired droplet size.

Generally, there are two basic types of foggers, thermal and cold foggers. The cold foggers or ULV foggers include many specialized methods and systems such as the *BICO 2000* that uses a spinn-disk for precise droplet formation or the *Birdhazer*, designed for long-lasting fog generation, or even spray cans. As there are many differences between the various machines and systems, it is important to select the right one for the problem on hand. For good operation all cold foggers need some airflow to disperse the product and move the fog out into the open. Except for use in very strong wind, spray equipment such as pump sprayer, powerblast and others, that use far too much product, produce a mist or wet fog with droplets above 30 microns that is not recommended and can lead to phyto-toxicity reactions.

Consideration needs to be made for the type of application. In manual application, generally larger capacity foggers are welcome that can cover large areas in very short times to reduce the labor cost, while in automated operations small pulses of fog, over extended periods of time, give much better results.

Thermal foggers

Thermal foggers represent a wide range of foggers that all are capable of producing a range of droplet size including a very large number of very small droplets, which make the fog highly visible. Thermal foggers operate either by flash evaporation or by pulse operation. In both types the product is evaporated by heat and then condenses again in the cooler surrounding. The droplet size of the fog depends on the heat input, the heat of evaporation of the product and the flow rate. The viscosity does not play a role in the fog formation with thermal foggers as with the cold foggers (Table 1). With the proper settings all can produce a dry fog with droplets of less than 10 microns and with good efficacy. Despite the high temperature of the operation, little or no thermal degradation, except for some occasional burnt odor generation, is observed due to the short time of exposure. Most are based on the principle of a jet propulsion engine and make the corresponding noise. The *Golden Eagle* has been the most widely used model for TP-40 to repel birds with good success. But also the larger *Blackhawk* and the *Igeba* machines have been used with great results (Table 2). Generally, it is important that they should be operated at no more than 50% of their rated capacity to assure a dry fog. Better results are actually achieved by lower settings in the 30% range, when the fog becomes less dense and less visible. With the thermal input, the fog rises easily and it makes the thermal fogger the preferred type of equipment for trees and bushes and to reach air spaces with physical obstructions in buildings.

At first applications, the birds are never disturbed by the noise. But once they have made the experience they recognize the noise of the machine and tend to leave before the operation can begin. On repeat foggings birds also tend to recognize the white plum and the operator handling the machine. Skilled operators, which are not always available, generally can overcome this problem. The noise generated by very large models, such as the *Model 1200* from Curtis Dyna-Fog, that generates a dry fog at a consumption rate of 60 gal TP-40 per hour is not a problem as the cloud can reach up to a mile under the right wind conditions. Generally, these types of foggers are too large for most operations, except to keep birds off from oil spills and other large disaster areas.

The small *Burgess Bug Killer*, which operates electrically or with a small propane cylinder where the product evaporates in a heated coil, does not create any noise and is very useful for small areas with little wind. The machine is very handy and generates a very effective fog with small droplet size.

The problem associated with all thermal foggers is the presence of an open flame or hot surfaces, which limit their uses in many industrial sites. While some can be started remotely or automatically, they are not well suited for automatic on/off cycles of short duration.

Mechanical fogger or cold fogger

Mechanical foggers, sometimes also called Ultra Low Volume (ULV) foggers are generally less noisy than thermal fogger, exert no heat load on the product and are much more suited for automation, specially if

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they are electrically driven (Table 3). Most use a high volume stream of air over a fine nozzle, with or without ultrasonic to disperse the product. They generate droplets of a more precise and narrow range. The absence of a large number of very small droplets will limit the penetration of the fog into highly obstructed areas and trees and bushes. They need to be calibrated to generate the desired droplet size at the given viscosity. Good success was reported with the *Hurricane*, despite the fact that the fog is somewhat wet when used with TP-40. But at the lowest setting droplets of 20-25 microns at a rate of 2.3 oz/min (68 ml/min) are possible which show good results when set up with a timing device (e.g., 30 seconds on at 30 minute intervals during the times of bird activity). At higher rates droplets of 30-35 microns are generated that do not stay in the air very long and drop out which leads to excess odor long after completion of the fogging operation. The different *Cyclone* has only one nozzle and delivers droplets of 14-18 microns with TP-40 at a rate of 0.2 oz/min (5.9 ml/min), which is more effective by using less product than the *Hurricane*. Due to the required electricity, their usefulness is mainly indoors or in open structures. Despite the relative quiet operation, the birds learn soon to recognize the sound when the unit starts up and leave the area. However, automated fogging operation, does not allow them to return to their original place without disturbance, and normally within two days the birds stay away completely.

Parameter	Thermal Fogger	Cold Fogger	BICO 2000
Flow rate high low	strong impact larger smaller	strong impact larger smaller	strong impact larger smaller
Viscosity high low	N/A	strong impact larger smaller	strong impact smaller larger
Air pressure high low	N/A	strong impact smaller larger	N/A

Table 1. Effects of various properties and settings on the droplet size for thermal and cold foggers using Rejex-it® TP-40.

Gasoline powered, truck mounted foggers, such as the Typhoon models, that use large blowers to disperse the product in one or several nozzles, which are widely used for aerial mosquito control, have been used on several airport runways. By adjusting the air pressure, they are set to deliver at least 90% of less than 20 microns for a given viscosity. Machines that are set at the factory for Malathion with a viscosity of 88 Saybolt seconds will produce similar droplets with TP-40 at 81 Saybolt seconds. If the machine was calibrated for aqueous solutions, the droplets would be too large with TP-40 even under reduced flow rates.

New developments specifically for the control of bird problems have led to several specialized ULV foggers, such as the *BIC 200*, the *Birdhazer* and an automated spray can, that produce a very controlled droplet size with little or no noise and the generation of a fog cloud that is practically invisible

BICO 2000

The *BICO 2000* is a 12-V battery operated automated fogger specially developed for a new watersoluble formulation of Rejex-it® for use in Europe. It is a true ULV fogger that uses only 20 ml/min of Rejex-it® WS-40 with a viscosity of 180 cps and generates uniform droplets of 35 microns that are practically invisible and are very effective. Contrary to the normal cold foggers, the droplets size with this machine decreases with increasing viscosity, up to a point where the product does not flow sufficiently. The machine is very effective under relatively windy conditions and runs completely silent.

Birdhazer

The *Birdhazer*, is a new development that uses compressed air or carbon dioxide from a cylinder to generate a fog of 27 microns with an average of 5 microns. The very fine fog within a narrow range of droplet sizes is barely visible and stays in the air for 4 hours before dissipating when used indoors. The machine does not make any noise that the birds could recognize. With the low consumption rate of 2 oz/hr (59 ml/h) it can be operated over long periods of time.

Spray Cans

Automated spray cans, similar to reodorant dispensers, which will be available soon, are very small and can be installed in any area, indoor or outdoors. They are battery operated and some can be programmed to the desired times of day. Operation of one puff at 7.5 minutes intervals have proven to be very successful in Europe and in many situations have had the desired result after just one or two days of operation. As there is no training needed for their operation, they are ideal for any occasional application without supervision and support.

SUMMARY

For the first time application, birds can be approached with any type of fogger. The problems come with subsequent applications. Once, the birds recognize the noise, the operator or any other visible or audible signal associated with the fogging operation, they leave the area prematurely without further exposure. This problem can easily be overcome with automation, less visible fog and noiseless operation. For best overall results the machines should be set to generate a droplet size of 5-15 microns.

The selection of the type of fogger to use depends on the birds, the specific problem, the weather conditions and the training of the applicator. Generally, thermal foggers are preferred for indoor operation to get the normal thermal updraft in large buildings and for trees and bushes. For outdoor use the selection depends on the size of the area to be covered and other circumstances. Generally, it is better to use several smaller automated foggers and start with a small area and move the fogger every week to a new location to cover the complete area. As the fogging continues over a given area for longer periods, the birds tend to avoid the airspace over a given area with increasing height until some will never again fly over the target area.

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- Vogt, P. F. 2001. Fogging of Rejex-itTP-40. Effectiveness as a function of Droplet size to repel birds. Bird Strike '01 Conference, August 27-30, 2001 Calgary, Canada.

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Company Model	Type	Operation	Remarks
Curtis Dyna-Fog, Ltd. 17335 U.S. Highway 31 North, Westfield, IN 46074-0297, Phone: 317-896-2561 www.dynafog.com US Distributor for the application with Rejex-it [®] TP-40: Flockfighters USA			
Golden Eagle	thermal jet propulsion	manual	Output 0-9 gal/hr. For Rejex-it [®] TP-40 best set at 3-4gal/hr to generate a dry fog. Best run at 3 gal/hr generating droplets of less than 10 microns. <u>Advantage:</u> good fog formation that penetrates foliage, fog very effective if it hits the birds. Easy to use. Good workhorse fogger. <u>Disadvantage:</u> noisy, manual operation, cloud very visible.
Blackhawk	thermal jet propulsion	manual	Output 0-18 gal/hr (twice the size of the Golden Eagle) For Rejex-it [®] TP-40 best set at 6 gal/hr to generate a dry fog with droplet size of 0.5-10 microns. <u>Advantage:</u> good fog formation that penetrates foliage, fog very effective if it hits the birds. Easy to use. <u>Disadvantage:</u> noisy, manual operation, cloud very visible.
Model 1200	thermal gasoline powered	manual automatic	Very large truck mounted machine for large areas. Controls in cab of car. Capacity to fog 15-120 gal/hr. For Rejex-it [®] TP-40 best to limit output to 60 gal/hr or less to assure a dry fog. Suitable for oil spill to keep birds off the oil, or for large airfields.
IGEBA Geraetebau GmbH , P.O. Box 6, D-87478 Weitnau, Germany, Phone 011-49 8375-9200-0, email: IGEBA-Germany@t-online.de , www.igeba.de US Distributor: Creative Effects, Inc. San Fernando, CA , Phone: 818-365-0655, email ceifx@creative-effects.com www.creative-effects.com			
IGEBA TF 35/10 IGEBA 35 FT IGEBA TF 35 EC	thermal jet propulsion	manual	Output similar to the Golden Eagle. <u>Advantage:</u> good fog formation that penetrates foliage, fog very effective if it hits the birds. Easy to use. Good work horse fogger. <u>Disadvantage:</u> noisy, manual operation
IGEBA TF-W 60	thermal jet propulsion	manual	Output 2-9 gal/hr. For good bird control output should not exceed 5 ga/hr. <u>Advantage:</u> good fog formation that penetrates foliage, fog very effective if it hits the birds. Easy to use. Capable to fog oil and water based formulations (TP-40 & WS-40) <u>Disadvantage:</u> noisy, manual operation
The Fountainhead Group, Inc. , 23 Garden Street, New York Mills, NY 13417, Phone 800-311-9903 www.thefountainheadgroup.com Sold in Hardware & Garden stores			
Burgess Bug Killer Model 1443	thermal	manual	Completely portable hand held propane driven fogger <u>Advantage:</u> small, no noise, very effective <u>Disadvantage:</u> open flame, limited to small areas.

Table 2: Thermal Aerosol Generator (Fogger) for the Control of Bird Problems with Rejex-it[®] TP-40.

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Company Model	Type	Operation	Remarks
Curtis Dyna-Fog, Ltd. 17335 U.S. Highway 31 North, Westfield, IN 46074-0297, Phone: 317-896-2561 www.dynafog.com US Distributor for the application with Rejex-it® TP-40: Flockfighters USA			
Hurricane	mechanical electric	manual automatic	Small electric ULV fogger. Droplets rather large with a range of 23-34 microns for TP-40 with a viscosity of 16 cps. At optimum setting (L) 23 microns for TP-40. Should be set at lowest possible setting for optimum results. <u>Advantages</u> : cheap, easy to operate, easy to automate with timer, easy on/off. Good for indoor use or open structures. <u>Disadvantages</u> : fog rather wet at high settings, does not penetrate foliage.
Cyclone	mechanical electric	manual automatic	Similar to Hurricane, somewhat larger in size. Small electric ULV fogger. Droplets smaller than with Hurricane, with a range of 14-18 microns. At optimum setting of 4-5 15 microns for TP-40 are expected. Set at lowest possible setting for optimum results. <u>Advantages</u> : cheap, easy to operate, easy to automate with timer, easy on/off. Good for indoor use or open structures. <u>Disadvantages</u> : fog rather wet, does not penetrate foliage.
Typhoon 1 Typhoon 2	gasoline powered	manual automatic	Truck mounted units. Typical mosquito fogger. Droplet size depends on air pressure and product flow settings. <u>Advantages</u> : Low visibility. Uniform droplet size: 90% of less than 20 micron for TP-40 <u>Disadvantages</u> : noisy, require manpower to operate.
Birdtec , 4074 155 th Ave., Hersey, MI 49677, Phone: 231-832-1943, email: glwnm@yahoo.com Sales and Distribution of fogger and Rejex-it® TP-40.			
Birdhazer	mechanical electric	automatic	New technology, electrically powered or by compressed gas. Droplet size from 5-7 micron at 2oz/hr. <u>Advantages</u> : fully automatic, low consumption rate of 2oz/hr. Fog hangs in the air for several hours. No sound. Invisible fog. Great for indoor and outdoor use.
Flockfighters USA , P.O. Box 6553, Fort Wayne, IN 46896, Phone: 800-489-6651, email: flockfighters@fwi.com www.flockfighters.com			
Birdbuster	mechanical pneumatic	automatic	Engineered system, powered by compressed gas. Droplet size depends on air pressure. Generally < 20 microns. <u>Advantages</u> : fully automatic. Explosion proof design, instant on/off. Works on plant air or nitrogen line.
HH Winkler GmbH , Ahrensfelder Weg 7, D-22926, Ahrensburg, Germany, Phone 011-49 4102-51261, email: aw@hhwinkler.de Web site www.hhwinkler.de Distributed in the US by Flockfighters			
BICO 2000	Spinn disk	fully automatic	<u>Advantages</u> : 12 V battery operated, no noise, fog practically invisible, very good for Rejex-it WS-40 (viscosity 180 cps). <u>Disadvantage</u> : relative large droplets of 35 micron at 2ml/min., not useful with TP-40

Table 3: Cold Foggers for the Control of Bird Problems with Rejex-it® TP-40.