

Low-volume aerial application with rotary atomizers in Brazil: new developments

Low volume aerial applications typically at 5-15 l/ha (0.5-1.5 US gallons/acre) with rotary atomizers are not new in Brazil but recent developments have seen a renewed interest in this technique. Low volumes offer operators improved productivity and reduced operational costs, particularly as the majority (75-80%) of the Brazilian Agaviation fleet of 1000 aircraft are of the Ipanema type that has a hopper capacity limited to 200-400 US gallons. For more than three decades, for example, Micronair™ rotary atomizers have been used throughout Brazil in a range of diverse cultures such as soyabean, corn, sugar cane, beans, rice, wheat, cotton and bananas. Products applied have usually been insecticides, fungicides, growth regulators and some foliar fertilizers where the biological performance of the Micronair™ system with it's control of droplet size was often superior to conventional high volume sprays with hydraulic nozzles.

One perceived limitation of the technique, however, was the inability to use rotary nozzles for herbicide applications due to the need for use of larger spray droplet sizes often in excess of 250um in diameter. Most rotary atomizers have to date not been suitable for use with herbicides particularly on faster fixed wing aircraft as the choice of droplet size was limited in the range 50-200um VMD (Volume Median diameter). Concerns about spray drift when using smaller droplets, particularly along field margins have also been a restriction to further uptake of the technique by aerial operators.

Aerial herbicide applications have also increased markedly over the years and operators have been required to use higher volume applications and larger droplets to compensate for reduced spray quality and drop size control.

An example of this is in Rio Grande do Sul, Brazil's southernmost state where around 90% of aerial applications are made on flooded rice and soybean crops. In some regions of the state, crops of rice and soybean coexist side by side. In rice crops, of which there are around 1 million ha in Rio Grande do Sul alone, the main aerial applications are of herbicides (50% of the applied area) followed by fungicide, insecticide and granulated fertilizers. In soybean crops, applications of insecticide, fungicide and herbicide (particularly crop dessicants such as glyphosate) are routinely used.

During the season 2003/2004, the Brazilian company Agrotec Ltda conducted a series of spray trials in southern Brazil on Rice crops applying herbicides with the newly developed Micronair AU5000LD low drift rotary atomizer. Spray applications were also made using fungicides in soya crops to target the recently discovered serious disease 'Asian leaf rust' *Phakopsora pachyrhizi*.

In conjunction with local aerial operators Julio Kampf, owner and pilot of the company Terra Aviação Agrícola Ltda, of Cachoeira do Sul, and his colleagues Vitor Hugo Nitz and Valdomiro Schramm, owners and pilots of the company Nitz Aviação Agrícola, in Pântano Grande, Agrotec equipped a number of Ipanema fixed wing aircraft with the new atomizers. The objective was to achieve:-

- a) A reduction in application volumes to 10-15 l/ha to improve productivity of aircraft, timeliness of application yet maintain or improve biological efficacy without incurring increased risks of drift.
- b) To use the same rotary atomizers for all applications (fungicides, insecticides and insecticides).
- c) To reduce drift when using herbicides by reduction in the small droplet fraction below 150um in size
- d) To use the optimal droplet size according to target, product and environmental conditions for the particular application by simply changing the blade angle setting on the atomizers.

The new Micronair AU5000LD atomizer assembly consists of a stack of precision moulded discs with serrations on the disc edge to improve droplet size control at the high flow rates required for aerial application. The diameter of the discs is only 65mm reducing the tangential velocity at the disc edge as the atomizer rotates compared with the standard AU5000 metal gauze atomizer. This together with an air deflector to prevent drops shattering as they are released into fast moving airstream reduces the small droplet fraction and hence off target drift. The AU5000LD atomizer assembly is interchangeable with the standard Micronair AU5000 gauze by simply removing three screws and is capable of selecting droplet sizes in the range 80um VMD up to 400um VMD depending on application by simply changing the blade angle setting and hence rotational speed of the atomizer from say 5000 rpm (100 -150um for insecticides) down to 1500 rpm for large drops (around 300-400um in size for herbicides).

A set of 8 atomizers were installed on a Ipanema EMB 201A, from Terra Aviação Agrícola as well as two more sets of atomizers installed on two Cessna Agtruck aircraft, from Nitz Aviação Agrícola.

An extensive series of spray deposition tests – using water sensitive spray cards, analyzed by the software AgroScan © from Agrotec – were conducted, in conjunction with Agrotec Engineers and Tim Sander (Technical manager, Micronair Division) from the manufacturer, Micron Sprayers Ltd, based in England.

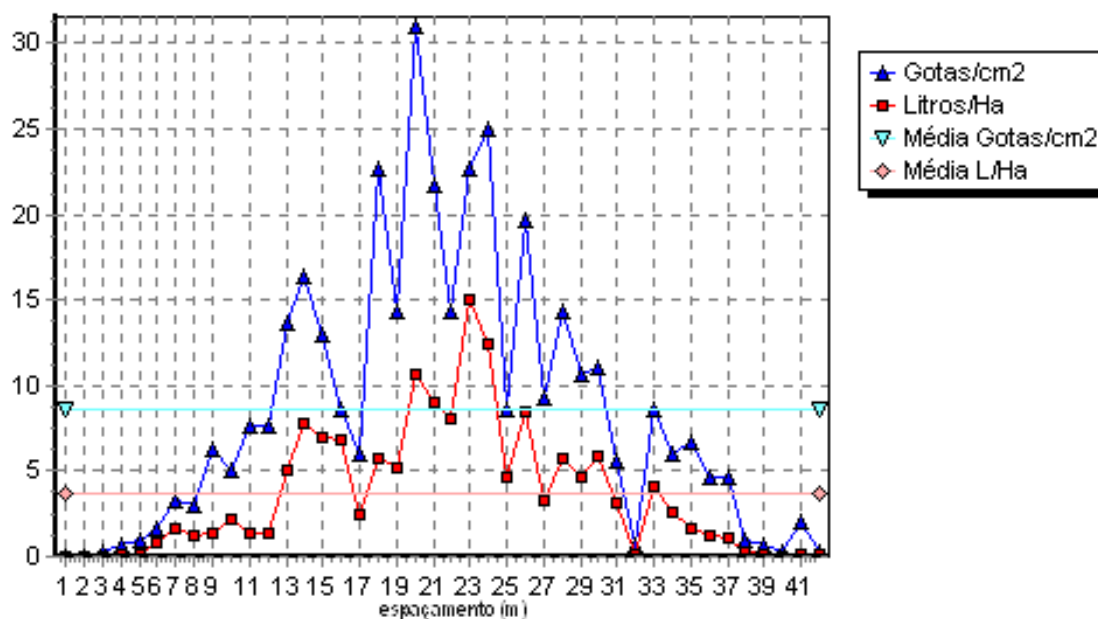
After analysis of the spray cards the following general recommendations were established:

- a) Application volumes:
 - Fungicides in water: 15 liters/ha
 - Fungicides in mix with vegetable oil: 7-10 liters/ha
 - Herbicide in water: 15 liters/ha
 - Insecticide in water: 10 liters/ha
 - Insecticide in mix with vegetable oil: 5-10 liters/ha

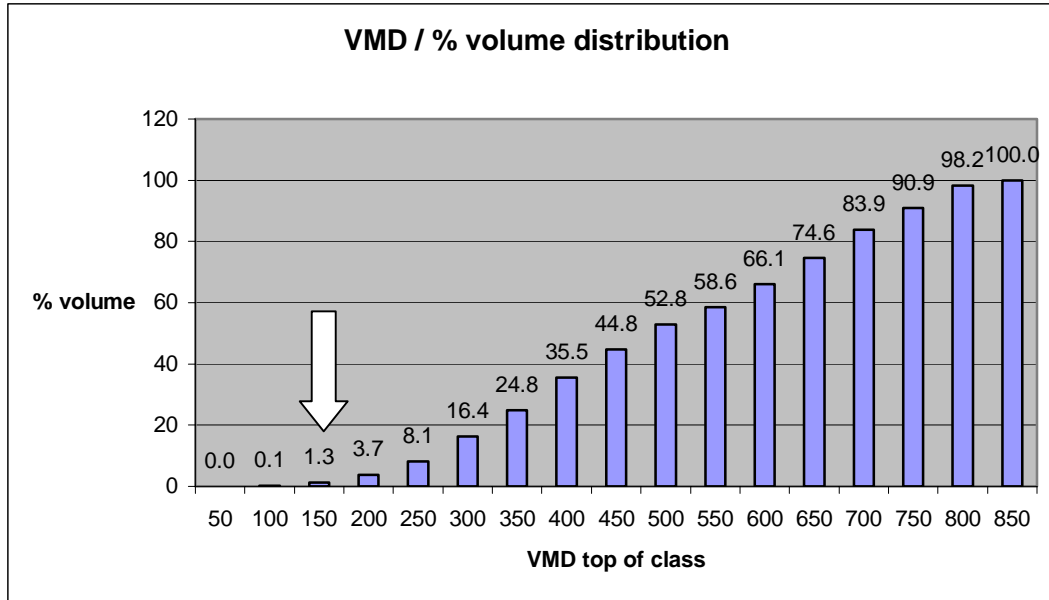
- b) Swath width:
- Herbicides and fungicides: 16 to 18 meters (depending on the mean droplet diameter and atmospheric conditions)
 - Insecticides: 18 to 20 meters
- c) Droplet Size Analysis:
- Herbicides: > 300 um in diameter to avoid drift using AU500LD.
 - Fungicide and insecticide in oil: 200-250 micrometers VMD
 - Fungicide and insecticide in oil: 150-200 micrometers VMD

Variations around the above values were adopted by operators in some circumstances during the season.

For greater swath uniformity, it became necessary to position the atomizers in an asymmetrical arrangement on the spray boom. A typical graph of simple swath deposition obtained with the final configuration is shown below (aircraft Ipanema EMB 201A):



For all herbicide applications the AU5000LD atomizer assembly is recommended. The standard AU5000 metal gauze can still be used for insecticide and fungicide applications as well as the AU5000LD by simply selecting the appropriate atomizer rotational speed. The graph below demonstrates the reduction in 'driftable fines' with the new AU5000LD as per analysis of water sensitive cards placed within a rice crop when applying herbicides with less than 1.3% below 150um.



The VMD₅₀ in this case was of 450 micron.

The three aircraft have operated throughout the 2003/2004 season in southern Brazil using only the Micronair rotary atomizers. Only when solid products were applied was it necessary to change the atomizers. They were used with a wide range of products (herbicides, fungicides, insecticides, foliar fertilizers and mixtures of each) in irrigated rice and soybean (treating a total of around 28,000ha of rice and soya).

Results to date have been encouraging with no reported incidences of drift or off target contamination.

Maintenance of atomizers has been negligible to date and both operators Terra Aviação Agrícola Ltda and Nitz Aviação Agrícola reported significant savings through improved productivity with a 30% reduction in spray volumes overall.

The table below shows the use of the three sets of atomizers during the season 2003/2004:

Applied area (hectares), with AU5000 and AU5000LD, 2003/2004

Rates	Herbicide	%	Insecticide	%	Fungicide	%
< 10 l/ha	0	0.0	7210	69.0	3185	33.2
10-20 l/ha	8031	99.5	2360	22.6	5711	59.6
> 20 l/ha	38	0.5	876	8.4	683	7.1
Total	8069	100	10446	100	9579	100

Further information is available from www.agrotec.etc.br or www.micron.co.uk