drift collected decreased. At optimum viscosities drift was reduced by 97% with Vistik and 75% with Norbak. Further increases in polymer concentration, and thus viscosity, did not improve control with Norbak. Vistik solutions were very sensitive to viscosity changes. An increase above the optimum level would inhibit divergence of the spray at the nozzle, and a decrease in viscosity would result in reduced drift control.

These results suggest that spray drift can be controlled in the field with thickening agents. Variations in viscosity of solutions caused by temperature changes and ions can be overcome by using varying amounts of polymer. Generally, conventional equipment can be used but some allowance for the thickness of solutions must be made.

Thickening agents only reduce the formation of small droplets - they do not reduce the movement of herbicide vapour. Complete control of drift cannot be achieved with thickening agents alone; this will only come with an integrated approach to design of equipment and spray solutions. The influence of droplet size on herbicide efficiency will also have to be considered in relation to spray drift.

EFFECT OF METEOROLOGICAL CONDITIONS ON DRIFT OF SPRAY CLOUDS

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Meteorological factors affect the behaviour of clouds of droplets released by spray units mounted on land vehicles or in low-flying aircraft. Such units will release swathes of droplets from a line source. In aerial spraying there is initial major disturbance of the spray cloud caused by the aerodynamics of the aircraft.

Our concern is with the atmospheric transport and diffusion of spray clouds, specifically of herbicides. As much as possible should be deposited on the target area, such as a field of weeds, but the risk that damaging concentrations will reach crops, livestock or humans must be avoided. Meteorological factors should be known and allowed for before release of the spray.

WIND

WIND

'Air movement in the vertical is related to atmospheric stability. If the temperature lapse with height exceeds approximately 3°F per 1000 ft. the atmosphere is unstable and upward promotion is promoted; whereas stable conditions occur when the lapse rate is less than 3°F per 1000 ft. A temperature inversion - warm air above cold - gives an extremely stable condition'.

TURBULENCE

Equally important is the vertical component of wind which, along with droplet size, largely determines the length of time the spray will be airborne (for a given release height). The longer the cloud takes to settle, the greater the dispersion of the droplets.

Air movement in the vertical is related to atmospheric stability. A temperature lapse in excess of the moist adiabatic rate will promote instability and upward motion; whereas stable conditions will result from a lower lapse rate and especially from a temperature inversion - warm air above cold.

On clear nights, through radiational cooling of the ground, air near the surface is cooled and density differences soon cause vertical motion to cease. A temperature inversion is formed, the height thereof depending, inter alia, on small scale mechanical eddies brought about by horizontal wind flow over the rough surface.

Contrariwise, heating of the surface by day promotes vertical motion and turbulence. The more uneven the motion of the atmosphere, the more the spray cloud will be 'torn apart'.

TEMPERATURE AND HUMIDITY

Air temperature will have two main effects on the drift of spray clouds. One, as already discussed, relates to stability. Temperature and humidity together will determine rate of evaporation from the droplet surfaces and thus their diminution in size. The smaller the droplet the less its downward velocity relative to air and so its greater horizontal travel in the time it is airborne.

OPTIMUM TIME FOR SPRAYING

Generally, there is a decreasing tendency for dispersion and unsteady motion of spray clouds between late afternoon and early morning, unless upset by grontal action, thunderstorm, katabatic wind or other local effect.

During the day thermal instability increases, downward transfer of wind energy occurs and eddy motion is promoted, these factors causing greater dispersion and more random aerial distribution of spray clouds.

While maximum stability is to be expected near dawn, the action of the herbicide on weeds may be adversely affected by wind and heat during the day. In some cases, therefore, the optimum time for spraying will be near dusk.

FACTORY AND FIELD HAZARDS IN RELATION TO VARIOUS WEEDICIDES

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Division of Occupational Health, New South Wales

Modern weedicides, along with all pesticides, present hazards during their formulation as well as in their field application. Until recent years weedicides have not presented many of the toxicity problems normally associated with groups like the insecticides. Arsenicals, of course, are the exception, having caused many deaths through ingestion and with the use of organic compounds for weed control in the last two decaldes other toxicity problems have arisen. These are dealt with, in chemical groups, in the paragraphs that follow.

Arsenic

In formulation plants, the oxides of arsenic used are in the form of a fine powder, which can present an inhalation hazard. Exhaust ventilation should be used to control the dust, and respiratory protection (half-face dust respirator) should be used by the operator.

When spraying arsenicals in the field a coarse jet should be used to prevent spray drift. Tests under both factory and field conditions have indicated concentrations of arsenic in air well in excess of the maximum allowable concentration (MAC) of 0.5 mg/m^3 in situations where such control was not implemented. The storage of respirators and gloves in locked boxes containing arsenic has been seen in several local government situations. Pole boring and arsenic application is a hazard to children unless hardwood plugs are driven into the holes after application.

Dermatitis from skin contact with arsenic is fairly common. indicating the need for gloves and protective clothing.