Delta T: A Tool for Pesticide Application Decision Making

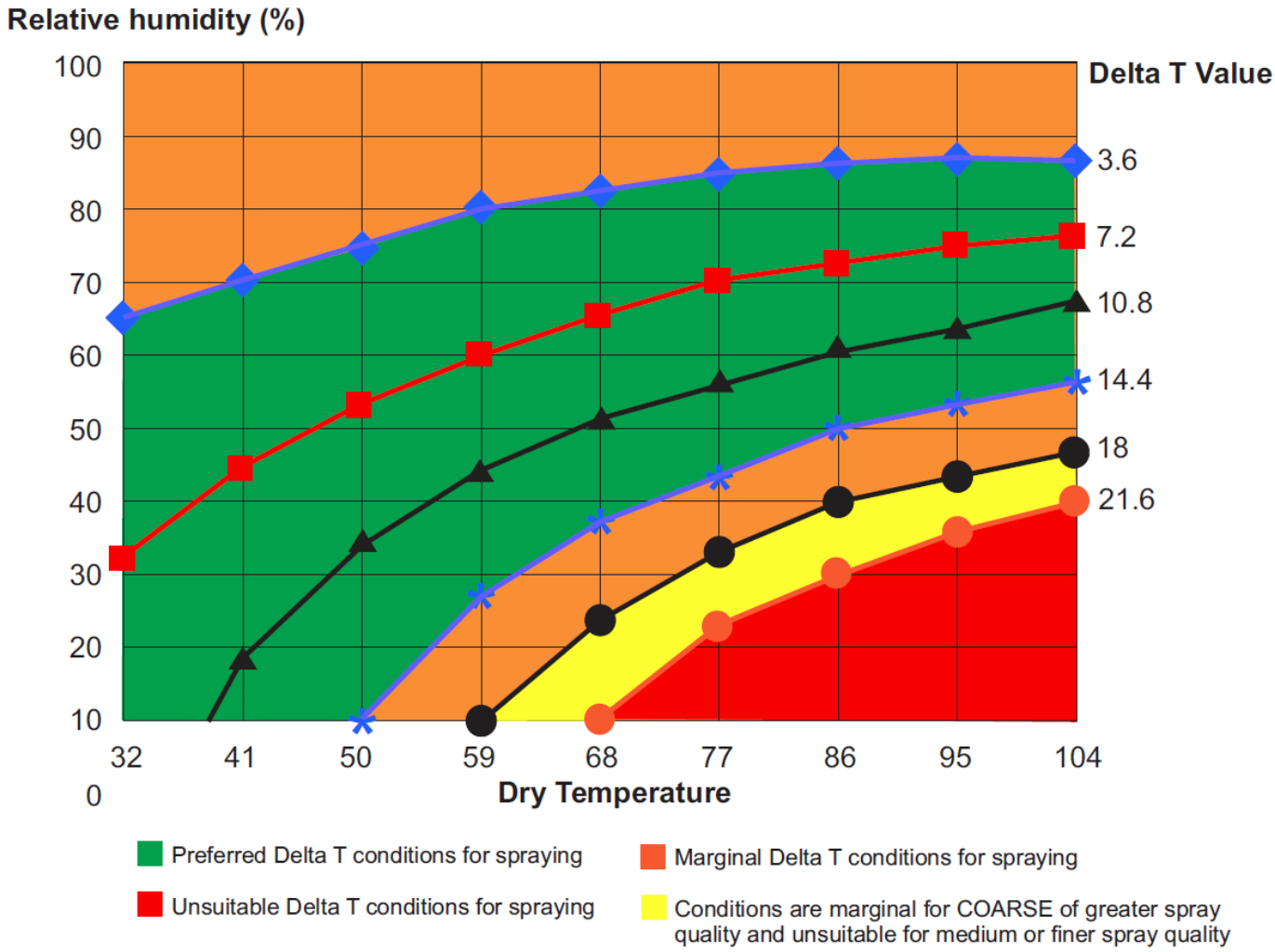
Delta T is the temperature difference between a dry bulb (air temperature sensor exposed directly to the air) and a wet bulb (air temperature sensor enclosed in wetted material so that water is constantly evaporating from it and cooling the bulb). The higher the Delta T value, the drier the atmosphere is with greater potential to evaporate spray drops.

Delta T is the primary method by which applicators in Australia decide when and how to apply pesticides to improve efficacy and reduce spray drift. It originated in the early 1990's. It was designed in the era when the primary spray nozzle was a flat fan. Because these nozzles produce a relatively high proportion of fine spray drops, there was widespread concern, especially in the drier and hotter parts of Australia, that significant evaporation of these fine drops would lead to coverage/efficacy issues as well as increased spray drift. The Australian's also use relatively low Delta T values as an indication that an air temperature inversion is likely occurring and/or the humidity is so high that fine spray drops would have a tendency to move further down range.

The Delta T concept has gained some adoption in the arid portions of Western Canada. Weather instrumentation manufacturers in North America have also built a Delta T value into their devices. Kestrel Meters and Weather Flow both make instruments that report a Delta T value. In the United States, Delta T has not been widely used. It is not part of standard pesticide application curricula.

Figure 1. is a graphic depicting how the Delta T value changes relative to humidity and temperature. Delta T is reported on the right side of this graphic. It is expressed in degrees F. On the bottom of the graphic, the legend describes whether it is acceptable or not to spray, what is optimum, and when are the conditions marginal and under what circumstances. Temperatures reported in the chart are not rounded to customary five or ten degree increments. That is because this chart was originally created in degrees Celsius. In order to maintain the integrity of the curves, Fahrenheit degrees have simply been substituted to replace the Celsius temperatures.

Figure 1. Delta T values for determining when to make pesticide applications. This graphic was created by NDSU Ag Communications.



A typical flat fan spray nozzle set at 40 psi will produce 30% or more fine spray drops. All those drops are likely to evaporate before they hit the target with a Delta T value of 18 or more. That will result in coverage and efficacy issues. Further, because ALL the spray drops are shrinking because of evaporation, more and more of the spray will be subjected to wind movement and drift. The impact of evaporation on a spray application can be partially offset by increasing droplet size. Coarse or greater spray quality drops, those often produced by an Air Induction or a Turbo Teejet Induction nozzle, can be used up to a Delta T of 21.6. But after that, the evaporation rate becomes so problematic that applications are no longer recommended.

Table 1. Sample weather variables from selected NDAWN Stations . The Delta T value is reported in green because the estimated Delta T is less than 14.4. degrees F but more than 3.6 degrees F. This is in the preferred range for spraying.

			Current							
Station	Ag District	Last Updated	Air Temp	Wind Dir	Wind Speed	Peak Gust	Rel Hum	Dew Point Temp	Est. Wet-bulb Temp	Est. ΔT
Ada 1N	MN-NW	16 May 15:20 CDT	58°	N	15 mph	19 mph	47 %	38°	48°	10°
Adams 5N	ND-NE	16 May 15:20 CDT	53°	N	12 mph	20 mph	41 %	30°	43°	10°
Alamo 2S	ND-NW	16 May 15:20 CDT	57°	NE	11 mph	16 mph	31 %	27°	43°	14°
Baker 1N	ND-NC	16 May 15:20 CDT	55°	NNE	6 mph	12 mph	36 %	28°	43°	12°
Beach 9S	ND-SW	16 May 15:20 CDT	55°	E	14 mph	19 mph	55 %	39°	47°	8°
Becker 1W	MN-C	16 May 15:20 CDT	73°	N	15 mph	20 mph	46 %	51°	60°	13°
Berthold 5NW	ND-NW	16 May 15:20 CDT	55°	NE	8 mph	15 mph	33 %	27°	43°	13°
Bottineau 14W	ND-NC	16 May 15:20 CDT	58°	NNE	12 mph	18 mph	29 %	25°	44°	14°
Bowbells 1N	ND-NW	16 May 15:20 CDT	55°	NE	6 mph	10 mph	33 %	26°	43°	13°
Bowman 4W	ND-SW	16 May 15:20 CDT	55°	ENE	14 mph	19 mph	61 %	41°	48°	7°
Brampton 2WSW	ND-SE	16 May 15:20 CDT	58°	NNE	13 mph	19 mph	57 %	43°	50°	8°
Brorson 5NW	MT-NE	16 May 15:20 CDT	59°	ENE	11 mph	17 mph	37 %	33°	46°	13°
Campbell 3SE	MN-WC	16 May 15:20 CDT	58°	N	19 mph	25 mph	62 %	46°	51°	7°
Cando 2SE	ND-NE	16 May 15:20 CDT	54°	NNW	10 mph	15 mph	46 %	34°	45°	10°
Carrington 4N	ND-C	16 May 15:20 CDT	57°	NNE	13 mph	20 mph	31 %	27°	43°	13°

Just like other weather variables, Delta T will change throughout the day. Generally, in the early morning hours, the value will be low, but as the day warms, the number will rise. As evening and night sets in, the numbers will fall again. In North Dakota, Delta T values will generally be higher in the SW and lower in the NE region of the state (relatively warmer and drier climate versus a cooler and higher precipitation one).

Delta T is an excellent way to understand the impact of temperature and humidity on a spray drop. Delta T values are reported every five minutes through the North Dakota Agriculture Weather Network (NDAWN). They are located on the world wide web at: https://ndawn.org