3.6 WIND MEASUREMENT

Fact Sheet Objectives

- Describe wind flow in the orchard environment
- Discuss measurement of wind speed and direction
- Discuss uses of wind data

Why Record Wind?

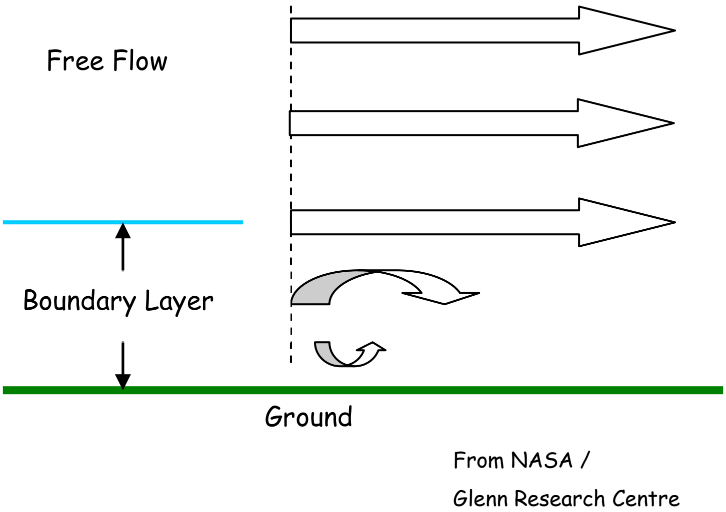
- As an aid to managing spray application.
- To document compliance with local authority requirements.
- As an input to some evapotranspiration models used in irrigation scheduling.
- To assess the adequacy of shelter.

A cup anemometer used for measuring wind speed.

Air Flow at Ground Level

Air flowing over the earth's surface encounters friction from uneven ground, trees and buildings, which slows it down. The interaction of the wind with obstacles means wind speed and direction can vary considerably from place to place over short distances.

The depth of the surface boundary layer can vary from a few metres during the night time up to hundreds of metres during the middle of the day.



A windvane used for measuring wind direction.

Wind Measurement

Wind **velocity** has two components: **speed** and the **direction** the wind is coming from. The two components are generally measured separately using a cup anemometer for wind speed and a wind vane for wind direction.

For meteorological purposes, wind sensors are mounted on a mast clear of immediate obstacles. Standard mast heights are 10m and 6m and there are rules about the distance the mast should be from obstructions.

Anemometers (and indeed *general purpose* weather stations) are not usually sited in orchards because of the obvious influence of shelter. For this reason those interested in orchard climate have had to erect their own anemometers.

Diurnal wind speeds in a sheltered orchard usually follow the radiation with the strongest winds around the middle of the day and in the afternoon, and little wind at night. Typical wind speeds in a sheltered orchard are 0.5-1 m/s.

The **Beaufort Wind Scale (below)** is an older indication of “wind force” where speed is estimated from the effects of the wind. It assumes the availability of a simple wind vane. The first column is the Beaufort Number.

A relatively low cost desk top weather station showing wind speed and direction information (photo: Davis Weather Station www.davisnet.co.nz).

Table 1. Beaufort Wind Scale

			m/s	Kt
0	Calm	Calm; smoke rises vertically	<0.5	<1
1	Light Air	Direction denoted by smoke drift, but not by wind vane	0.5-1.5	1-3
2	Slight breeze	Wind felt on face; vane moved by wind	2.0-3.0	4-6
3	Gentle breeze	Leaves and twigs in constant motion, wind extends light flag	3.6-5.1	7-10
4	Moderate breeze	Raises dust and loose paper; small branches moved	5.6-8.2	11-16
5	Fresh breeze	Small trees in leaf begin to sway; wavelets form on inland waters	8.7-10.8	17-21
6	Strong breeze	Large branches in motion; whistling heard in overhead wires; umbrellas used with difficulty	11-14	22-27
7	Near Gale	Whole trees in motion; inconvenience felt when walking against wind	14-17	28-33
8	Gale	Breaks twigs off trees; generally impedes progress	17-21	34-40
9	Strong gale	Slight structural damage (Chimney pots and slates removed)	21-24	41-47
10	Storm	Seldom experienced inland; trees uprooted; considerable structural damage occurs	25-28	48-55

Conversion Factors

In additional to standard measurements of speed such as Km/h and m/s, wind speed is sometimes measured in knots as in the Beaufort Scale.

1 knot (Kt)	=	0.514 m/s
	=	1.85 Km/h
1 m/s	=	1.94 Kt
	=	3.6 Km/h
1 Km/h	=	0.28 m/s
	=	0.54 Kt

The Wind Rose is a way of summarising a long period of wind recording, by showing the distribution of wind speeds and the frequency of the varying wind directions.

Wind Run over a period of time is calculated as mean wind speed x time, in units of distance. For example wind of 1 m/s blowing for an hour (=60 x 60 seconds) produces a wind run of 1 x 3600 m or 3.6Km.Use of wind data

When setting up an orchard operation outside or at the margin of established horticultural areas, climatic information on wind speed and direction is useful in determining **shelter** requirements.

Wind speed and wind direction provide important information when considering **spray drift**. Under normal conditions (wind speed 1-5 m/s) the actual wind speed should not have much effect. At higher wind speeds, spray deposited up to 30m directly outside the block will increase, but further downwind drift may be minimal because of dilution from the higher volume flow. Spraying at high wind speeds should be avoided. Drop size also has a major effect on drift, and at low wind speeds (< 1m/s) very small suspended drops may drift a considerable distance.

Some computer based evapotranspiration models, used to estimate **irrigation** requirements, include wind speed as part of their calculations.

Summary

- Wind is an important factor in determining the risk to crops of physical damage, in estimating water use and the ability to apply sprays.
- The key measurements are speed and direction, both of which can change over time and height above ground. A number of different scales can be used to describe wind.
- A wind rose shows the amount of wind blowing from each direction over a certain time period.

Further Information

WeatherBase: Records and averages for New Zealand: www.weatherbase.com

MetService: Climate of New Zealand: www.metservice.co.nz see learning centre

NIWA National Climate Centre: www.niwa.co.nz

Spray Drift: www.hortnet.co.nz/publications/science/sprydrft.htm

A MAF Sustainable Farming Fund extension initiative for Pipfruit and Winegrapes

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