

$$\text{VPD} = \text{es}(\text{T}_{\text{leaf}}) - (\text{RH}/100) \times \text{es}(\text{T}_{\text{air}}) \quad \text{es}(\text{T}) = 0.6108 \times \exp((17.27 \times \text{T}) / (\text{T} + 237.3)) \quad - \text{Tetens equation, kPa} \quad \text{T}_{\text{leaf}} = \text{T}_{\text{air}} + 0$$

AIR TEMP °C / °F	RELATIVE HUMIDITY %												
	30	35	40	45	50	55	60	65	70	75	80	85	90
15 59.0	1.19	1.11	1.02	0.94	0.85	0.77	0.68	0.60	0.51	0.43	0.34	0.26	0.17
15.5 59.9	1.23	1.14	1.06	0.97	0.88	0.79	0.70	0.62	0.53	0.44	0.35	0.26	0.18
16 60.8	1.27	1.18	1.09	1.00	0.91	0.82	0.73	0.64	0.55	0.45	0.36	0.27	0.18
16.5 61.7	1.31	1.22	1.13	1.03	0.94	0.84	0.75	0.66	0.56	0.47	0.38	0.28	0.19
17 62.6	1.36	1.26	1.16	1.07	0.97	0.87	0.78	0.68	0.58	0.48	0.39	0.29	0.19
17.5 63.5	1.40	1.30	1.20	1.10	1.00	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20
18 64.4	1.44	1.34	1.24	1.14	1.03	0.93	0.83	0.72	0.62	0.52	0.41	0.31	0.21
18.5 65.3	1.49	1.38	1.28	1.17	1.06	0.96	0.85	0.75	0.64	0.53	0.43	0.32	0.21
19 66.2	1.54	1.43	1.32	1.21	1.10	0.99	0.88	0.77	0.66	0.55	0.44	0.33	0.22
19.5 67.1	1.59	1.47	1.36	1.25	1.13	1.02	0.91	0.79	0.68	0.57	0.45	0.34	0.23
20 68.0	1.64	1.52	1.40	1.29	1.17	1.05	0.94	0.82	0.70	0.58	0.47	0.35	0.23
20.5 68.9	1.69	1.57	1.45	1.33	1.21	1.09	0.96	0.84	0.72	0.60	0.48	0.36	0.24
21 69.8	1.74	1.62	1.49	1.37	1.24	1.12	0.99	0.87	0.75	0.62	0.50	0.37	0.25
21.5 70.7	1.80	1.67	1.54	1.41	1.28	1.15	1.03	0.90	0.77	0.64	0.51	0.38	0.26
22 71.6	1.85	1.72	1.59	1.45	1.32	1.19	1.06	0.93	0.79	0.66	0.53	0.40	0.26
22.5 72.5	1.91	1.77	1.64	1.50	1.36	1.23	1.09	0.95	0.82	0.68	0.55	0.41	0.27
23 73.4	1.97	1.83	1.69	1.55	1.40	1.26	1.12	0.98	0.84	0.70	0.56	0.42	0.28
23.5 74.3	2.03	1.88	1.74	1.59	1.45	1.30	1.16	1.01	0.87	0.72	0.58	0.43	0.29
24 75.2	2.09	1.94	1.79	1.64	1.49	1.34	1.19	1.04	0.90	0.75	0.60	0.45	0.30
24.5 76.1	2.15	2.00	1.84	1.69	1.54	1.38	1.23	1.08	0.92	0.77	0.61	0.46	0.31
25 77.0	2.22	2.06	1.90	1.74	1.58	1.43	1.27	1.11	0.95	0.79	0.63	0.48	0.32
25.5 77.9	2.28	2.12	1.96	1.79	1.63	1.47	1.31	1.14	0.98	0.82	0.65	0.49	0.33
26 78.8	2.35	2.18	2.02	1.85	1.68	1.51	1.34	1.18	1.01	0.84	0.67	0.50	0.34
26.5 79.7	2.42	2.25	2.08	1.90	1.73	1.56	1.38	1.21	1.04	0.87	0.69	0.52	0.35
27 80.6	2.50	2.32	2.14	1.96	1.78	1.60	1.43	1.25	1.07	0.89	0.71	0.53	0.36
27.5 81.5	2.57	2.39	2.20	2.02	1.84	1.65	1.47	1.28	1.10	0.92	0.73	0.55	0.37
28 82.4	2.65	2.46	2.27	2.08	1.89	1.70	1.51	1.32	1.13	0.94	0.76	0.57	0.38

under 0.40

0.40 – 0.79

0.80 – 1.19

1.20 – 1.39

1.40 and up

VERY LOW

Germination only. “dew” =
condensing on the leaf

PROPAGATION

Seedlings and un-rooted cuttings

GROW-OUT

The working band for salad crops

FINISH & HERBS

Basil and kale only — lettuce should
stay below

TOO HIGH

Tipburn, bolting, bitter leaf

HOW TO READ IT

Air temperature down the left, humidity across the top.
The number where they meet is your leaf VPD in kPa. “dew”
= water condensing on the leaf.

THIS SHEET'S OFFSET

Leaf at air temperature. Lights off, or a leaf that has
stopped transpiring. Sheet 5 shows how to measure your
own.

PRINT IT RIGHT

Print at 100% / Actual Size, not Fit to Page. Readable
laminated, and it survives a black-and-white photocopy.

$$\text{VPD} = \text{es}(\text{T}_{\text{leaf}}) - (\text{RH}/100) \times \text{es}(\text{T}_{\text{air}})$$

$$\text{es}(\text{T}) = 0.6108 \times \exp((17.27 \times \text{T}) / (\text{T} + 237.3))$$
 — Tetens equation, kPa

$$\text{T}_{\text{leaf}} = \text{T}_{\text{air}} - 1 \text{ } ^\circ\text{C}$$

AIR TEMP °C / °F	RELATIVE HUMIDITY %												
	30	35	40	45	50	55	60	65	70	75	80	85	90
15 59.0	1.09	1.00	0.92	0.83	0.75	0.66	0.58	0.49	0.40	0.32	0.23	0.15	0.06
15.5 59.9	1.12	1.03	0.95	0.86	0.77	0.68	0.59	0.51	0.42	0.33	0.24	0.15	0.07
16 60.8	1.16	1.07	0.98	0.89	0.80	0.71	0.61	0.52	0.43	0.34	0.25	0.16	0.07
16.5 61.7	1.20	1.10	1.01	0.92	0.82	0.73	0.63	0.54	0.45	0.35	0.26	0.17	0.07
17 62.6	1.24	1.14	1.04	0.95	0.85	0.75	0.66	0.56	0.46	0.36	0.27	0.17	0.07
17.5 63.5	1.28	1.18	1.08	0.98	0.88	0.78	0.68	0.58	0.48	0.38	0.28	0.18	0.08
18 64.4	1.32	1.22	1.11	1.01	0.91	0.80	0.70	0.60	0.49	0.39	0.29	0.18	0.08
18.5 65.3	1.36	1.25	1.15	1.04	0.94	0.83	0.72	0.62	0.51	0.40	0.30	0.19	0.08
19 66.2	1.40	1.29	1.19	1.08	0.97	0.86	0.75	0.64	0.53	0.42	0.31	0.20	0.09
19.5 67.1	1.45	1.34	1.22	1.11	1.00	0.88	0.77	0.66	0.54	0.43	0.32	0.20	0.09
20 68.0	1.50	1.38	1.26	1.15	1.03	0.91	0.79	0.68	0.56	0.44	0.33	0.21	0.09
20.5 68.9	1.54	1.42	1.30	1.18	1.06	0.94	0.82	0.70	0.58	0.46	0.34	0.22	0.10
21 69.8	1.59	1.47	1.34	1.22	1.09	0.97	0.85	0.72	0.60	0.47	0.35	0.22	0.10
21.5 70.7	1.64	1.51	1.39	1.26	1.13	1.00	0.87	0.74	0.62	0.49	0.36	0.23	0.10
22 71.6	1.69	1.56	1.43	1.30	1.17	1.03	0.90	0.77	0.64	0.50	0.37	0.24	0.11
22.5 72.5	1.75	1.61	1.47	1.34	1.20	1.07	0.93	0.79	0.66	0.52	0.38	0.25	0.11
23 73.4	1.80	1.66	1.52	1.38	1.24	1.10	0.96	0.82	0.68	0.54	0.40	0.26	0.12
23.5 74.3	1.86	1.71	1.57	1.42	1.28	1.13	0.99	0.84	0.70	0.55	0.41	0.26	0.12
24 75.2	1.91	1.77	1.62	1.47	1.32	1.17	1.02	0.87	0.72	0.57	0.42	0.27	0.12
24.5 76.1	1.97	1.82	1.67	1.51	1.36	1.20	1.05	0.90	0.74	0.59	0.44	0.28	0.13
25 77.0	2.03	1.88	1.72	1.56	1.40	1.24	1.08	0.92	0.77	0.61	0.45	0.29	0.13
25.5 77.9	2.10	1.93	1.77	1.61	1.44	1.28	1.12	0.95	0.79	0.63	0.46	0.30	0.14
26 78.8	2.16	1.99	1.82	1.66	1.49	1.32	1.15	0.98	0.81	0.65	0.48	0.31	0.14
26.5 79.7	2.22	2.05	1.88	1.71	1.53	1.36	1.19	1.01	0.84	0.67	0.49	0.32	0.15
27 80.6	2.29	2.11	1.94	1.76	1.58	1.40	1.22	1.04	0.87	0.69	0.51	0.33	0.15
27.5 81.5	2.36	2.18	1.99	1.81	1.63	1.44	1.26	1.08	0.89	0.71	0.53	0.34	0.16
28 82.4	2.43	2.24	2.05	1.86	1.68	1.49	1.30	1.11	0.92	0.73	0.54	0.35	0.16

under 0.40

VERY LOW

Germination only. "dew" =
condensing on the leaf

0.40 – 0.79

PROPAGATION

Seedlings and un-rooted cuttings

0.80 – 1.19

GROW-OUT

The working band for salad crops

1.20 – 1.39

FINISH & HERBS

Basil and kale only — lettuce should
stay below

1.40 and up

TOO HIGH

Tipburn, bolting, bitter leaf

HOW TO READ IT

Air temperature down the left, humidity across the top.
The number where they meet is your leaf VPD in kPa. "dew"
= water condensing on the leaf.

THIS SHEET'S OFFSET

Light radiant load, modest airflow. Common under
low-intensity LED. Sheet 5 shows how to measure your
own.

PRINT IT RIGHT

Print at 100% / Actual Size, not Fit to Page. Readable
laminated, and it survives a black-and-white photocopy.

START HERE · MOST ROOMS

$$\text{VPD} = \text{es}(\text{T}_{\text{leaf}}) - (\text{RH}/100) \times \text{es}(\text{T}_{\text{air}})$$

$$\text{es}(\text{T}) = 0.6108 \times \exp((17.27 \times \text{T}) / (\text{T} + 237.3))$$
 — Tetens equation, kPa

$$\text{T}_{\text{leaf}} = \text{T}_{\text{air}} - 2 \text{ °C}$$

AIR TEMP °C / °F	RELATIVE HUMIDITY %												
	30	35	40	45	50	55	60	65	70	75	80	85	90
15 59.0	0.99	0.90	0.82	0.73	0.65	0.56	0.47	0.39	0.30	0.22	0.13	0.05	dew
15.5 59.9	1.02	0.93	0.84	0.76	0.67	0.58	0.49	0.40	0.31	0.23	0.14	0.05	dew
16 60.8	1.05	0.96	0.87	0.78	0.69	0.60	0.51	0.42	0.33	0.23	0.14	0.05	dew
16.5 61.7	1.09	0.99	0.90	0.81	0.71	0.62	0.52	0.43	0.34	0.24	0.15	0.06	dew
17 62.6	1.12	1.03	0.93	0.83	0.74	0.64	0.54	0.45	0.35	0.25	0.16	0.06	dew
17.5 63.5	1.16	1.06	0.96	0.86	0.76	0.66	0.56	0.46	0.36	0.26	0.16	0.06	dew
18 64.4	1.20	1.10	0.99	0.89	0.79	0.68	0.58	0.48	0.37	0.27	0.17	0.06	dew
18.5 65.3	1.24	1.13	1.03	0.92	0.81	0.71	0.60	0.49	0.39	0.28	0.17	0.07	dew
19 66.2	1.28	1.17	1.06	0.95	0.84	0.73	0.62	0.51	0.40	0.29	0.18	0.07	dew
19.5 67.1	1.32	1.21	1.09	0.98	0.87	0.75	0.64	0.53	0.41	0.30	0.19	0.07	dew
20 68.0	1.36	1.25	1.13	1.01	0.89	0.78	0.66	0.54	0.43	0.31	0.19	0.08	dew
20.5 68.9	1.41	1.29	1.17	1.04	0.92	0.80	0.68	0.56	0.44	0.32	0.20	0.08	dew
21 69.8	1.45	1.33	1.20	1.08	0.95	0.83	0.71	0.58	0.46	0.33	0.21	0.08	dew
21.5 70.7	1.50	1.37	1.24	1.11	0.98	0.86	0.73	0.60	0.47	0.34	0.22	0.09	dew
22 71.6	1.55	1.41	1.28	1.15	1.02	0.88	0.75	0.62	0.49	0.36	0.22	0.09	dew
22.5 72.5	1.59	1.46	1.32	1.19	1.05	0.91	0.78	0.64	0.50	0.37	0.23	0.09	dew
23 73.4	1.64	1.50	1.36	1.22	1.08	0.94	0.80	0.66	0.52	0.38	0.24	0.10	dew
23.5 74.3	1.70	1.55	1.41	1.26	1.12	0.97	0.83	0.68	0.54	0.39	0.25	0.10	dew
24 75.2	1.75	1.60	1.45	1.30	1.15	1.00	0.85	0.70	0.56	0.41	0.26	0.11	dew
24.5 76.1	1.80	1.65	1.50	1.34	1.19	1.03	0.88	0.73	0.57	0.42	0.27	0.11	dew
25 77.0	1.86	1.70	1.54	1.38	1.23	1.07	0.91	0.75	0.59	0.43	0.28	0.12	dew
25.5 77.9	1.92	1.75	1.59	1.43	1.26	1.10	0.94	0.77	0.61	0.45	0.28	0.12	dew
26 78.8	1.98	1.81	1.64	1.47	1.30	1.14	0.97	0.80	0.63	0.46	0.29	0.13	dew
26.5 79.7	2.04	1.86	1.69	1.52	1.34	1.17	1.00	0.82	0.65	0.48	0.30	0.13	dew
27 80.6	2.10	1.92	1.74	1.56	1.39	1.21	1.03	0.85	0.67	0.49	0.32	0.14	dew
27.5 81.5	2.16	1.98	1.79	1.61	1.43	1.24	1.06	0.88	0.69	0.51	0.33	0.14	dew
28 82.4	2.23	2.04	1.85	1.66	1.47	1.28	1.09	0.90	0.72	0.53	0.34	0.15	dew

under 0.40

0.40 – 0.79

0.80 – 1.19

1.20 – 1.39

1.40 and up

VERY LOW

Germination only. “dew” =
condensing on the leaf

PROPAGATION

Seedlings and un-rooted cuttings

GROW-OUT

The working band for salad crops

FINISH & HERBS

Basil and kale only — lettuce should
stay below

TOO HIGH

Tipburn, bolting, bitter leaf

HOW TO READ IT

Air temperature down the left, humidity across the top.
The number where they meet is your leaf VPD in kPa. “dew”
= water condensing on the leaf.

THIS SHEET'S OFFSET

The usual case: LED at full intensity, good airflow, healthy
transpiration. Sheet 5 shows how to measure your own.

PRINT IT RIGHT

Print at 100% / Actual Size, not Fit to Page. Readable
laminated, and it survives a black-and-white photocopy.

$$\text{VPD} = \text{es}(\text{T}_{\text{leaf}}) - (\text{RH}/100) \times \text{es}(\text{T}_{\text{air}})$$

$$\text{es}(\text{T}) = 0.6108 \times \exp((17.27 \times \text{T}) / (\text{T} + 237.3))$$
 — Tetens equation, kPa

$$\text{T}_{\text{leaf}} = \text{T}_{\text{air}} - 3 \text{ }^{\circ}\text{C}$$

AIR TEMP °C / °F		RELATIVE HUMIDITY %												
		30	35	40	45	50	55	60	65	70	75	80	85	90
15	59.0	0.89	0.81	0.72	0.64	0.55	0.46	0.38	0.29	0.21	0.12	0.04	dew	dew
15.5	59.9	0.92	0.83	0.75	0.66	0.57	0.48	0.39	0.30	0.22	0.13	0.04	dew	dew
16	60.8	0.95	0.86	0.77	0.68	0.59	0.50	0.41	0.32	0.22	0.13	0.04	dew	dew
16.5	61.7	0.98	0.89	0.80	0.70	0.61	0.52	0.42	0.33	0.23	0.14	0.05	dew	dew
17	62.6	1.02	0.92	0.82	0.73	0.63	0.53	0.44	0.34	0.24	0.15	0.05	dew	dew
17.5	63.5	1.05	0.95	0.85	0.75	0.65	0.55	0.45	0.35	0.25	0.15	0.05	dew	dew
18	64.4	1.09	0.98	0.88	0.78	0.67	0.57	0.47	0.36	0.26	0.16	0.05	dew	dew
18.5	65.3	1.12	1.02	0.91	0.80	0.70	0.59	0.48	0.38	0.27	0.16	0.06	dew	dew
19	66.2	1.16	1.05	0.94	0.83	0.72	0.61	0.50	0.39	0.28	0.17	0.06	dew	dew
19.5	67.1	1.20	1.08	0.97	0.86	0.74	0.63	0.52	0.40	0.29	0.18	0.06	dew	dew
20	68.0	1.24	1.12	1.00	0.89	0.77	0.65	0.53	0.42	0.30	0.18	0.07	dew	dew
20.5	68.9	1.28	1.16	1.04	0.91	0.79	0.67	0.55	0.43	0.31	0.19	0.07	dew	dew
21	69.8	1.32	1.19	1.07	0.94	0.82	0.70	0.57	0.45	0.32	0.20	0.07	dew	dew
21.5	70.7	1.36	1.23	1.10	0.98	0.85	0.72	0.59	0.46	0.33	0.21	0.08	dew	dew
22	71.6	1.40	1.27	1.14	1.01	0.88	0.74	0.61	0.48	0.35	0.21	0.08	dew	dew
22.5	72.5	1.45	1.31	1.18	1.04	0.90	0.77	0.63	0.50	0.36	0.22	0.09	dew	dew
23	73.4	1.50	1.35	1.21	1.07	0.93	0.79	0.65	0.51	0.37	0.23	0.09	dew	dew
23.5	74.3	1.54	1.40	1.25	1.11	0.96	0.82	0.67	0.53	0.38	0.24	0.10	dew	dew
24	75.2	1.59	1.44	1.29	1.14	1.00	0.85	0.70	0.55	0.40	0.25	0.10	dew	dew
24.5	76.1	1.64	1.49	1.33	1.18	1.03	0.87	0.72	0.57	0.41	0.26	0.10	dew	dew
25	77.0	1.69	1.54	1.38	1.22	1.06	0.90	0.74	0.58	0.43	0.27	0.11	dew	dew
25.5	77.9	1.75	1.58	1.42	1.26	1.09	0.93	0.77	0.60	0.44	0.28	0.11	dew	dew
26	78.8	1.80	1.63	1.46	1.30	1.13	0.96	0.79	0.62	0.46	0.29	0.12	dew	dew
26.5	79.7	1.86	1.68	1.51	1.34	1.16	0.99	0.82	0.65	0.47	0.30	0.13	dew	dew
27	80.6	1.91	1.74	1.56	1.38	1.20	1.02	0.84	0.67	0.49	0.31	0.13	dew	dew
27.5	81.5	1.97	1.79	1.61	1.42	1.24	1.06	0.87	0.69	0.50	0.32	0.14	dew	dew
28	82.4	2.03	1.84	1.66	1.47	1.28	1.09	0.90	0.71	0.52	0.33	0.14	dew	dew

under 0.40

VERY LOW

Germination only. "dew" =
condensing on the leaf

0.40 – 0.79

PROPAGATION

Seedlings and un-rooted cuttings

0.80 – 1.19

GROW-OUT

The working band for salad crops

1.20 – 1.39

FINISH & HERBS

Basil and kale only — lettuce should
stay below

1.40 and up

TOO HIGH

Tipburn, bolting, bitter leaf

HOW TO READ IT

Air temperature down the left, humidity across the top.
The number where they meet is your leaf VPD in kPa. "dew"
= water condensing on the leaf.

THIS SHEET'S OFFSET

Vigorous transpiration — high airflow, dry air, a fully open
canopy. Sheet 5 shows how to measure your own.

PRINT IT RIGHT

Print at 100% / Actual Size, not Fit to Page. Readable
laminated, and it survives a black-and-white photocopy.

01 • READING THE CHART

- 1 Measure air temperature and relative humidity where the canopy is, not at the controller.
- 2 Pick the sheet whose leaf-temperature offset matches your room. If you have never measured yours, use -2°C .
- 3 Find the temperature down the left, the humidity across the top, and read the kPa where they meet. “dew” means the leaf is at or below the dew point and water is condensing on it.
- 4 Compare that number against the band your crop is in right now. The band legend at the foot of every sheet names them.

02 • WHY LEAF TEMPERATURE, NOT AIR

A plant does not transpire against the air's temperature. Water evaporates from inside the leaf, so the pressure pushing it out is the saturation pressure at LEAF temperature. The air only supplies the second half of the equation — how much vapor it is already carrying.

Transpiration cools a leaf, and light warms it. Under LED with real airflow the net is usually $1\text{--}3^{\circ}\text{C}$ below air. That gap is not a rounding error: at 25°C and 60% RH, each 1°C of leaf offset moves VPD by about 0.18 kPa. Guessing the offset wrong is a larger error than reading humidity wrong by 5 points.

A chart drawn at air temperature — which is most of them — overstates your VPD by roughly 0.2–0.5 kPa in a lit room.

03 • WHAT OFFSET TO SET

SITUATION	OFFSET $^{\circ}\text{C}$	WHY
Lights off / dark period	0 to -0.5	No radiant load. The leaf sits at, or a little under, air temperature.
Low-intensity LED, gentle airflow	-0.5 to -1.5	Modest transpiration; the leaf runs slightly cool.
Full-intensity LED, good airflow	-1.5 to -2.5	The common case in a working indoor room. Start here.
High airflow, dry air, open canopy	-2.5 to -3.5	Vigorous transpiration pulls leaf temperature well below air.
HPS / high radiant load	-1.0 to $+2.0$	Radiant heat can push a leaf ABOVE air temperature. Measure, do not assume.
Water stress, closed stomata	0 to $+3.0$	A leaf that has stopped transpiring stops cooling itself. Offsets go positive.

04 • MEASURING YOUR OWN OFFSET

Use an infrared thermometer set to emissivity 0.95. Aim at a fully expanded, well-lit leaf from about 30 cm, slightly off perpendicular so you are not reading your own reflection. Average five leaves across the zone, mid-photoperiod, and subtract the air temperature at canopy height. Avoid the growing point and leaf edges — both run warm. Re-measure when you change light intensity, airflow, or crop stage.

05 • THE REST OF THE PACK

Sheets 1–4 are the same chart at leaf offsets of 0, -1 , -2 and -3°C . Editions exist for cannabis and general use, greenhouse produce, and leafy greens and herbs — each in $^{\circ}\text{F}$ and $^{\circ}\text{C}$, for US Letter and A4. All of them are free and ungated at ageyetechnologies.com/vpd-chart, as is ageyetechnologies.com/vpd-calculator, the tool that generated them.

06 • TARGET VPD BY CROP AND STAGE

CROP	STAGE	TARGET VPD (kPa)
Butterhead	Propagation	0.4 – 0.8
	Grow-out	0.8 – 1.2
	Pre-harvest	1.0 – 1.3
Romaine	Propagation	0.4 – 0.8
	Grow-out	0.8 – 1.2
	Pre-harvest	1.0 – 1.3
Arugula	Propagation	0.4 – 0.8
	Grow-out	0.8 – 1.1
	Harvest	0.9 – 1.2
Kale	Propagation	0.4 – 0.8
	Grow-out	0.8 – 1.2
	Harvest	1.0 – 1.3
Basil	Propagation	0.4 – 0.8
	Vegetative	0.9 – 1.3
	Harvest	1.0 – 1.4
Microgreens	Germination	0.2 – 0.5
	Greening	0.5 – 0.9
	Harvest	0.6 – 1.0

Salad crops close out at 1.40 kPa, not the 1.60 kPa you see on a generic chart. Lettuce cannot move calcium to a fast-growing leaf margin quickly enough above roughly 1.3 kPa — that is tipburn, and it is a transpiration problem before it is a nutrient problem.

07 • THE MATH ON THIS SHEET

$$\begin{aligned} \text{es}(T) &= 0.6108 \times \exp((17.27 \times T) / (T + 237.3)) \\ T_{\text{leaf}} &= T_{\text{air}} + \text{offset} \\ \text{VPD} &= \text{es}(T_{\text{leaf}}) - (\text{RH}/100) \times \text{es}(T_{\text{air}}) \end{aligned}$$

T is temperature in $^{\circ}\text{C}$ and es is saturation vapor pressure in kPa. The saturation term is the Tetens equation — the same one the AGEYE VPD calculator runs. $^{\circ}\text{F}$ values on these sheets are converted to $^{\circ}\text{C}$ before the equation is applied, never after.

Worked example — air 25.0°C (77.0°F), RH 60%, offset -2°C . Leaf is 23.0°C . $\text{es}(23.0) = 2.8094$ kPa. $\text{es}(25.0) = 3.1678$ kPa. $\text{VPD} = 2.8094 - 0.60 \times 3.1678 = 0.91$ kPa.

08 • WHICH LEVER MOVES VPD FASTEST

CHANGE	VPD MOVES	NOTE
Leaf offset, $+1^{\circ}\text{C}$	$+0.17$ kPa	Biggest lever, and the one nobody measures.
Relative humidity, $+5$ pts	-0.16 kPa	Dehumidify or humidify — the fastest control you own.
Air temperature, $+1^{\circ}\text{C}$	$+0.06$ kPa	Roughly a third of the humidity lever. Weaker than it feels.

Measured at 25°C , 60% RH, -2°C offset, from the same equation these charts are drawn with. Humidity is about three times the lever that air temperature is — and the leaf offset beats both.

09 • PRINTING AND LAMINATION

Print at 100% / Actual Size, not Fit to Page. Use the edition that matches your paper — the other will scale and lose contrast at the band edges.

Nothing here is thinner than 0.4 pt and no meaning rests on hue alone, so a black-and-white photocopy of a laminated sheet stays readable: danger bands print dark, working bands print light, every band boundary is a heavy stepped rule, and every cell carries its own number.