

24-HOUR CO₂-BURST vs 3-DAY OR 1-WEEK TESTS

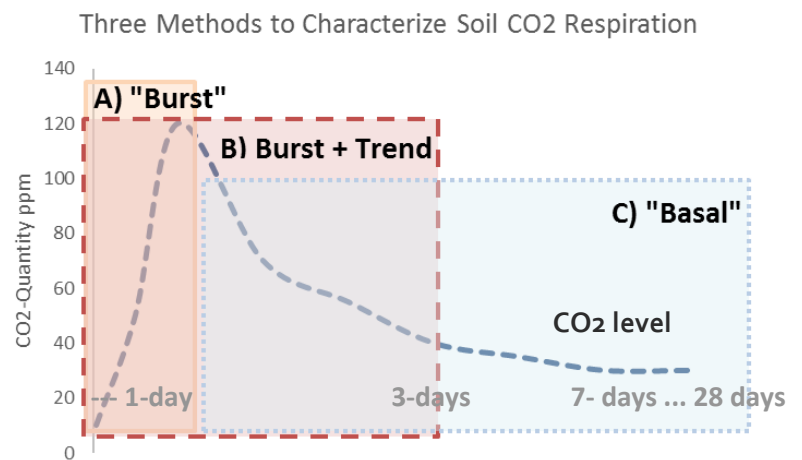


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SOIL RESPIRATION : VARIOUS MODES OF CHARACTERIZATION

CO₂-Burst is a test based on the flush of soil microbial CO₂ occurring after dry soil is suddenly moistened. In the Solvita® application it is measured at 24-hrs, a protocol used widely by soil labs to gauge soil biological activity. The original discovery of the phenomena called CO₂-burst was made simultaneously in Africa and Germany¹. While several explanations have been advanced as to the cause of the burst, a current view is that microbes accumulate osmolytes during prolonged dryness to avoid stress and these are dumped into the soil solution at the onset of rewetting, triggering a burst of growth². The phenomena is fairly robust and is repeatable with slight diminishing effect over several drying-rewetting cycles.

Recent discussions on soil indicators consider at least 3 modes of testing soil CO₂ respiration (see figure). When dry soil is re-moistened, a surge of CO₂ in about 24 hrs (area "A") is the CO₂-Burst. Another mode is to measure over 4 days (area "B") which includes the rise and partial decline. A final approach is to wait for respiration to reach equilibrium by 7-days (area "C") and is often called "basal" respiration. It is fairly well established that 1-day respiration is highly correlated with longer-term measurements³ whether in the "B" or "C" form, and all the way out to 28-day basal.⁴



Solvita® was originally developed as a 1-day basal respiration test (fresh, as-is soil), later adapted to 1-day burst (dry soil). Solvita needs not to be limited to 24-hr results and within limits can be adapted to be a 3-day or 1-week test by changing the jar size (to accommodate increased CO₂ atmosphere). Changing the jar volume proportional to the difference in time means the uncorrected Solvita results will be the average rate for that period of time. The following table illustrates the desired length of time and jar size involved (with soil mass held constant at 30 cc (volume)).

Jar Size to Obtain a 1-day, 3-day or 8-day result

Jar, cc	Imperial	Soil Used	Equiv Days
475	pint	30	1
1265	liter	30	3
3800	gallon	30	8

Adjusted SOP: To obtain a Solvita result equivalent to the indicated number of days from 1-day to 8-day basal, place soil in indicated jar sizes and read after the given time-period. The resulting ppm from a DCR reading must still be multiplied by the equivalent days to correct for the time involved. For more information please contact the technical team at [Solvita](http://Solvita.com).

¹ Birch H.F. Effect of Soil Drying on Humus Decomposition and N-availability. Plant & Soil No 1:9-31 1956 / Koepf H.H. Soil CO₂ from Intermittent Moistening [in German]. Zeitschr. Bodenkd. 1955

² Fierer & Schimel: Proposed Mechanism for the Rewetting CO₂ Pulse. Soil Sci. Soc. Am. J. 67:798-805 (2003)

³ Franzluebbers, A.J. Should Soil Testing Services Measure Soil Biological Activity? Agric. Environ. Lett. 1:150009 (2016)

⁴ Bakhshandeh et al. (2019) A cost and time-effective method to evaluate soil microbial respiration for soil quality assessment. Appl. Soil Ecol. Volume 140, 121-125