The Full Moon
of Tishri 15
2004

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Some have asked why Tishri 15 in 2004 fell a day after the full moon instead of on the day of the full moon. The date of Tishri 15 is based on Hebrew Calendar mathematics as well as the astronomical history of the calendar. The first step to understanding the determination of Tishri 15 is to realize that the Hebrew Calendar does not calculate to the exact time of the astronomical full moon.

When we look at the Roman Calendar on our wall and see a hollow circle, that circle indicates the day of the astronomical full moon. The astronomical full moon is that very short moment in time which cannot possibly be gauged by the human eye but must be calculated instead.

Rather than calculate to the astronomical full moon, the Hebrew Calendar calculates to the best possible illumination of the full moon. Attaining the highest illumination possible for the moon of Tishri 15 is accomplished by first calculating the Molad of Tishri, which is based on the *average* length of the lunar month. This mathematical average is then refined or "fine tuned" by the application of the postponement rules of the Hebrew Calendar. Although the Molad of Tishri may in some years coincide with the astronomical conjunction, it is not based on that specific point in time but on the average conjunction of the earth, moon and sun, which is 29.53059 days. In fact, if the Hebrew Calendar calculated the Molad of Tishri on the basis of the astronomical conjunction (or the first visible crescent, as some do), the illumination percentages for Tishri 15 would not be as high.

Following the declaration of Tishri 1, the Feast of Trumpets, it is a simple matter to count 15 days to Tishri 15, the beginning of the Feast of Tabernacles. A very important result of this process is the best possible illumination of the full moon on a continual basis, year after year and 19-year cycle after 19-year cycle. Because the Hebrew Calendar calculates to the best possible illumination for the moon of Tishri 15 on the basis of sequential 19-year cycles, no single year can be calculated independently of the years preceding or the years following. Consequently, the Hebrew Calendar allows for a 3-day swing in Tishri 15 declarations in regard to the astronomical full moon. There are some years when the 15th of Tishri, on the Roman Calendar, begins a day or two after the astronomical full moon or a day before the astronomical full moon.

Table 1.0 shows that in the current 19-year cycle, in 8 out of 19 years Tishri 15 falls on the day of the astronomical full moon. In 9 years of the 19-year cycle, Tishri 15 falls one day after the astronomical full moon. In one year Tishri 15 fall two days after the astronomical full moon. In another year, Tishri 15 falls one day before the astronomical full moon.

Does this mean that there is something wrong with the Hebrew Calendar? Not at all. According to Hebrew Calendar mathematics, the astronomical full moon does not determine the date of Tishri 15. These calendar rules have remained unchanged since the days of Jesus and the apostles, and were in effect for many centuries before the New Testament era. The Hebrew Calendar has always calculated to the best possible illumination for Tishri 15 in the sequence of 19-year cycles. This is the Scriptural standard for the "full moon."

The generally accepted measure of a full moon in modern times is to look at a wall calendar for the little circle that indicates the day of the astronomical full moon. This moon always has an illumination of 100%. The Hebrew Calendar does not calculate to the astronomical full moon because it is astronomically impossible to always have an illumination of 100% for Tishri 15 year after year over centuries of 19-year cycles.

According to the Hebrew Calendar, a moon is "full" when the illumination ranges in age from 14.3 days waxing to 15.3 days waning. This range of illumination is built into Hebrew Calendar mathematics and has been the standard since the days of Ezra and before. This range allows for an illumination spread of about 97.5% waxing to about 97.5% waning.

These extremes are very rare, however. The illumination range usually falls between 98% waxing and 98% waning.

As I wrote in my paper *Why the Full Moon Cannot be Determined by Observation*, the human eye cannot tell the difference between a moon at 98% illumination and one at 100% illumination. The 98% illumination figure applies to both a waxing and waning moon. You may find a copy of this paper on our church website at http://www.cbcg.org/hebrew_cal.htm. This means that the calculations of the Hebrew Calendar are well within the boundaries of the optical science of the moon's illumination patterns.

In the current 19-year cycle, which runs from 1997 AD through 2015 AD, there are 7 years of waxing moon illuminations on the eve of Tishri 15. By waxing illuminations we mean an illumination with a basic range of 13.3 to 14.3 days in length. The 7 waxing illuminations of the current 19-year cycle range from 13.5 to 14.2 days in length. The average length of these 7 waxing moons is therefore 13.89 days.

The current 19-year cycle has an incredible 9 years of "full moon" illuminations on the eve of Tishri 15. By "full" we mean an illumination with a basic length of about 14.3 to 15.3 to days. The 9 "full" illuminations of the current 19-year cycle range from 14.3 to 15.1 days in length. The length of these days is measured from the occurrence of the astronomical conjunction. The average length of these 9 "full" moons is therefore 14.78 days.

In the current 19-year cycle there are also 3 years of waning moon illuminations on the eve of Tishri 15. Waning illuminations have a basic range of 15.3 to 16.3 days in length. The 3 waning illuminations of the current 19-year cycle range from 15.3 to 15.9 days in length. The average length of these 3 waning moons is therefore 15.5 days.

The Hebrew Calendar calculates over a full range extending from 13.3 days waxing to 16.3 waning. This range allows for a spread of 3 days. The total spread for the current 19-year cycle is 13.5 days waxing to 15.9 days waning, or 2.4 days.

The illumination of the moon on the eve of Tishri 15, 2004, was 98.32% waning. At 15.9 days waning, it was very near the limit of the range for waning moons. The table below lists the illuminations and stages of the full

moons of Tishri 15 for each year in the current 19-year lunar cycle. Note that the average illumination for this cycle exceeds 99%.

Table 1.0 19-Year Lunar Cycle—1997 AD through 2015 AD

Cycle Year	Year AD	Tishri 15	Astronomical Full Moon	Universal Time	Days Tishri 15 + or - Astronomical Full Moon	% Illum
1	1997	October 16	October 16	03:46	same day	99.67% 14.2 wax
2	1998	October 5	October 5	20:13	same day	98.11% 13.5 wax
3	1999	September 26	September 25	10:53	1 day after	99.70% 15.0 full
4	2000	October 14	October 13	08:55	1 day after	99.58% 15.1 full
5	2001	October 2	October 2	13:50	same day	99.11% 14.0 wax
6	2002	September 21	September 21	14:00	same day	99.12% 14.0 wax
7	2003	October 11	October 10	07:28	1 day after	99.73% 15.1 full
8	2004	September 30	September 28	13:09	2 days after	98.32% 15.9 wan
9	2005	October 18	October 17	12:13	1 day after	99.92% 15.0 full
10	2006	October 7	October 7	03:13	same day	99.77% 14.3 full
11	2007	September 27	September 26	19:47	1 day after	99.98% 14.6 full
12	2008	October 15	October 14	20:04	1 day after	99.88% 14.6 full
13	2009	October 3	October 4	16:03	1 day before	97.51% 13.3 wax
14	2010	September 23	September 23	09:18	same day	99.50% 14.2 wax
15	2011	October 13	October 12	02:07	1 day after	99.52% 15.3 wan
16	2012	October 1	September 30	03:18	1 day after	99.57% 15.3 wan
17	2013	September 19	September 19	11:12	same day	99.24% 14.0 wax
18	2014	October 9	October 8	10:50	1 day after	99.87% 15.0 full
19	2015	September 28	September 28	02:52	same day	99.78% 14.3 full
						99.36% Average

The following tables of 19-year cycles both past and future demonstrate the consistently high average of illumination for the moons of Tishri 15 that occurs as a result of Hebrew Calendar calculations.

Table 1.1 19-Year Lunar Cycle—2016 AD through 2034 AD

Cycle Year	Year AD	Tishri 15	Astronomical Full Moon	Universal Time	Days Tishri 15 + or - Astronomical Full Moon	% Illum
1	2016	October 17	October 16	04:25	1 day after	99.34% 15.4 wan
2	2017	October 5	October 5	18:41	same day	98.56% 13.6 wax
3	2018	September 24	September 25	02:54	1 day before	98.01% 13.4 wax
4	2019	October 14	October 13	21:10	1 day after	99.74% 14.6 full
5	2020	October 3	October 1	21:06	2 days after	99.10% 15.5 wan
6	2021	September 21	September 20	23:54	1 day after	99.70% 14.5 full
7	2022	October 10	October 9	20:54	1 day after	99.90% 14.6 full
8	2023	September 30	September 29	09:58	1 day after	99.80% 15.1 full
9	2024	October 17	October 17	11:27	same day	99.17% 13.9 wax
10	2025	October 7	October 7	03:48	same day	99.74% 14.3 wax
11	2026	September 26	September 26	16:50	same day	98.92% 13.8 wax
12	2027	October 16	October 15	13:48	1 day after	99.93% 14.9 full
13	2028	October 5	October 3	16:26	2 days after	98.81% 15.7 wan
14	2029	September 24	September 22	16:30	2 days after	98.81% 15.7 wan
15	2030	October 12	October 11	10:46	1 day after	99.83% 15.0 full
16	2031	October 2	September 30	18:58	2 days after	98.82% 15.7 wan
17	2032	September 20	September 19	09:31	1 day after	99.79% 15.1 full
18	2033	October 9	October 8	10:59	1 day after	99.85% 15.1 full
19	2034	September 28	September 28	02:58	same day	99.79% 14.3 full
						99.35% Average

Of the 19 years in this cycle, 9 are "full moon" illuminations, 5 are waxing illuminations and 5 are waning illuminations.

Table 1.2 19th Year of Lunar Cycles from 1768 AD to 2110 AD

Cycle Year	Year AD	Tishri 15	Astronomical Full Moon	Universal Time	Days Tishri 15 + or - Astronomical Full Moon	% Illum
19	1768	September 26	September 26	08:43	same day	99.30% 14.0 wax
19	1787	September 27	September 27	06:14	same day	99.54% 14.2 wax
19	1806	September 27	September 27	20:23	same day	98.69% 13.7 wax
19	1825	September 27	September 27	04:05	same day	99.71% 14.4 full
19	1844	September 28	September 26	13:12	2 days after	98.46% 15.9 wan
19	1863	September 28	September 27	06:00	1 day after	99.60% 15.3 full
19	1882	September 28	September 27	05:10	1 day after	99.52% 15.3 wan
19	1901	September 28	September 28	05:37	same day	99.58% 14.2 wax
19	1920	September 27	September 28	01:57	1 day before	97.91% 13.4 wax
19	1939	September 28	September 28	14:28	same day	99.28% 14.0 wax
19	1958	September 29	September 27	21:44	2 days after	99.35% 15.5 wan
19	1977	September 27	September 27	08:16	same day	99.60% 14.1 wax
19	1996	September 28	September 27	02:51	1 day after	99.45% 15.4 wan
19	2015	September 28	September 28	02:52	same day	99.78% 14.3 full
19	2034	September 28	September 28	02:58	same day	99.79% 14.3 full
19	2053	September 27	September 27	21:52	same day	98.54% 13.6 wax
19	2072	September 27	September 27	08:46	same day	99.62% 14.2 wax
19	2091	September 27	September 27	15:59	same day	99.16% 13.9 wax
19	2110	September 29	September 28	04:06	1 day after	99.46% 15.3 wan
						99.28% Average

The above record of the final year in each sequential 19-year cycle shows that 4 were full illuminations, 10 were waxing illuminations and 5 were waning illuminations. These cycles covered a period of 342 years.

Table 1.4   19-Year Lunar Cycle—2 AD through 20 AD

Cycle Year	Year AD	Tishri 15	Astronomical Full Moon	Universal Time	Days Tishri 15 + or - Astronomical Full Moon	% Illum
1	2	October 10	October 10	06:42	same day	99.77% 14.3 full
2	3	September 29	September 29	06:12	same day	99.80% 14.4 full
3	4	September 18	September 17	10:03	1 day after	99.79% 14.1 full
4	5	October 8	October 6	08:54	2 days after	97.28% 16.3 wan
5	6	September 27	September 25	22:41	2 days after	98.69% 15.8 wan
6	7	September 15	September 15	15:01	same day	99.03% 13.8 wax
7	8	October 4	October 3	16:09	1 day after	99.72% 14.9 full
8	9	September 23	September 23	03:24	same day	99.66% 14.4 full
9	10	October 11	October 12	00:09	1 day before	98.42% 13.6 wax
10	11	October 1	October 1	01:15	same day	99.77% 14.5 full
11	12	September 19	September 19	01:22	same day	99.79% 14.5 full
12	13	October 9	October 7	21:27	2 days after	99.05% 15.6 wan
13	14	September 27	September 27	06:54	same day	99.71% 14.2 wax
14	15	September 16	September 16	22:00	same day	98.20% 13.5 wax
15	16	October 5	October 5	00:03	same day	99.91% 14.5 full
16	17	September 25	September 24	14:52	1 day after	99.84% 15.0 full
17	18	September 13	September 14	00:20	1 day before	98.51% 13.6 wax
18	19	October 2	October 2	19:49	same day	98.94% 13.8 wax
19	20	September 21	September 20	19:53	1 day after	99.88% 14.7 full
						99.25% Average

Note that this 19-year cycle took place during the years of Jesus' youth in Palestine and that He observed the Feast days with Joseph and Mary at Jerusalem, as recorded in the Gospels. The calculations of the Hebrew Calendar have remained unchanged since that time.

Table 1.5   19-Year Lunar Cycle—21 AD through 39 AD

Cycle Year	Year AD	Tishri 15	Astronomical Full Moon	Universal Time	Days Tishri 15 + or - Astronomical Full Moon	% Illum
1	21	October 9	October 9	13:53	same day	99.44% 14.1 wax
2	22	September 29	September 28	17:59	1 day after	99.98% 14.8 full
3	23	September 18	September 18	05:29	same day	99.77% 14.3 full
4	24	October 7	October 6	07:09	1 day after	99.47% 15.3 wan
5	25	September 27	September 25	23:21	2 days after	98.72% 15.7 wan
6	26	September 16	September 15	13:10	1 day after	99.76% 15.0 full
7	27	October 4	October 4	11:23	same day	99.34% 14.1 wax
8	28	September 23	September 22	15:06	1 day after	99.71% 14.9 full
9	29	October 11	October 11	08:52	same day	99.56% 14.3 wax
10	30	September 30	September 30	09:01	same day	99.54% 14.2 wax
11	31	September 20	September 19	15:19	1 day after	99.83% 14.9 full
12	32	October 9	October 7	15:14	2 days after	98.08% 16.0 wan
13	33	September 28	September 27	06:23	1 day after	99.49% 15.4 wan
14	34	September 16	September 16	22:29	same day	98.28% 13.5 wax
15	35	October 6	October 5	23:08	1 day after	99.90% 14.6 full
16	36	September 24	September 24	08:04	same day	99.66% 14.3 wax
17	37	September 14	September 13	10:06	1 day after	99.71% 15.1 full
18	38	October 2	October 2	03:23	same day	99.79% 14.5 full
19	39	September 21	September 21	04:52	same day	99.74% 14.4 full
						99.46% Average

The above 19-year cycle includes the years of Jesus' ministry. In two of these years, 26 AD and 28 AD, the date of Tishri 15 fell one day after the astronomical full moon.

As these tables show, the Hebrew Calendar has produced the highest illumination possible for the moons of Tishri 15 over centuries of 19-year cycles. This high standard of illumination for the moons of Tishri 15 would not be possible without the application of the postponement rules. Our current 19-year lunar cycle is extremely unique in the application of these rules. The calendar is currently going through a rare six-year mathematical realignment that will maintain its accuracy for decades to come. There have been only twelve such realignment periods in the past 2000 years.

In 2000 AD, the declaration of the Feast of Trumpets was based on a 2-day adjustment by the rules of postponement. Tishri 15 that year fell one day after the astronomical full moon, which occurred on October 13. In addition, the year 2000 AD was the beginning of a 6-year cycle leading up to the application of Rule 4 in the year 2005 AD. This will be only the twelfth application of Rule 4 in the past 2000 years.

In addition, in 2009 AD, a very rare 6942-day period will begin at the Feast of Trumpets. This will be the twelfth such occurrence in the past 2863 years (854 BC to 2009 AD).

No other 19-year cycle has included both the application of Rule 4 within a 6-year cycle as well as the beginning of a 6942-day period. The last historical application of Rule 4 in conjunction with a 6942-day period within the same 19-year lunar cycle was in the year 249 AD, which was the last year of the 6-year cycle leading up to Rule 4, but the first year of a new 19-year cycle. Thus the 6-year cycle for the application of Rule 4 was split between two 19-year cycles. The fifth year of the new cycle was 253 AD, which began the rare 6942-day period.

The current 19-year cycle is an extremely rare phenomenon in the history of the Hebrew Calendar, necessitated by cumulative centuries of infinitesimally small differences between astronomical cycles of time and the fixed standards of the best mathematical calculations, given in ancient times to the people of God. As Christians who seek to worship God on His holy days, we can rest assured that the Hebrew Calendar is continuing to calculate these days as accurately as at the time that Jesus and the apostles observed them.