STORAGE & STABILITY STUDY

OVERVIEW

Data provided by

veda SCIENTIFIC

March, 2023

GROVE BAGS

Background

In late 2022, Grove Bags commissioned a study with Veda Scientific, a California-based cannabis testing laboratory specializing in advanced compound analysis and experimental design, in order to examine the effectiveness of TerpLoc® compared to other storage devices and conditions.

Grove Bags has previously employed independent, third-party testing to demonstrate the effectiveness of TerpLoc® as recently as 2017, wherein it was found that Grove Bags are more effective at preserving terpene content than other storage methods.

As the industry has matured, additional resources have been made available to further analyze the wide array of volatile compounds found in cannabis. For the purposes of this study, Veda Scientific utilized a highly specialized two-dimensional gas chromatography system (2D GC) to measure *all* of the volatile content of cannabis, including terpenes, thiols, esters, and dozens of other compounds.

Experimental Design

A 12-week curing and storage study was conducted using two chemotypically distinct strains - GG4 and MAC. For each strain, dried samples were divided evenly among five Grove Bags and five Mason jars, so that each container had 2.5 pounds of flower. At regular intervals (Weeks 1, 4, 8 , and 12), samples were analyzed for N_2, CO_2, and O_2 retention, moisture and water activity, cannabinoid content, terpene content, and an untargeted 2D GC/MS analysis, enabling a broader array of component qualification.

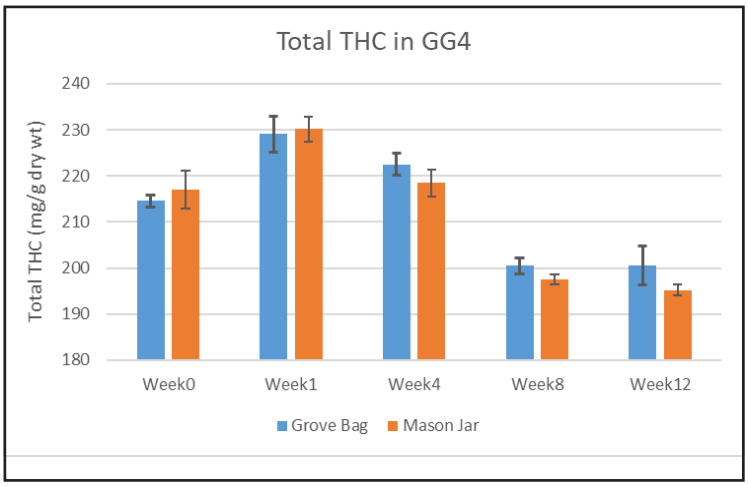
Summary of Findings

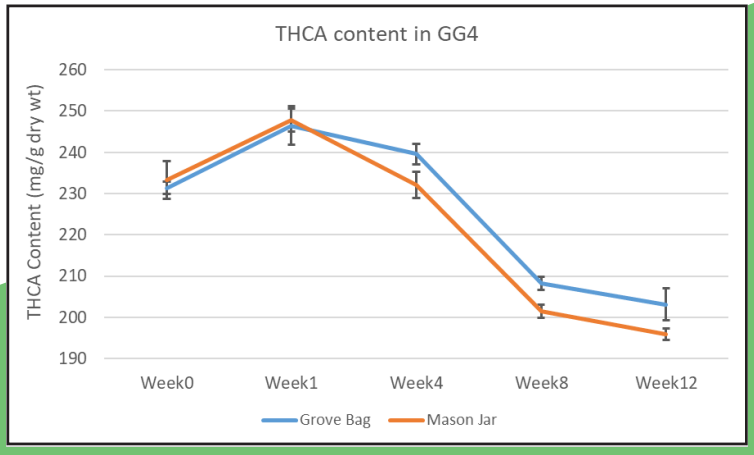
Results from the 12-week study determined, conclusively, that flower cured in Grove Bags *more effectively retained the full spectrum of volatile compounds found in cannabis compared to glass jars*. Additionally, Grove Bags were found to create an elevated CO_2, lower oxygen environment.

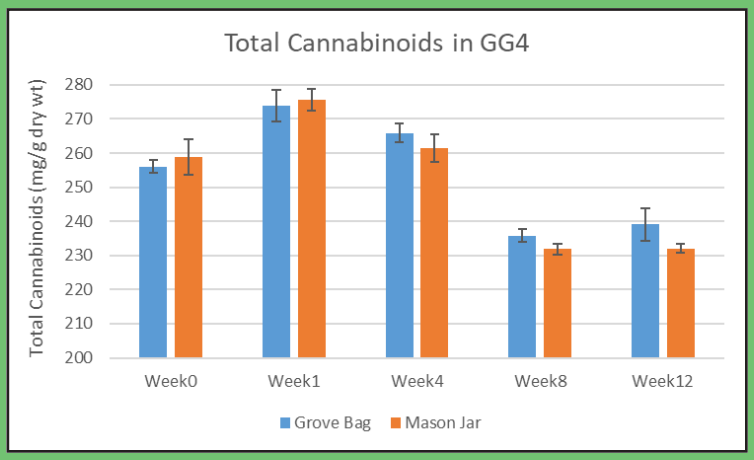
A notable distinction between these newest results and the results of previous studies is the inclusion of untargeted 2D GC/MS analysis, enabling the measurement of a much broader array of plant components. As shown in prior results, TerpLoc® was again more effective at retaining terpenes and THC, and with the inclusion of additional variables in this most recent study, it is apparent that *Grove Bags provide a better environment for the preservation of the plant's full spectrum of volatile compounds*.

RESULTS

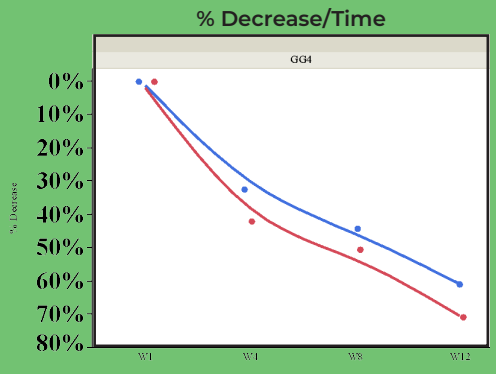
Cannabinoid test results over the 12 week period indicate that Grove Bags are more effective than jars at retaining THC and other cannabinoids. In GG4, the decrease in THCA content was more pronounced in jars than in bags. The data suggested that there was greater overall loss in both THCA and THC for flower stored in jars, independent of the decarboxylation reaction. This is confirmed by the decrease in Total THC and Total Cannabinoids during the curing process.







While this overall decrease in THC percentage through the curing process regardless of method is noted, Grove Bags preserved more potency in both THC content and overall cannabinoid retention.

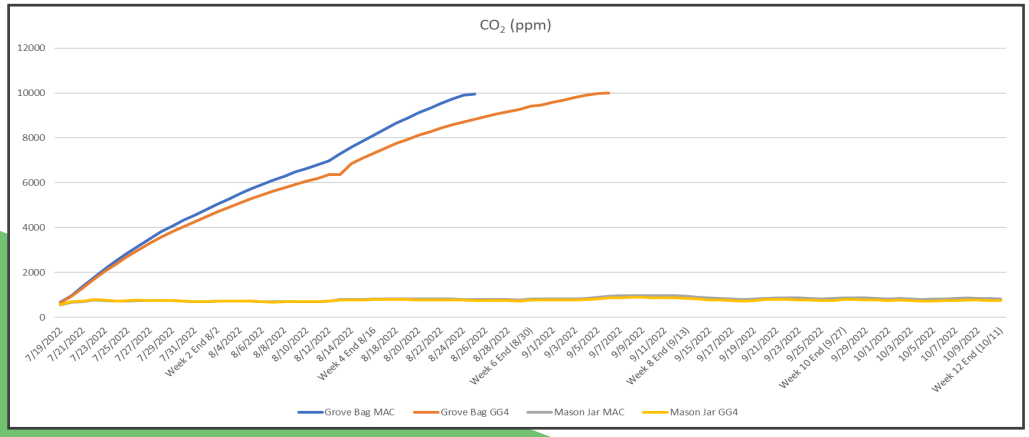


An untargeted analysis of natural product components, including minor terpene groups and cannabinoids, was also undertaken, calculated by analyte signal strength. Results (seen left with Grove Bags represented in blue) show a clear indication that the Grove Bag storage solution results in a greater retention of overall signal compared to jars for the GG4 cultivar.

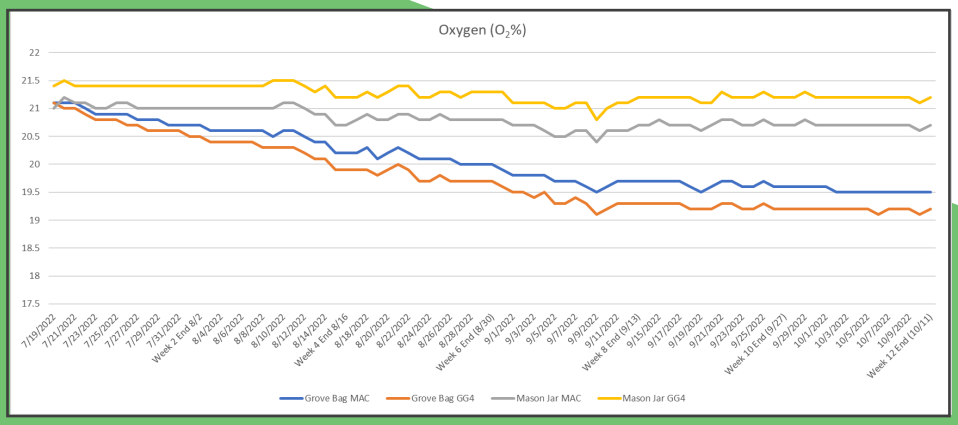
RESULTS
continued

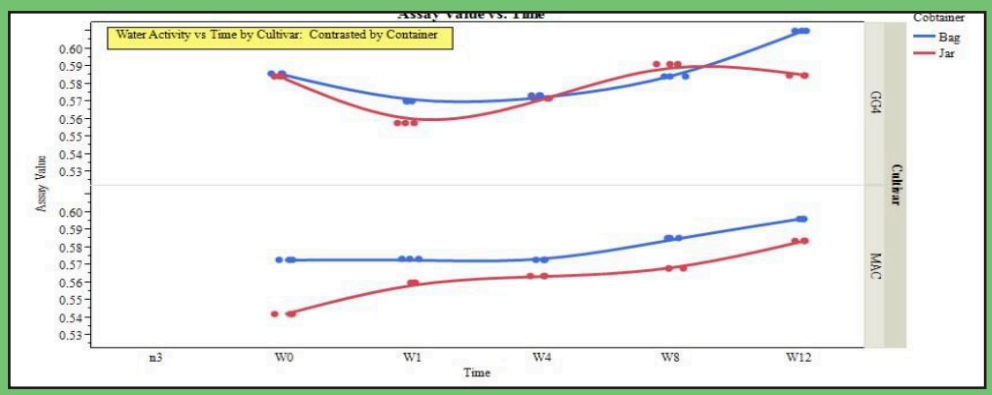
A significant finding from this study is the extent to which Grove Bags create an elevated CO_2 environment with lower oxygen levels. It is noted in the data that this is likely caused by the ability of TerpLoc® to trap and retain gases released via biomass respiration during the curing process.

NOTE: Between weeks 5 and 7, both cultivar samples stored in Grove Bags reached the maximum limit of the measurment tool. Supplementary data was collected using additional resources.



The increase in carbon dioxide was accompanied by a decrease in oxygen levels. It is possible that respiration contributed to the changes observed in gas levels. However, it is also possible that some CO_2 may have come from decarboxylation of THCA.





The data also determined there to be a consistent, slightly higher water activity value at all time points for the MAC cultivar stored in Grove Bags, and for both cultivars at the end of 12 weeks.

CONCLUSIONS

Among the findings, Veda determined that the most significant difference between flower that is cured in Grove Bags versus mason jars was the improved retention of the full spectrum of volatile compounds detected in the flower cured in the Grove Bags. This difference is critical, because we are still learning which compounds contribute to the taste, smell and effects of cannabis, and hemp. Therefore, the loss of volatile content, regardless of whether it is currently known or unknown, makes it more difficult to create and deliver consistent quality to consumers, because what is being lost could materially impact the consumer experience. Ultimately, it was determined that Grove Bags represent a convenient solution for the storage of cannabis during early stage curing.

References

Veda Scientific. “Grove Bags Storage & Stability Study 2022/2023.” Lompoc: California, 2023.

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