Measuring Chile Pepper Heat

Guide H-237

Paul W. Bosland and Stephanie J. Walker[1]

Cooperative Extension Service • College of Agricultural, Consumer and Environmental Sciences

This publication is scheduled to be updated and reissued 2/15.

What most people notice when eating chile peppers—and the reason most people eat them—is the "heat," "bite," or "pungency" associated with the fruit. Chile pepper "heat" is often defined as a sharp, piercing, stinging, biting, burning, or penetrating quality. Chile pepper connoisseurs agree with these claims.

Most chile peppers and foods with chile pepper additives are labeled as "mild," "medium," or "hot." These designations describe the amount of heat one can expect when eating these foods. These classifications are broad and may be rather subjective, depending on the methods used to measure and rank heat.

Heat in chile peppers is caused by chemical compounds known as capsaicinoids. There are more than 22 known capsaicinoids. The major ones, capsaicin and dihydrocapsaicin, normally occur in the highest concentrations. The other capsaicinoids occur in smaller concentrations and are the "minor" capsaicinoids.

GENETICS AND ENVIRONMENT

The heat level in chile peppers is the result of two factors: the plant's genetics and the interaction of the plant with the environment. The genetic control of heat allows plant breeders to produce a chile pepper plant with a certain relative heat level. For example, the cultivar 'NuMex Joe E. Parker' was genetically selected to produce fruit of "medium" heat. However, environmental factors such as temperature and water influence the heat level. A mild chile pepper cultivar bred for low levels of heat will become hotter when exposed to any type of stress in the field. Conversely, a relatively hot cultivar given optimal environmental conditions will become only moderately hot. A chile pepper plant that genetically produces low-heat fruit will not produce hot chile peppers even when grown in a stressed environment. To produce chile peppers of a predictable heat, both cultivar selection and optimum stress-free growing conditions are important.

METHODS TO DETERMINE CHILE PEPPER HEAT

Methods to measure heat in chile peppers range from the unrefined to the scientific. A common style of evaluating heat is to simply take a chile fruit and taste it. This method, while being quick and cost effective, may leave much to the palate of the taster. In addition, this method only gives an approximation of heat of the particular chile pepper pod that is being tasted.

Scoville Organoleptic Test

The Scoville Organoleptic Test is a refined, systematic approach that was the first laboratory test used to measure heat in chile peppers. In the test, human subjects taste a series of prepared chile samples to determine the heat level. The samples are diluted in the laboratory until heat can no longer be detected by the tasters. A single unit of dilution is called a Scoville Heat Unit. This procedure can be appropriate in many circumstances because it is more accurate than the taste test ("bite the chile") technique. The Scoville Organoleptic Test is also less expensive than more advanced laboratory techniques, but it has limitations. Measuring heat with this technique is still subjective and depends on the taster's palate and sensitivity to the chemicals that

[1]Respectively, Regents Professor, Department of Plant and Environmental Sciences; and Extension Vegetable Specialist/Assistant Professor, Department of Extension Plant Sciences, both of New Mexico State University.

To find more resources for your business, home, or family, visit the College of Agricultural, Consumer and Environmental Sciences on the World Wide Web at aces.nmsu.edu

are responsible for heat. In addition, there are serious limits on how many samples a taster can handle within a reasonable time.

High-Performance Liquid Chromatography

The most accurate method for measuring heat in chile peppers is high-performance liquid chromatography (HPLC). In this procedure, fruit are dried and then ground. Next, the chemicals responsible for heat are extracted, and the extract is injected into the HPLC for analysis. This method is more costly than the Scoville test, but it gives an objective heat analysis. Not only does this method measure the total heat present, it also allows the amounts of the individual capsaicinoids to be determined. In addition, many samples may be analyzed within a short period. The NMSU Chile Breeding and Genetics Program has analyzed more than 5,000 samples using this method and has found it to be reliable and consistent.

As the demand for chile peppers increases, the heat level of the crop is more important, and an accurate and precise measurement of heat is necessary. Several testing laboratories perform the organoleptic and/or HPLC methods. The American Spice Trade Association (ASTA) publishes the procedure accepted by the spice industry. Several laboratories that perform such tests are listed below.

Hauser Chemical Research
5555 Airport Blvd.
Boulder, CO 80301
1-800-241-2322

Industrial Labs
1450 E. 62nd Ave.
Denver, CO 80216-1242
1-800-456-5288

Southwest Bio-Labs
401 N. 17th St.
Las Cruces, NM 88005
(575) 524-8917

REFERENCES

Collins, M.D., L. Mayer-Wasmund, and P.W. Bosland. 1995. Improved method for quantifying capsaicinoids in *Capsicum* using high-performance liquid chromatography. *HortScience*, *30*, 137–139.

Harvell, K.P., and P.W. Bosland. 1997. The environment produces a significant effect on pungency of chiles. *HortScience*, *32*, 1292.

Scoville, W.L. 1912. Note *Capsicum*. *Journal of American Pharmaceutical Association*, *1*, 453.

Woodbury, J.E. 1980. Determination of *Capsicum* pungency by high pressure liquid chromatography and spectrofluorometric detection. *Journal of the Association of Official Analytical Chemists*, *63*, 556–558.

Zewdie, Y., and P.W. Bosland. 2000. Evaluation of genotype, environment, and genotype-by-environment interaction for capsaicinoids in *Capscium annuum* L. *Euphytica*, *111*, 185–190.

Contents of publications may be freely reproduced for educational purposes. All other rights reserved. For permission to use publications for other purposes, contact pubs@nmsu.edu or the authors listed on the publication.

New Mexico State University is an equal opportunity/affirmative action employer and educator. NMSU and the U.S. Department of Agriculture cooperating.