Postharvest Handling of Dehydrated Chiles

Guide H-236

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

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Large quantities of dehydrated chile are used in prepared meals, seasoning blends, and the canning industry. Dehydrated capsicum types are New Mexican, cayenne, ancho, pasilla, mirasol, piquin, and de arbol. International spice traders use the term "paprika" for nonpungent (sweet) red *Capsicum annuum* powder. In the U.S., pungent red chile and nonpungent paprika are produced mainly from New Mexican type chile that is dehydrated and sold as whole pods or ground into flakes or powder. Because the quality of red chile and paprika products is based on extractable red color, pungency level, and flavor, they must be processed and stored correctly to maintain high quality.

Color is the most important quality criterion for dehydrated chile because paprika is used principally as a coloring agent in foods and its price is directly related to extractable color. Initial color at harvest and color retention during processing, shipping, and storage are important. The color of chile at harvest depends on the cultivar, maturity stage, and growing conditions. Color retention after harvest depends primarily on preventing oxidation of the carotenoid pigments.

Cultivar choice has the greatest effect on color and pungency, and cultivar purity often affects the uniformity of those traits. Nonpungent red chile cultivars commonly grown in New Mexico include 'NuMex Conquistador', 'NuMex RNaky', and LB-25. Some pungent red chile cultivars are 'New Mexico 6-4', 'Sandia', and 'Española Improved'.

Extractable color is measured by a method developed by the American Spice Trade Association (ASTA). Samples are extracted with acetone, and the color intensity of the extract is quantified with a spectrophotometer. Color is expressed in ASTA units. The ASTA color of New Mexican chile crops ranges from about 120 to 220 units. Paprika cultivars are usually higher in ASTA color than pungent chile cultivars. The price differential between high-ASTA and low-ASTA chile can be an incentive for growers and processors to produce high-color chile.

Color uniformity and stability are also significant in determining quality, and if the chile is a pungent type, then both pungency and color must be stable and uniform. Other important quality criteria are low microbial counts (yeasts, molds, bacteria), low extraneous matter (leaves, stems, soil), and minimal insect parts. Microbial counts can be related to a number of factors: freezing or wet weather; pod damage; delays before or after delivery to the processor; the presence of leaves, stems, or insect parts; the degree of chlorination of the wash water; general sanitation at all points during processing; drying temperature; moisture content; and storage temperature. Often, steps taken to lower extraneous matter and microbial counts will also improve color and the overall quality of a dehydrated chile crop. Commercial laboratories that perform capsicum quality analyses are listed in Table 1.

CROP MANAGEMENT PRACTICES FOR IMPROVED QUALITY OF RED CHILE

A cultivar's potential for high yield and quality is only realized under optimal crop management practices. Fertilization and irrigation practices should be timed to slow crop growth before the first frost in order to enhance fruit color development and to promote fruit dry-down. Desiccants containing sodium chlorate can be used to defoliate crop canopies to accelerate fruit drying and aid in harvesting.

Fruit on any one plant will vary in maturity from partially dried pods set early in the season to succulent green pods set late in the season. Ethephon ([2-chloroethyl] phosphonic acid), a synthetic form of the ripening hormone ethylene, can be applied to the crop to hasten the ripening process. Ethephon is labeled for use on chiles at a rate of 3 to 4 pt in 40 to 100 gal/acre. Apply ethephon when about 30% of the fruit are red and about 50% are "mature green." Ethephon will not ripen immature fruit and can reduce yields if applied too

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Table 1. Addresses for the American Spice Trade Association and Some Commercial Laboratories that Provides Quality Analyses for Capsicums

American Spice Trade Assoc.
2025 M Street N.W.
Suite 800
Washington, D.C. 20036
(202) 367-1127
Procedures for pungency, ASTA color, microbiology, and extraneous matter

Industrial Labs
1450 E. 62 Ave.
Denver, CO 80216
1-800-456-5288
Pungency, microbiology, extraneous matter, and nutritional analysis

National Food Lab
6363 Clark Blvd.
Dublin, CA 94568
(925) 828-1440
Pungency, microbiology, and extraneous matter

Southwest Bio-Labs
401 N. 17th St., #11
Las Cruces, NM 88005
(575) 524-8917
Pungency, ASTA color, microbiology, and extraneous matter

Warren Analytical
P.O. Box G, 650 East 0 St.
Greeley, CO 80631
1-800-945-6669
Pungency, microbiology, extraneous matter, and nutritional analysis

early. Some paprika cultivars are particularly sensitive to the effects of ethylene compounds and may shed fruit prematurely following application. Temperature, time of day, and other factors can greatly affect the activity of ethephon. Applications should not be made when temperatures exceed 95°F (35°C) because excessive defoliation and fruit drop may occur. Also, temperatures below 60°F (16°C) reduce or negate the effect of the growth regulator. Use higher concentrations under conditions of cool temperatures or dense foliage, but lower rates at warmer temperatures. Harvest fruit 2 to 3 weeks after ethephon treatment. Fruit from ethephon-treated fields should never be used as a seed source.

One of the most common preharvest problems that can affect red color is sunburn, which occurs when crop canopies are sparse during fruit development and ripening. Following sunburn damage, black mold can develop on the pods. This mold is caused by the fungus *Alternaria alternata* and can appear on pods either before or after harvest. Red chile harvested and stored improperly before processing can develop this disease, as well as other diseases. The severity of black mold increases as chile ripens. Other fruit rots are caused by *Rhizopus, Colletotrichum*, *Fusarium*, *Phytophthora*, and *Aspergillus* species. These pod diseases increase under conditions of plant stress, excess irrigation or rainfall, and mechanical damage to the fruit. Some of these pathogens are known producers of mycotoxins, so every effort should be taken to eliminate diseased fruit from the harvested crop.

HARVEST METHODS

Chile should be harvested for maximum color when the fruit have partially dried on the plant, as succulent red pods will not have fully developed their color. Research has shown marketable yields to be highest in late October and early November before the first seasonal freeze. Fruits harvested after the freeze have higher incidences of disease and more losses from fruit dropped to the ground.

Approximately 85% of the red chile crop in New Mexico is mechanically harvested. The remaining 15% of the crop is hand-harvested into buckets or sacks and transferred into field bins for transport to the processor. Advantages of harvesting by hand include the ability of harvest crews to select for proper maturity, provide successive harvests, and handle the fruit with minimum damage. However, in parts of New Mexico where labor sources are less available, mechanical harvesters predominate. These harvesters can be distinguished from one another by the three types of picking apparatus. The first type is a helical design, with either angled or vertical, open double-helixes. The second type has rubber fingers and brushes to remove fruit from the plant, and the spacing of the fingers can be adjusted according to crop type and condition. The third design has a propeller system that uses metal bars to remove fruit from the plants.

Because a machine cannot discriminate between desirable and undesirable pods, more diseased and unripened fruit may be harvested along with high-quality chile. In addition to sunburned, diseased, and immature pods, leaves and stems present in the harvested crop lower extractable color if not removed prior to processing. Some mechanical harvesters have harvest aids such as sorting lines, rotating barrels, roller cleaners, blowers, or electronic sensors for better sorting and cleaning. Regardless of harvest method, the crop should be culled in the field as much as possible. Sorting excessive amounts of leaves, stems, and defective pods at the processing facility increases the cost of waste disposal and lowers the marketable yield realized by the grower.

PROCESSING AND DEHYDRATION

Pod moisture content from field-picked red chile is between 65 and 80%, depending on whether they are partially dried on the plant or harvested while still succulent. Moisture must be reduced to about 10 to 11% for storage. Traditionally, chile was dehydrated by sun drying, with fruit spread on roofs or on the ground. Disadvantages of this method included contamination by birds and rodents, which led to poor quality chile for processors. This method was replaced by controlled artificial drying, now practiced by virtually all commercial processors in the United States. However, there is still a small market for traditional whole dried chiles with good red color.

Chiles arriving at the processor move through a dry-reel, a sorting line, a chlorinated wash, a rock tank, a final rinse, and a slicer before dehydration. Magnets are installed at several points to remove any metal pieces. Chiles are transported to the dehydrator on either trays or conveyor belts, depending on whether a tunnel dryer or continuous belt system is used. The continuous belt dryers are more expensive to build, but are faster and more energy efficient than tunnel dryers. Dehydration temperatures range from 140 to 150°F (60–65°C), but higher temperatures may be used in the initial stage of drying if moisture content is high. Chile is dried to 8 to 12% moisture, depending on buyer specifications. The ratio of fresh weight entering the processor to dry product yield is about 5:1.

COLOR RETENTION DURING STORAGE

Moisture content, storage temperature and atmosphere, light, harvest conditions and timing, cultivar, and drying conditions affect color retention. Of these, cultivar and storage temperature have the greatest influence on color retention. The initial color of chile fruits at harvest or after dehydration is not a good indication of the expected rate of color loss in storage. Therefore, cultivars should be evaluated both for initial color and for color retention properties.

Ground chile loses color faster than whole pods during storage. For this reason, red chile is often stored as flakes before final grinding. Flakes require less storage space than whole pods and maintain color better than ground powder. The presence of seeds in ground chile reduces the initial color of the product but decreases the rate of color loss in storage. Storage temperature affects color more than any other environmental factor. Color loss is accelerated as temperature increases, and any exposure to light or oxygen hastens the rate of pigment bleaching. Storage at 32 to 41°F (0–5°C) in the dark is recommended, although chile powder removed from cold storage can lose color quickly, reducing its retail shelf life. Antioxidants such as ethoxyquin, tocopherols, and ascorbic acid can be added to the product to improve color retention. These compounds are normally added during product reconditioning (grinding, blending, packaging).

Currently, the storage life of dehydrated red chile, with respect to color retention, is difficult to predict because of the many cultivar differences and environmental factors affecting both initial and postharvest quality. As with all chile products, the preharvest quality of the fruit greatly affects postharvest quality and shelf life. Processors must manipulate harvest timing, dehydration method and temperature, moisture content, granulation, and storage environment to obtain maximum quality dehydrated red chile.

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Laboratory names appearing here are for identification purposes only. No endorsement is intended, nor is criticism implied of similar facilities not mentioned. Persons using such services assume responsibility for their use.

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