



# PRODUCE WASH GUIDE

Limit your exposure to chemical pesticides with  
baking soda, salt, vinegar and more!

Effective ways to clean  
your fruits and vegetables



# About Produce

Organic farmers are required to grow their crops without the use of synthetic agrochemicals, protecting you from the health risks associated with chemical pesticide residues found on conventional fruits and vegetables. However, when organic options are unavailable, you can still reduce pesticide exposure **by using household remedies to wash your fruits and vegetables.**

The Organic Center compiled the most effective treatments for removing pesticides from various fruits and vegetables. All of the information provided is derived from peer-reviewed research, links are provided for further reference.

Organic farmers are required to grow their crops without the use of synthetic agrochemicals, protecting you from the health risks associated with chemical pesticide residues found on conventional fruits and vegetables. However, when you can't access unlimited organic options, [EWG's Dirty Dozen Shoppers Guide to Pesticides in Produce](#) can help you prioritize by highlighting the produce where organic options will protect you the most. And when organic options are unavailable, you can still reduce pesticide exposure by using household remedies to wash your fruits and vegetables.

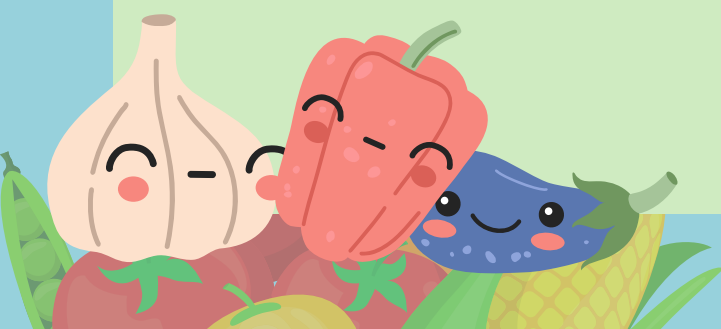
\*Limitation: Unfortunately, not all methods can eliminate 100% of pesticides from produce. Pesticides, especially those that do not dissolve readily in water, can be difficult to remove from the skin of fruits and vegetables and some of these chemical stains are near-permanent. **Learn more about the [Dirty Dozen list](#) from EWG.**

\*Disclaimer\* these recommendations are for the removal of pesticides only and not foodborne pathogens. So for produce items that are of greatest concern for food safety, [additional FDA recommendations](#) should be considered.

## Get your fruits and veggies squeaky clean with these washing tips!



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## Apples



### How to wash:

Peeling is the most effective method, followed by a baking soda wash as the second most effective



**Notes:** Tap water alone is ineffective

## Cabbage



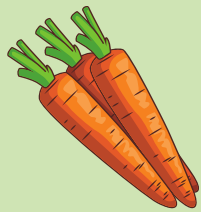
### How to wash:

Saltwater is the most effective method



**Notes:** Tap water alone is ineffective

## Carrots



### How to wash:

Peeling, washing or blanching are the most effective methods



**Notes:** Using all three methods together is most effective

## Citruses



### How to wash:

Baking soda is the most effective method



**Notes:** Tap water and salt water are ineffective

## Cucumber



### How to wash:

Peeling is the most effective method but use baking soda if only washing



**Notes:** Tap water alone is ineffective

## Lettuce



### How to wash:

Tap water is the most effective method

**Notes:** Wash lettuce for up to 10 minutes

## Melons



### How to wash:

Peeling is the most effective method



**Notes:** Peel to enjoy

## Nectarines



### How to wash:

Peeling is the most effective method



**Notes:** Peel to enjoy

## Okra



### How to wash:

Washing with tap water and boiling is the most effective method



**Notes:** Washing okra with tap water for 5 minutes reduces pesticide residues by 48-90%. Boiling afterward further increases removal



## Onions



### How to wash:

Rinse onions with tap water



**Notes:** Peel and enjoy

## Peaches



### How to wash:

Peeling is the most effective technique



**Notes:** Tap water alone is ineffective

## Peppers



### How to wash:

Soak in vinegar for most effective method



**Notes:** Soak to enjoy

## Potatoes



### How to wash:

Peel or soak in vinegar for most effective method



**Notes:** Tap water alone is ineffective

## Spinach



### How to wash:

Washing with baking soda is the most effective technique



**Notes:** Baking soda solutions remove 25-50% of residue for most pesticides on spinach

## Strawberry



### How to wash:

Soaking in vinegar is the most effective method



**Notes:** You can still use tap water, baking soda, salt water, and acetic acid, respectively

## Tomato



### How to wash:

Soak in vinegar for most effective method



**Notes:** A vinegar wash decreased pesticide residues by 40-90%

# Produce wash guide



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# Washing Explanations



**Tap Water Wash:** Although some studies examined pesticide removal in “Tap Water” conditions by quickly rinsing the produce, similar to most consumers, the most effective method is to soak the fruits or vegetables in water for up to 30 minutes.



**Baking Soda / Salt Water Wash:** These studies employed dilutions of these chemicals, soaking produce in them for up to 30 minutes. Most researchers used 5% solutions (by mass) of these chemicals. To create a 5% solution of baking soda or salt water, add 1 teaspoon of the baking soda or salt for every 1 cup of water you use. After soaking the produce, you can rinse them off with water to remove any taste that might be added via soaking.



**Vinegar Wash:** These studies employed 5% acetic acid solutions and vinegar, soaking produce in them for up to 30 minutes. 5% acetic acid solutions are effectively interchangeable with white vinegar (4-7% acetic acid) or any other vinegar with an acetic acid concentration of approximately 5%. After soaking the produce, you can rinse them off with water to remove any taste that might be added via soaking.



**Peeling:** To peel, you can use a knife or specialized peeling tool to remove the skin from your produce. Then, you can dispose of the peels in the compost or garbage.



**Blanching:** To blanch, produce is placed in boiling water for 2-3 minutes before being quickly removed and placed in ice water. After being completely chilled, you can remove the fruits and vegetables and pat them dry.

# References



1. Kin & Huat (2012): Strawberries were soaked for 30 minutes in different treatments before drying overnight. Publication does not provide strawberry-specific data but states it is statistically similar to cucumbers, which provided ~20%, ~40%, ~30%, and ~60% removal of pesticide residues on average using tap water, baking soda, salt water, and acetic acid respectively.



2. Acoglu & Omeroglu (2011): Oranges were soaked for 30 minutes in different treatments. Removal of pesticide ranged from 3-68%, 30-84%, 2-55%, and 5-82% respectively using tap water, baking soda, salt water, and acetic acid respectively. The rate of removal varied with pesticide and concentration of solution (higher concentration correlated higher removal). Vinegar solution pesticide removal data was not provided, but researchers stated it to be similar to salt water.



3. Yang (2017): Apples were soaked in bleach and baking soda solutions or rinsed under tap water, then air-dried. 51% and 95.8% of the two examined pesticides were removed in the baking soda treatment. Bleach and water treatments did not effectively remove surface pesticide residues. Peeling was stated to be the most effective treatment at removing surface pesticides.



4. Balinova (2006): Peeling was over 90% effective in reducing pesticide residues on the surface of peaches for all examined pesticides. Washing peaches with water reduced pesticide quantities by 20-50%.



5. Wanwimolruk (2017): A tap water rinse decreased pesticide residues on tomatoes by 27-58%, depending on the pesticide.



6. Andrade (2015): Washing tomatoes with water decreased pesticide residues by 5-75%, reducing concentrations of 6 of the 8 pesticides by more than 50%. A vinegar wash decreased pesticide residues by 40-90%. A wash with 10% baking soda solution reduced pesticide residues by 15-75%. This study found that a few pesticide primarily reside in the peel of the tomato, so peeling it would decrease pesticide concentration of the consumed part of the fruit.



7. Pugliese (2004): Tap water decreased pesticide residues by 7-34%, depending on the pesticide. 70% ethanol solution decreased pesticide residues by 26-79%, over 50% for all but two pesticides.



8. Polak & Tiryaki (2019): Washing peppers with water led to a 32-69% reduction in pesticide residues. Washing with acetic acid solution decreased pesticide residues by 33-77%. A citric acid wash led to a 32-77% decrease in pesticide residues. Ultrasonic cleaning removed 30-82% of pesticide residues.



9. Bonnechere (2019): Peeling removes 67-95% of pesticides from two varieties of melons.



10. Hanafa (2016): Washing okra with tap water for 5 minutes reduces pesticide residues by 48-90%. Boiling afterwards further increases removal (but not by a significant margin), however steaming the okra increased the pesticide concentrations. Cooking the okra after treatment decreases pesticide residue additionally, not significantly.



11. Soliman (2001): Washing potatoes with 10% acetic acid and 10% salt solution proved to be effective in removing pesticide residue from potatoes, with 59.7-97.6% and 40.1-88.6% reductions respectively. These solutions were much more adept at removing organophosphorus pesticides than organochlorines. Peeling potatoes was similarly effective among both pesticide classes removing 70.7-75.3% of residue. Cooking potatoes via blanching and frying removed 22.9-47.3% and 30.12-53.4% of pesticides respectively. A tap water rinse was ineffective in removing pesticide residues, only removing 11.2-23.7% of residue.



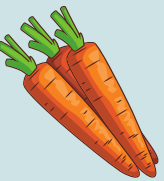
12. Wu (2019): Tap water is ineffective in removing pesticide residues from spinach, but baking soda solutions remove 25-50% of residue for most pesticides on spinach. Ozone solution washing for 30 minutes was the most effective method of removing pesticides from spinach. On Kumquats, tap water removed 20-40% of pesticides, but a baking soda wash resulted in 20-40% more removal of pesticide residues. The most effective method for removing pesticide residues from kumquats was a 20-minute micron calcium wash. On cucumbers, pesticides were not effectively removed by tap water, but removal rate via baking soda solutions was approximately 50%.



13. Chen (2019): Rinsing onions with tap water reduced pesticide residues by 12-70% Washing with ozonated water for 5 minutes resulted in a 30-69% reduction in pesticide residues.



14. Chen (2014): Washing lettuce with tap water for 10 minutes can remove approximately 20-40% of pesticide residues. Using a 10 mg/L chlorine dioxide solution for 10 minutes is more effective, removing approximately 35-70% of residues, depending on the pesticide.



15. Bonnechere (2015): Washing or peeling carrots reduced pesticide residues by 12-89% and 11-86% respectively, generally below 50% for each treatment while increasing pesticide residues in a few cases. Blanching carrots decreased pesticide residue by 19-59%, depending on the variety of carrot and the type of pesticide. Peeling and washing together decreased residues by over 85% in the majority of examined pesticides. Peeling, washing, and blanching together decreased residues by 85% in the majority of examined pesticides and reduced residues by over 50% in all variety/pesticide combinations besides one.



16. Zhang (2007): Washing cabbage with tap water for 20 minutes caused a 15.2-17.6% reduction in pesticide residues, dependent on the pesticide. Washing with 10% salt and acetic acid solutions reduced 65-74.1% and 65.8-79.8% of pesticide residues respectively after 20 minutes. Stir frying cabbage for 5 minutes resulted in a 67.5-86.6% reduction in pesticide residues.