Compatibility, Temperature Guidelines & Ethylene Sensitivity

COMPATIBILITY, TEMPERATURE GUIDELINES

LOAD COMPATIBILITY GROUPS[1]

GROUP 1

Apples
Apricots
Berries (except cranberries)
Cherries
Figs (not with apples, danger of odor transfer to figs; also see group 6a)
Grapes[2] (see groups 2 and 6a)
Peaches
Pears
Persimmons
Plums and prunes
Pomegranates
Quinces

Recommended Transit Conditions:

- *Temperature:*
  32° to 34°F (0° to 1.5°C)
- *Relative humidity:*
  90 to 95 percent
- *Atmosphere:*
  Normally used on berries and cherries only
  10 to 20 percent CO^2
- *Ice:*
  Never in contact with commodity.

Note: Most members of this group are not compatible with group 6a or 6b because ethylene production by group 1 can be high, and thus harmful to members of group 6a or 6b.

[1] Taken from USDA Marketing Research Report No. 1070, Compatibility of Fruits and Vegetables During Transport in Mixed Loads, by W.J. Lipton and J.M. Harvey, 1977.

[2] Grapes: Compatible with other commodities only if the grapes are not fumigated with sulfur dioxide (SO^2) in vehicle and if no chemicals that release SO^2 are included in packages.

GROUP 2

Avocados
Bananas
Eggplants (also see group 5)
Grapefruit3
Guava
Limes
Mangoes
Muskmelons, other than cantaloupes
Casaba
Crenshaw
Honey Dew
Persian
Olives, fresh
Papayas
Pineapples (not with avocados, danger of avocados odor absorption)
Tomatoes, green
Tomatoes, pink (also see group 4)
Watermelons (also see groups 4 and 5)

Recommended Transit Conditions:

- *Temperature:*
  55° to 65°F (13° to 18°C)
- *Relative humidity:*
  85 to 95 percent
- *Ice:*
  Never in contact with commodity

[3] Citrus Fruits : Oranges and tangerinesócompatibility depends on source. Florida or Texas grown oranges are shipped at 32° to 34°F (0.0° to 1.1°C), but oranges grown in California and Arizona are shipped at 38° to 48°F (3.3° to 8.8° C).

GROUP 3

Cantaloupes
Cranberries
Lemons (adjust temperature to other commodity)
Lychees (also see group 4)
Oranges
Tangerines

Recommended Transit Conditions:

- *Temperature:*
  36° to 41°F (2.5° to 5.0°C)
- *Relative humidity:*
  90 to 95 percent; cantaloupes about 95 percent
- *Ice:*
  In contact only with cantaloupes

GROUP 4

Beans, snap
Lychees (also see group 3)
Okra
Peppers, green (not with beans)
Peppers, red (if with green peppers, temperature adjusted toward top of range)
Squash, summer
Tomatoes, pink (also see group 2)
Watermelons (also see groups 2 and 5)

Recommended Transit Conditions:

- *Temperature:*
  40° to 45°F (4.5° to 7.5°C)
- *Relative humidity:*
  About 95 percent
- *Ice:*
  Never in contact with commodity

GROUP 5

Cucumbers
Eggplants (also see group 2)
Ginger (not with eggplants, also see group 7)
Grapefruit, Florida (after January 1), and Texas
Potatoes (late crop)
Pumpkin and squashes, winter
Watermelons (temperature adjusted for other members of groups; also see groups 2 and 4)

Recommended Transit Conditions:

- *Temperature:*
  40° to 55°F (4.4° to 13°C); ginger not below 55°F
- *Relative humidity:*
  85 to 90 percent
- *Ice:*
  Never in contact with commodity

COMPATIBILITY, TEMPERATURE GUIDELINES

GROUP 6a

Artichokes
Asparagus
Beets, red
Carrots
Endive and escarole
Figs (also see group 1)
Grapes (also see group 1)
Greens
Leeks (not with figs or grapes)
Lettuce
Mushrooms
Parsley
Parsnips
Peas
Rhubarb
Salsify
Spinach
Sweet corn
Watercress

This group, except for figs, grapes, and mushrooms, is compatible with group 6b.

Recommended Transit Conditions:

- *Temperature:*
  32° to 34°F (0° to 1.1°C)
- *Relative humidity:*
  95 to 100 percent
- *Ice:*
  Never in contact with asparagus, figs, grapes, or mushrooms

GROUP 6b

Broccoli
Brussels sprouts
Cabbage
Cauliflower
Celeriac
Horseradish
Kohlrabi
Onions, green (not with rhubarb, figs, grapes, mushrooms, or sweet corn)
Radishes
Rutabagas
Turnips

This group is compatible with group 6a, except for figs, grapes, and mushrooms.

Recommended Transit Conditions:

- *Temperature:*
  32° to 34°F (0° to 1.1°C)
- *Relative humidity:*
  95 to 100 percent
- *Ice:*
  Contact acceptable for all

GROUP 7

Ginger (also see group 5)
Potatoes, early crop (temperatures adjusted for others)
Sweet potatoes

Recommended Transit Conditions:

- *Temperature:*
  55° to 65°F (13° to 18°C)
- *Relative humidity:*
  85 to 90 percent
- *Ice:*
  Never in contact with commodity

GROUP 8

Garlic
Onions, dry

Recommended Transit Conditions:

- *Temperature:*
  32° to 34°F (0° to 1.5°C)
- *Relative humidity:*
  65 to 75 percent
- *Ice:*
  Never in contact with commodity

Source: United States Department of Agriculture (USDA)

COMPATIBILITY CHART FOR FRUITS & VEGETABLES

Compatible produce for long distance transport. Produce in the same temperature section can be mixed safely. Ethylene-sensitive vegetables should not be mixed with ethylene-producing fruits and vegetables. Dry vegetables can be mixed with other fruits and vegetables on trips lasting less than about one week.

ETHYLENE-SENSITIVE VEGETABLES

(32-36° F)

arugula
asparagus
Belgian/endive
broccoli
Brussels sprouts
cabbage[1]
carrot[1,3]
cauliflower
celery[1,3,9]
collard
escarole
green onion[9]
herbs
leek[8]
lettuce
mustard greens
parsley
snow peas
spinach
sweet peas
turnip greens
watercress

(45-50° F)

chayote
eggplant[5]
squash, summer
cucumber
okra

(55-65° F)

squash: pumpkin, winter, yam
sweet potato

NOT SENSITIVE TO ETHYLENE VEGETABLES

(32-36° F)

alfalfa sprouts
amaranth
anise
artichoke
beans: fava, lima
bean sprouts
beet
bok choy
garlic
horseradish
kale
mint
mushroom[7]
parsnip
radicchio
radish
rhubarb[7]
rutbaga
shallot
sweet corn[7]
water chestnut

(45-50° F)

basil
cowpea
tomatillo
beans: green, snap[10]
pepper: bell, chili[10]

NOT SENSITIVE TO ETHYLENE VEGETABLES (55-65° F)

dry onion[9]
jicama
potato
ginger[5]
melon: bitter
tomato

ETHYLENE-PRODUCING (VERY LOW) FRUITS AND MELONS (various temps)

apple[1,3,9]
apricot
avocado (ripe)
berries
cantaloupe
cherry
coconut
currant
date
fig[1,7,8]
grape[6,7,8]
loquat
nectarine
peach
pear[1,9]
plum
pomegranate
prune
quince
watermelon

ETHYLENE-SENSITIVE FRUITS (various temps)

banana
grapefruit[4,9]
lemon, lime[4,9]
watermelon

NOT SENSITIVE TO ETHYLENE FRUITS

(45-50° F)

avocado (unripe)
cactus pear[1,9]
cranberry
guava
kumquat
mandarin[4,9]
olive
orange[4,9]
passion fruit
pineapple[2,10]
tamarillo
tamarind
tangelo[4,9]

(55-65° F)

jackfruit
melon: casaba, crenshaw, honeydew Persian
plantain
soursop
breadfruit
mango
papaya
rambutan

Notes:

[1] Odors from apples and pears are absorbed by cabbage, carrots, celery, figs, onions, and potatoes.
[2] Avocado odor is absorbed by pineapple.
[3] Celery absorbs odor from onion, apple, and carrot.
[4] Citrus absorbs odor from strongly scented fruits and vegetables.
[5] Ginger odor is absorbed by eggplant.
[6] Sulfur dioxide released from pads used with table grapes will damage other produce.
[7] Green onion odor is absorbed by fig, grape, mushroom, rhubarb, and corn.
[8] Leek odor is absorbed by fig and grape.
[9] Onion odor is absorbed by apple, celery, pear, and citrus.
[10] Pepper odor is absorbed by beans, pineapple, and avocado.

Source: University of California-Davis.