2016 PESTICIDE APPLICATION RECORD

Location of Application				Pesticide Product Used			Mixture Recipe per Product Label		Total Volume Applied Total Volumen Aplicar	Date *(M/D/Y)* & Time (*am/.pm*)		Applicator Full Name/ Pesticide License or Handler Number
Farm Name & Address; City or Township; and County of Application	Field Name Sitio Aplicado	Acres Treated/ Tratado	Crop Treated Cosech Tratado	Brand Name of Pesticide Nombre del Pesticida	EPA Registration Number Numero de Registracion EPA	Active Ingredient(s) Ingrediente Acitvo	Amount of Pesticide Concentrate used before mixing*	Total Diluent Candidad Usada		Date/Time Application Completed Fecha y Hora de la Aplicacion	Date/Time of Reentry Fecha y Hora de Reentrada	

**Aumente el pesticida concentrado usarlo antes mesclarlo*

R1

2016 PESTICIDE APPLICATION RECORD

New Jersey regulations require growers [private applicators] to maintain records of **all applications** of pesticides (both general and restricted use) for 3 years. All records should be recorded in writing as soon as possible, but no later than 24 hours. These records must be made available to the New Jersey Department of Environmental Protection and medical personnel (for emergencies) upon request.

Below is an example using a one-page format for keeping your records. The most current version can be found on the Rutgers Pest Management Office website at www.pestmanagement.rutgers.edu/PAT/record_forms.htm. You can use your own recordkeeping format as long as you include all of the information required by State regulations (NJAC 7:30-8.8 Records). If you don't include it as part of your application record, keep a separate list of handlers working under the private applicator's supervision.

The crop/field designation must be specific. *For example*- assign a number to each field, or the parts of a field planted to different crops, or the parts of a field planted to the same crop in a different growth stage. Then use this number on the application record for each application to that specific location. For all pesticides having a reentry time, enter the date and the hour hat the application was completed.

Location of Application				Pesticide Product Used			Mixture Recipe per Product Label		Total Volume Applied Total Volumen Aplicar	Date *(M/D/Y)* & Time (*am/.pm*)		Applicator Full Name/ Pesticide License or Handler Number
Farm Name & Address; City or Township; and County of Application	Field Name Sitio Aplicado	Acres Treated/ Tratado	Crop Treated Cosech Tratado	Brand Name of Pesticide Nombre del Pesticida	EPA Registration Number Numero de Registracion EPA	Active Ingredient(s) Ingrediente Acitvo	Amount of Pesticide Concentrate used before mixing*	Total Diluent Candidad Usada		Date/Time Application Completed Fecha y Hora de la Aplicacion	Date/Time of Reentry Fecha y Hora de Reentrada	
XYZ Farm 1234 Farm Road; Agriville; Cumberland County	G-11	8	Tomatoes	Vydate L	352-372	Oxamyl	12 qts.	400 gal	400 gal	6/15/12- 9:30 a.m.	6/17/12- 9:30 a.m.	John Smith C080569

**Aumente el pesticida concentrado usarlo antes mesclarlo*

R2

PESTICIDE REGISTRATION NUMBERS

Use the space below to list the pesticides that you use and their EPA registration numbers. These numbers are printed on the label.

Pesticide*	EPA Registration No.*	Active Ingredient*	Formulation
Example: Rally	62719-410	myclobutanil 40%	40 WSP

* In New Jersey, a form listing all pesticides stored on site must be sent each year to your local Fire Department with an explanatory cover letter. It must include a description or diagram of the exact location of the storage area. See www.pestmanagement.rutgers.edu/PAT/record_forms.htm for template

VEGETABLE SEED SIZES

Table R-1. Vegetable Seed Sizes[1]

Crop	Seeds/Unit Weight	Crop	Seeds/Unit Weight
Asparagus	13,000-20,000/lb	Mustard	15,000-17,000/oz
Beans: baby lima	1,150-1,450/lb	Okra	450-550/oz
fordhook	440-550/lb	Onions: bulb	105,000-144,000/lb
snap	1,600-2,200/lb	bunching	180,000-200,000/lb
Beets	24,000-26,000/lb	Parsnips	7,500-12,000/oz
Broccoli	8,500-9,000/oz	Parsley	240,000-288,000/lb
Brussels sprouts	8,500-9,000/oz	Peas	1,440-2,580/lb
Cabbage	8,500-9,000/oz	Peppers	4,000-4,700/oz
Carrots	300,000-400,000/lb	Pumpkins	1,900-3,200/lb
Cauliflower	8,900-10,000/oz	Radishes	40,000-50,000/lb
Celery	60,000-72,000/oz	Rutabaga	150,000-192,000/lb
Collards	7,500-8,500/oz	Spinach	25,000-50,000/lb
Cucumbers	15,000-16,000/lb	Squash: summer	3,500-4,800/lb
Eggplants	6,000-6,500/oz	winter	1,600-4,000/lb
Endive, escarole	22,000-26,000/oz	Sweet corn: normal, sugary enhanced	1,800-2,500/lb
Kale	7,500-8,900/oz	Super sweet (Sh)	3,000-5,000/lb
Leeks	170,000-180,000/lb	Tomatoes: fresh	10,000-11,400/oz
Lettuce: head	20,000-25,000/oz	processing	160,000-190,000/lb
leaf	25,000-31,000/oz	Watermelons: small seed	8,000-10,400/lb
Muskmelons	16,000-19,000/lb	large seed	3,200-4,800/lb

[1]Use this table to estimate your seed requirements. Varieties and seed lots can differ in seed size. Check with your seed supplier and the label on the container for more precise information.

PLANT SPACINGS AND POPULATIONS

Table R-2. Population of Plants per Acre at Several Between-Row and In-Row Spacings

Inches between Rows	Inches Apart in Row												
	2	4	6	8	10	12	14	16	18	24	30	36	48
7	448,046	224,023	149,349	112,011	89,609	74,674	64,006						
12	261,360	130,680	87,120	65,340	52,272	43,560	37,337	32,670	29,040	21,780	17,424	14,520	10,890
18	174,240	87,120	58,080	43,560	34,848	29,040	24,891	21,780	19,360	14,520	11,616	9,680	7,260
21	149,349	74,674	49,783	37,337	29,870	24,891	21,336	18,669	16,594	12,446	9,957	8,297	6,223
24	130,680	65,340	43,560	32,670	26,136	21,780	18,669	16,335	14,520	10,890	8,712	7,260	5,445
30	104,544	52,272	34,848	26,136	20,909	17,424	14,935	13,068	11,616	8,712	6,970	5,808	4,356
36 (3 ft)	87,120	43,560	29,040	21,780	17,424	14,520	12,446	10,890	9,680	7,260	5,808	4,840	3,630
42 (3½ ft)	74,674	37,337	24,891	18,669	14,934	12,446	10,668	9,334	8,297	6,223	4,978	4,149	3,111
48 (4 ft)	65,340	32,670	21,780	16,335	13,068	10,890	9,334	8,167	7,260	5,445	4,356	3,630	2,722
60 (5 ft)			17,424	13,068	10,454	8,712	7,467	6,534	5,808	4,356	3,485	2,904	2,178
72 (6 ft)			14,520	10,890	8,712	7,260	6,223	5,445	4,840	3,630	2,904	2,420	1,815
84 (7 ft)			12,446	9,334	7,467	6,223	5,334	4,667	4,149	3,111	2,489	2,074	1,556
96 (8 ft)			10,890	8,167	6,534	5,445	4,667	4,084	3,630	2,722	2,178	1,815	1,361

USEFUL WEBSITES

The following is a list of websites that may be of interest and value to vegetable growers. Growers should carefully evaluate the source and accuracy of the information. Cooperative Extension DOES NOT confirm the accuracy of information at these websites. No endorsement of the information found at these websites is implied and no lack of endorsement is implied for sites not listed.

AGRICULTURAL SEARCH ENGINES	
cris.csrees.usda.gov	USDA Current Research Information System
produceoasis.com	About produce--recipes, nutrition, etc.
agricultureinformation.com/forums	Agricultural Search Engine
VEGETABLE PRODUCTION	
njaes.rutgers.edu/pubs/publication.asp?pid=E001	2015 Commercial Vegetable Production Recommendations for New Jersey
aesop.rutgers.edu/~horteng	Rutgers Horticultural Engineering
extension.udel.edu/ag/vegetable-fruit-resources/vegetable-small-fruits-program	Delaware Cooperative Extension Vegetable and Small Fruit Program
vric.ucdavis.edu	Univ of California Vegetable Crops Information
edis.ifas.ufl.edu/topic_commercial_vegetable_production	Univ of Florida Commercial Vegetable Information
weedid.aces.uiuc.edu	Univ. of Illinois Weed Identification
edis.ifas.ufl.edu/HS131	Reducing Postharvest Tomato Losses
www.ces.ncsu.edu/hil/veg-index.html	North Carolina Cooperative Extension Commercial Vegetable Information
hightunnels.org	High Tunnel Information
msucares.com/crops/comhort/index.html	Mississippi Extension Service Vegetable Information
extension.psu.edu/vegetable-fruit	Penn State Extension Vegetable, Small Fruit and Mushroom Production Information
plasticulture.cas.psu.edu	Penn State Extension Center for Plasticulture
extension.psu.edu/pests/plant-diseases	Penn State Extension Plant Disease Information
agsci.psu.edu/aasl	Penn State Agricultural Analytical Services Lab.
msue.anr.msu.edu	Michigan State University Extension
vegetables.cornell.edu	Cornell Univ. Vegetable Information
extension.oregonstate.edu	Oregon State Univ. Extension
ag.arizona.edu/hydroponictomatoes	Growing Hydroponic Tomatoes
extension.umass.edu/vegetable	Univ. of Mass. Vegetable Information
cals.arizonia.edu/grafting/home	Grafting Information
vegetablegrafting.org/resources	Grafting rootstock
ext.vt.edu	Virginia Cooperative Extension Information
ohioline.osu.edu/lines/facts.html	The Ohio State Univ. Fact Sheets
oak.ppws.vt.edu/weedindex.htm	Virginia Tech Weed ID Guide
ca.uky.edu/agc/pubs/id/id36/id36.htm	Univ. of Kentucky 2014-15 Vegetable Growers Guide
pubs.ext.vt.edu/438/438-012/438-012.html	Virginia Tech White Potato Nitrogen Management
cals.ncsu.edu/plantpath/extension/commodities/sweetpotatoes_postharvest.pdf	NCSU Postharvest Handling of Sweet Potatoes publication
ncsu.edu/~clrivard/TubeGraftingTechnique.pdf	NCSU Grafting for Disease Resistance in Heirloom Tomatoes publication
farmassist.com	Syngenta (Special labels) FarmAssist®
eurofinsus.com/stalabs	STA Laboratories (seed testing)

USEFUL WEBSITES (continued)

VEGETABLE PRODUCTION IN GREENHOUSES	
agrisk.umn.edu/cache/arl01481.htm	Greenhouse and Hydroponic Vegetable Production Resources on the Internet
msucares.com/pubs/publications/p1828.pdf	Mississippi State Greenhouse Tomato Handbook
edis.ifas.ufl.edu/topic_book_florida_greenhouse_vegetable_production_handbook	Univ. of Florida Greenhouse Vegetable Production Handbook
POLLINATION	
pollinator.com	The Pollination Home Page
www.xerces.org/pollinator-conservation	The Xerces Society Pollinator Conservation
http://dda.delaware.gov/plantind/forms/publications/FarmManagementforNativeBees-AGuideforDelaware.pdf	Farm Management for Native Bees (Delaware)
epa.gov/pollinator-protection/new-labeling-neonicotinoid-pesticides	EPA's new pollinator protection labeling guidelines and new bee advisory box
ohioline.osu.edu/cv-fact/pdf/1003.pdf	Biology of Squash Bees
icpbees.org/tools-for-growers	Tools for Growers – supported by Project ICP (Integrated Crop Pollination)
ento.psu.edu/pollinators/information-for-growers	Center for Pollinator Research
SUSTAINABLE/ALTERNATIVE CROP PRODUCTION	
ibiblio.org/farming-connection	Sustainable Farming Connection
sarep.ucdavis.edu	Univ. of California Sustainable Ag Program
sfc.ucdavis.edu	Univ. of California Small Farm Center
hort.purdue.edu/newcrop	Purdue's NewCrop™ Information
afsic.nal.usda.gov	USDA Alternative Farming Systems Info. Ctr.
attra.ncat.org/horticultural.html	ATTRA Horticultural Crops
sare.org	Sustainable Agriculture Research & Education
kerrcenter.com	The Kerr Center for Sustainable Agriculture
INTEGRATED PEST MANAGEMENT (IPM)	
omri.org	Approved Organic Nutrients and Sources
njaes.rutgers.edu/weeds	New Jersey Weed Gallery
veg-guidelines.cce.cornell.edu	Cornell Commercial Vegetable Production IPM
pestmanagement.rutgers.edu/IPM/Vegetable/index.htm	Rutgers Cooperative Extension Vegetable IPM Program
ipm.ucdavis.edu	Univ. of California IPM
ipm.uconn.edu/pa_vegetable	Univ. of Connecticut Vegetable IPM
vegedge.umn.edu/MNFruit&VegNews/mnindex.htm	Univ. of Minnesota IPM Newsletter
nysipm.cornell.edu/vegetables/default.asp	New York State Vegetable IPM
biocontrol.entomology.cornell.edu/index.php	Cornell Univ. Biological Control Site
extension.umd.edu/ipm	University of Maryland Extension IPM
cdm.ipmpipe.org	Cucurbit Downy Mildew Forecasting
pestwatch.psu.edu	Penn State Pest Watch
itunes.apple.com/us/app/sample-submission/id669269520?mt=8	Plant Diagnostic Lab App (Ala, U. of Conn., U of Ill., U. of KY, MSU, U. of NH, Ohio State U.)
PESTICIDE NEWS AND INFORMATION	
npic.orst.edu	National Pesticide Information Center
cdms.net/LabelsMsds/LMDefault.aspx?t=	Pesticide Labels & MSDS
greenbook.net	C&P Press Greenbook.net
ipmcenters.org	Office of Pest Management Program USDA
irac-online.org	Insecticide Resistance Action Committee
epa.gov/pesticides	U.S. EPA Office of Pesticide Programs

USEFUL WEBSITES (continued)

PESTICIDE NEWS AND INFORMATION (continued)	
pcpnj.org	NJ DEP Pesticide Control Program
extension.org/mediawiki/files/1/15/NativeBees2009.pdf	Bryn Mawr College & Rutgers Native Bee Benefits For Pa and NJ publication
usablight.org	USA Blight: National Project on Late Blight
NEWSLETTERS	
njaes.rutgers.edu/pubs/plantandpestadvisory	New Jersey Plant & Pest Advisory Newsletter
agdev.anr.udel.edu/weeklycropupdate	Univ. of Delaware Weekly Crop Update
vegnet.osu.edu/newsletter	The Ohio State Univ. Weekly Newsletter
ipm.uiuc.edu/ifvn/index.html	Illinois Fruit and Vegetable News
ag.arizona.edu/crops/vegetables/vegetables.html	Univ. of Arizona Vegetable Pest Reports
MARKETING	
ams.usda.gov/AMSv1.0/marketnews	USDA Agricultural Marketing Service Reports
farmersmarketonline.com/marketwa.htm	Terminal Market Prices for U.S. Crops
fas.usda.gov/commodities	Terminal Market Prices Around the World
sfproduce.org/home.html	San Francisco Wholesale Market Listings
nass.usda.gov	USDA National Agricultural Statistics Service
ams.usda.gov/directmarketing	USDA's Direct Marketing Information
pafarm.com	PA Farm Market Association
worldcrops.org	Ethnic Vegetable Production & Marketing
pma.com	Produce Marketing Association
FARM MANAGEMENT	
aesop.rutgers.edu/~farmmgmt	Farm Management
ers.usda.gov	USDA Economic Research Service
farminfo.org	The Small Farm Resource
dda.delaware.gov/plantind/forms/publications/FarmManagementforNativeBees-AGuideforDelaware.pdf	Farm Management for Native Bees Guide
WILDLIFE MANAGEMENT	
berrymaninstitute.org	The Jack H. Berryman Institute
wildlifecontrol.info/newdm/Pages/default.aspx	The Northeast Wildlife Damage Management Research and Outreach Cooperative
icwdm.org/handbook/index.asp	Internet Center for Wildlife Damage Management
EDUCATION	
njaes.rutgers.edu	Rutgers NJ Agricultural Experiment Station
cpe.rutgers.edu	NJAES Office of Continuing Profess. Ed.
GOVERNMENT AGENCIES RELATED TO AGRICULTURE	
usda.gov	US Department of Agriculture
dda.delaware.gov	Delaware Department of Agriculture
state.nj.us/agriculture	NJ Department of Agriculture
mda.state.md.us	Maryland Department of Agriculture
nj.gov/dep/enforcement/pcp	NJ Pesticide Control Program
agriculture.state.pa.us	Pennsylvania Department of Agriculture
vdacs.virginia.gov	Virginia Department of Agriculture
rma.usda.gov	Risk Management Agency USDA
wvagriculture.org	West Virginia Department of Agriculture

USEFUL WEBSITES (continued)

TRADE PUBLICATIONS	
americanfarm.com	American Farm Publications
meistermedia.com/publications/american-vegetable-grower	American Vegetable Grower
vegetablegrowersnews.com	The Vegetable Grower News
agriculture.com	Agriculture Online
www.thepacker.com/thegrower	The Grower Magazine
WEATHER	
weather.gov	National Weather Service
climate.rutgers.edu/stateclim	Office of the NJ State Climatologist
deos.udel.edu/index.html	Delaware Environmental Observing System
usna.usda.gov/Hardzone	U.S. Natl.Arboretum--Plant Hardiness Zone Map
FOOD SAFETY	
fda.gov/Food/GuidanceRegulation/FSMA/default.htm	FDA Food Safety Modernization Act (FSMA)
ecommons.library.cornell.edu/handle/1813/2209	Growers Guide to Food Safety
caleafygreens.ca.gov/food-safety-practices	Food Safety Practices
foodsafety.gov	National Food Safety Programs
producesafetyalliance.cornell.edu	Produce Safety Alliance
gaps.cornell.edu	National Good Agricultural Practices Program
ams.usda.gov/services/auditing/gap-ghp	Good Agricultural Practices (GAP) & Good Handling Practices (GHP)
extension.psu.edu/food/safety/farm	Penn State Farm Food Safety Site
plant-pest-advisory.rutgers.edu/food-safety-publications	Rutgers On Farm Food Safety Materials

PUBLICATION RESOURCES

The following publications are suggested for agents, growers, agriculture-industry representatives, and others who desire more detailed information on specific crops or production practices.

General Texts and Handbooks

Holcomb, E.J., editor. 1994. *Bedding Plants IV*. 516 pages. Fourth edition. Pennsylvania Flower Growers, Ball Publishing Co., P.O. Box 9, Batavia, IL 60510-0009. A manual on the culture of bedding plants as a greenhouse crop.

Uva, Richard H., Joseph C. Neal and Joseph M. DiTomaso, 1997; *Weeds of the Northeast;* 416 pages, Cornell University Press, 750 Cascadilla St., Ithaca, NY 14851. Comprehensive handbook for identifying 299 common and economically important weeds. 46 color photos and 118 drawings.

Maynard, D.N., and George Hochmuth. 2006. *Knott's Handbook for Vegetable Growers*. 582 pages. Fourth edition, John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10158. A practical handbook on commercial vegetable production.

Meister, R.T., editor. July issue. *Annual Buyer's Guide: American Vegetable Grower*. Meister Publishing Co., 37841 Euclid Ave., Willoughby, OH 44094.

Phillips, Roger, and Martyn Rix. 1993. *The Random House Book of Vegetables*. Random House Publishers, New York, NY. Illustrations and photographs of 650 vegetables with some production information included.

Pierce, Lincoln C. 1987. *Vegetables: Characteristics, Production, and Marketing*. 433 pages. First edition, John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10158. A good technical textbook for temperate vegetables.

Plucknett, D.L. and H.B. Sprague. 1989. *Detecting Mineral Nutrient Deficiencies in Tropical and Temperate Crops*. Westview Tropical Agriculture Series No. 7, Westview Press, Boulder, CO 80302.

Scaife, A. and M. Turner. 1984. *Diagnosis of Mineral Disorders in Plants. Volume 2: Vegetables*. Chemical Publishing Co., New York, NY 10000.

Shepersky, K. 1984. *The Rain Bird Landscape Drip Irrigation Design Manual*. Rain Bird Sprinkler Mfg. Corp., Glendora, CA 91740.

Sherf, A.F., and A.A. MacNab. 1986. *Vegetable Diseases and Their Control*. 728 pages. Second edition. John Wiley & Sons, Inc., 605 3rd Ave., New York, NY 10158. Information on diagnosis, disease cycles, and control; includes over 400 diseases and over 200 illustrations.

Swiader, John M., George W. Ware, and J.P. McCollum. 1992. *Producing Vegetable Crops.* Fourth Edition. Interstate publishers, Inc., 510 N. Vermillion Street, PO Box 50, Danville, IL 61834.

Anonymous. 1990. *Western Fertilizer Handbook*, Interstate Publishers, Inc., Danville, IL, 279 pp.

Anonymous. 2007. *Crop Protection Handbook*, Meister Media, Inc., Willoughby, OH, 828 pp.

Barenklau, K. E. 2001. *Agricultural Safety*, Lewis Publishers, Boca Raton, FL, 135 pp.

Brase, T. A. 2005. *Precision Agriculture*, Thomson Delmar Learning, Clifton Park, NY, 224 pp.

Cloyd, R. A., Nixon, P. L., and Pataky, N. R. 2004. *IPM For Gardeners*, Timber Press, Portland, OR, 204 pp.

Decoteau, D. R. 2000. *Vegetable Crops*, Prentice-Hall, Upper Saddle River, NJ, 464 pp.

Jones, J. Benton Jr. 2005. *Hydroponics: A Practical Guide for the Soilless Grower*, CRC Press, Boca Raton, FL, 423 pp.

McElhatton, A. and Marshall, R. J. 2007. *Food Safety – A Practical and Case Study Approach*, Springer, New York, NY, 311 pp.

McKinlay, R. G. 1992. *Vegetable Crop Pests*, CRC Press, Inc., Boca Raton, FL, 406 pp.

Monaco, T. J., Weller, S. C., and Ashton, F. M. 2002. *Weed Science: Principles and Practices, 4th Edition*, John Wiley & Sons, New York, NY, 669 pp.

Naylor, R. E. 2002. *Weed Management Handbook, 9th Edition*, Blackwell Publishers, Oxford, UK, 423 pp.

Rechcigl, N. A. and Rechcigl, J. E. 1997. *Environmentally Safe Approaches to Crop Disease Control*, CRC Lewis, Boca Raton, FL, 386 pp.

Rubatzky, V. E. and Yamaguchi, M. 1997. *World Vegetables: Principles, Production, and Nutritive Values*, Chapman and Hall, New York, NY, 843 pp.

Singh, H. P., Batish, D. R., and Kohli, R. K. 2005. *Handbook of Sustainable Weed Management*, Food Prod. Press, New York, NY, 892 pp.

Snowdon, A. L. 1990. *Color Atlas of Post-Harvest Diseases and Disorders Vol. 2: Vegetables*, CRC Press, Inc., Boca Raton, FL, 416 pp.

Van Emden, H. F. and Service, M. W. 2004. *Pest and Vector Control*, Cambridge University Press, Cambridge, UK, 349 pp.

Publications from Universities, USDA, Societies, and Commercial Companies

Compendium of Bean Diseases, Compendium of Beet Diseases and Insects, Compendium of Brassica Diseases, Compendium of Corn Diseases, Compendium of Cucurbit Diseases, Compendium of Lettuce Diseases, Compendium of Pea Diseases, Compendium of Pepper Diseases, Compendium of Potato Diseases, Compendium of Sweet Potato Diseases, Compendium of Tomato Diseases, Compendium of Umbelliferous Crop Diseases Compendium of Onion and Garlic Diseases and Pests. Compendium of Strawberry Diseases, Second Edition, Diseases, Pests, and Beneficial Organisms of Strawberry, Raspberry, and Blueberry, Tomato Diseases: A Color Handbook, Second Edition, Postharvest Biology and Technology of Fruits, Vegetables, and Flowers, Color Atlas of Postharvest Quality of Fruits and Vegetables, A Colour Atlas of Diseases of Lettuce and Related Salad Crops, Vegetable Diseases: A Colour Handbook, Available from APS Press, The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121.

Hardenburg, R.E., A.E. Watada, and C.Y. Wong. 1995. *The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks*. 136 pages. USDA Agricultural Handbook No.66 (revised).

PUBLICATION RESOURCES

Publications from Universities, USDA, Societies, and Commercial Companies (continued)

Kader, Adel A., et al. 1985. *Postharvest Technology of Horticultural Crops*. 192 pages. Special Publication 3311. Univ. of CA, 6701 San Pablo Ave, Oakland, CA 94608-1239.

Integrated Pest Management for Cole Crops and Lettuce. 1992. Publication of the Div. of Agric. and Natural Resources. Univ. of CA, 6701 San Pablo Ave., Oakland, CA 94608-1239.

MacNab, A.A., A.F. Sherf, and J.K. Springer. 1983. *Identifying Diseases of Vegetables*. 62 pages. Order from Publications Distribution Center, Penn State University, 112 Agricultural Administ. Building, University Park, PA 16802. Color photos and description of common vegetable diseases.

McGregor, S.E. (continuously updated). *Insect Pollination of Cultivated Crop Plants*. USDA Agricultural Handbook 496. 411 pages. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Specialty and Minor Crops Handbook. 1991. Publication 3346. Publication Div. of Agric. and Natural Resources. Univ. of CA, 6701 San Pablo Ave., Oakland, CA 94608-1239.

Stephens, J.M. 1989. *Manual of Minor Vegetables*. 123 pages. Florida Cooperative Extension Service, Univ. of FL, Gainesville, FL 32611.

Weeds of the North Central States (Bulletin 7). 303 pages. Illustrated book that lists and describes most of the weeds found in New Jersey. Available from the University of Illinois, Champaign, IL 61820.

Grubinger, Vernon P. 1999 *Sustainable Vegetable Production from Start-Up to Market*. 280 pages. Guide for those who are considering beginning a vegetable production business. The Natural Resource, Agriculture, and Engineering Service. Contact NRAES by phone (607) 255-7654 or www.nraes.org.

Zitter, Thomas A., Hopkins, Donald L., and Thomas, Claude E. 1996. *Compendium of Cucurbit Diseases*, American Phytopathological Society, 140 pp. www.shopapspress.org/42074.html

FREQUENTLY USED WEIGHTS & MEASURES

Table R-3. Frequently Used Weights and Measures and Approximate Metric Equivalents

Liquid			Dry				
Pint	**Liters**	**Gallons**	**Liters**	**Ounces**	**Grams**	**Pounds**	**Kilograms**
0.5	0.24	1	3.8	0.25	7.1	1	0.5
1.0	0.47	2	7.6	0.50	14.2	2	0.9
1.5	0.71	3	11.4	0.75	21.3	3	1.4
2.0	0.95	4	15.1	1.0	28.4	4	1.8
2.5	1.18	5	18.9	2.0	56.7	5	2.3
3.0	1.42	6	22.7	3.0	85.0	6	2.7
3.5	1.65	7	26.5	4.0	113.4	7	3.2
4.0	1.90	8	30.3	5.0	141.7	8	3.6
4.5	2.13	9	34.1	10.0	283.5	9	4.1
5.0	2.37	10	37.9	16.0	453.6	10	4.5

Length and Area

1 acre	=	0.405	hectares	1 inch	=	2.54	centimeters
1 square mile	=	2.39	square kilometers	1 foot	=	30.3	centimeters
1 square yard	=	0.836	square meters	1 yard	=	0.914	meters
1 square foot	=	0.0929	square meters	1 mile	=	1.61	kilometers
1 square inch	=	6.45	square centimeters				

PLANT GROWING MIX

Making a Plant-Growing Mix. Many pre-mixed growing media products suitable for conventional and organic production are available commercially. A good, lightweight, disease-free, plant-growing material can also be made from a mixture of peat and vermiculite. A formula for a very simple mix for conventional production is given in Table R-4, but a preferred formulation is shown in Table R-5. If plants are to be grown in a mix longer than 8 weeks, use the formula in Table R-5. Organic growing media differ from conventional media because all components used must be allowable under organic production standards. When mixing your own formulation it is important to verify with your certifier that the materials you are using will not compromise your certification. For more information on organic growing media including several formulations can be found in:

- *Potting Media and Plant Propagation* - http://extension.psu.edu/start-farming/vegetables/potting-media-and-plant-propagation
- *Potting Mixes for Certified Organic Production* - https://attra.ncat.org/attra-pub/viewhtml.php?id=47
- *Organic Potting Mix Basics* - http://www.extension.org/pages/20982/organic-potting-mix-basics

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Table R-4. Simple Plant-Growing Mix

Materials	Cubic Yard (22 Bushels)	2 Bushels
Shredded sphagnum peat moss	11 bu	1 bu (10 gal)
No. 2, 3, or 4 domestic or African vermiculite[1] or horticultural grade (dust-screened)	11 bu	1 bu (10 gal)
Pulverized limestone		
use *dolomitic* lime for mixes made with *domestic* vermiculite	10 lb	1 lb (1¼ cups)
or		
use *calcitic* lime mixes made with *African* vermiculite	6 lb	9 oz (3/4 cup)
Superphosphate (20% P_2O_5) or	2½ lb	4 oz (½ cup)
Triple superphosphate (46% P_2O_5)	1¼ lb	2 oz (¼ cup)
Fertilizer (5-10-10)	5 lb	8 oz (1 cup)

[1] Vermiculite should be pea-sized and relatively free of fines and dust. Final mix should have a pH of 6.0-6.5.

Notes. Good results for growing lettuce and cabbage transplants have been obtained by diluting this mix with an equal part of sand.

This mix will only get the seedlings up. Supplemental fertilizing will be needed to grow plants to transplant size. About 3 weeks after seeding, begin liquid fertilizing the plants with a soluble fertilizer, such as a 20-20-20, at the rate of 2-3 teaspoons per gallon of water. This rate should be applied at least weekly. More frequent applications may be desirable.

Table R-5. Preferred Plant-Growing Mix

Materials	Cubic Yard (22 Bushels)	2 Bushels
Shredded sphagnum peat moss	11 bu	1 bu (10 gal)
No. 2, 3, or 4 domestic vermiculite[1] or horticultural grade (dust-screened)	11 bu	1 bu (10 gal)
or		
African vermiculite[1]	11 bu	1 bu (10 gal)
Pulverized limestone		
use *dolomitic* lime for mixes made with *domestic* vermiculite	10 lb	1 lb (1¼ cups)
or		
use *calcitic* lime mixes made with *African* vermiculite	6 lb	9 oz (3/4 cup)
Superphosphate (20% P_2O_5) or	2½ lb	4 oz (½ cup)
Triple superphosphate (46% P_2O_5)	1¼ lb	2 oz (¼ cup)
Sulfate or muriate of potash (50%-60% K_2O)	½ lb	1 oz (2 tbs)
Osmocote[2] (18-6-12)		
Tomatoes	4 lb	6 oz (3/4 cup)
Eggplants	8 lb	12 oz (1½ cups)
Peppers	8 lb	12 oz (1½ cups)
Micronutrient mix	Use according to mfgr.'s recommendations	
Wetting agent (such as Aqua-Gro granular)	1½ pt	1 oz (4 tbs)

[1] Vermiculite should be approximately pea-sized and relatively free of fines and dust. Final mix should have a pH of 6.0-6.5.

[2] Osmocote is a slow-release fertilizer. Use a formula that will release nutrients over a period of 8 to 9 months. Therefore, mixes should be made just prior to seeding. Plants grown in mixes containing Osmocote must be carefully watered and the temperature carefully controlled prior to field planting. Reduced rates are suggested to control plant height when using small cells.

Regardless of which formula is chosen, unless good mixing procedures are used, the results will be less than optimal. For best mixing, use a horizontal-type paddle mixer that folds or blends the components, such as lime and fertilizer, evenly throughout the mix. With tilted or other types of mixers, the components tend to segregate or separate out, resulting in erratic performance of the mix.

Good procedures to follow when preparing a mix are:

1. **Use a respirator to prevent inhalation of dust when mixing peat, vermiculite and additives.**
2. For small quantities of mix preparation--1 cubic yard or less--place 4 to 5 inches of vermiculite in the bottom of a 5-gallon pail. Add all the additives (lime, fertilizer, micronutrient, etc.) to the vermiculite in the pail and mix thoroughly.
3. Fluff the recommended amount of peat. Start mixer and begin blending the peat.
4. While blending, add water according to the dampness of the peat. You will need approximately 1 gallon of water per bushel of peat in the mix.
5. While blending, slowly pour the additives, which you have already mixed thoroughly with a small amount of vermiculite, into the mixer and blend for 3 to 5 minutes.

PLANT GROWING MIX *(CONTINUED)*

6. Add the recommended amount of vermiculite after the other ingredients and blend for 1 minute or less, depending on the consistency of the vermiculite. It should be mixed thoroughly without breaking down. Soon after mixing, use the mix for growing your plants. It is not a good practice to stockpile the mix in large piles for long periods of time.
7. Read all labels of the ingredients used, and heed all warnings that may be marked on the labels or bags.

Appendix A

Methods to measure honeybee colony size and strength

Colony strength can be assessed in several ways.

1. **Inspect hives**. This method is the most time-consuming, but also the most accurate. Colonies used for springtime pollination should have at least:
    - a laying queen
    - one and one-half or two stories (hive bodies or boxes)
    - four to six frames of brood
    - enough adult bees to cover six to eight frames

These are minimum requirements; stronger colonies with larger populations make superior pollination units and may command a higher price. As these stronger colonies are opened, bees will "boil out" or cover the tops of the frames. When smoked, however, the bees move down onto the frames and may not cover the frame tops. In this case, the frames themselves should be covered with bees. Note that there will be some variability in the quality of the colonies you rent. As a general rule, a group of colonies where 10 percent fall below the minimum standard is acceptable if 10 percent are also above the minimum standard. Also, for a variety of reasons, some colonies may become queenless for a time; however, if these colonies meet all the other minimum requirements they still will be effective pollination units.

You can request hives to be inspected. In Pennsylvania, The Pennsylvania Department of Agriculture Apiary Inspection Service runs a hive evaluation program for colonies used for pollination. Requests may be made by either the grower or the beekeeper and should be arranged through the state apiarist at the PDA Bureau of Plant Industry, 2301 North Cameron Street, Harrisburg, PA 17110; telephone 717-772-5225. Requests should be made as early as possible to facilitate scheduling. If an evaluation is requested by the grower, the beekeeper will be informed that a request has been made. Colonies are inspected to determine the colony size (number of supers), the presence of a laying queen, the number of frames of brood and adult bees, and the presence of disease and parasites. At least 10 percent of the colonies in an apiary, or a minimum of five colonies, are selected at random for inspection. Inspected colonies are identified by sticker. If selected colonies are banded or stapled, these are not refastened by the inspector. A copy of the evaluation report is given to both the grower and the beekeeper.

2. **Assess traffic at hive entrance**. This method is less time- consuming but also less accurate. On a warm (70 to 80˚F), calm day between 11 AM and 3 PM, bee traffic at hive entrances should be heavy. During a one-minute observation period, strong colonies should have 50 to 100 or more bees arriving and leaving the hive. Bees also should be seen arriving with pollen pellets on their back legs. In weak colonies, less than 40 bees will be seen arriving and leaving per minute. Colonies that are being used for summer pollination should have heavier traffic at the hive entrance.

   Another crude way to assess colony strength is to observe entrances when temperatures are cool (between 55 and 60˚F). In strong colonies, flights will be observed when temperatures are between 55 and 60°F, but in weaker colonies bees rarely fly when temperatures are below 60°F. Honeybees very rarely fly when the temperature is below 55°F.
3. **Assess bee density on the crop**. This method allows you to assess the contribution of feral or other honeybee colonies in the area in addition to rented bees. If you are using rented colonies, however, this method tells you little about the quality of the bees. We suggest that if you use this technique and find that the number of bees on the crop is low, you then use options (1) or (2) to assess colony strength before renting additional bees.

Additional information

The publications listed below are available on the MAAREC Web site at **MAAREC.cas.psu.edu**.

- *Beekeeping Basics*
- *Beekeeping Topics: Sources of Bees for Pollination in Pennsylvania, Bees and Insecticides, Pollination Contracts, Basic Biology and Management of the Japanese Hornfaced Bee*

Appendix A *(continued)*

U.S. distributors of "Fruit Boost" that was recommended in the Pollination for attracting bees section are located in the Pacific Northwest. For more information, contact Phero Tech, Inc., 7572 Progress Way, RR 5, Delta, British Columbia, Canada V4G 1E9; phone: 604-940-9944; fax: 604-940-9433.

Other sources of information for bee guides in your area see the websites listed below:
www.state.nj.us/agriculture/divisions/pi
anr.ext.wvu.edu/bees
www.virginiafruit.ento.vt.edu/VAFS-bees.html
www.attra.org/attra-pub/beekeeping.html
dda.delaware.gov/plantind/forms/publications/FarmManagementforNativeBees-AGuideforDelaware.pdf
maarec.psu.edu/pdfs/WilliamsWinfree_NativeBees2009%201.pdf
ohioline.osu.edu/cv-f**act**/pdf/1003.pdf