



August 9, 1993
Project OJ42-001.02

California Integrated Waste Management Board
8800 Cal Center Drive
Sacramento, California 95826

Re: Market Research into the Use of Organic Soil Amendments by Agriculture in California

Dear Ms. Jones:

EMCON and its subcontractor, Vector Engineers, have performed preliminary market research into the use of organic soil amendments by growers of a variety of selected crops in California. Responses received to date are summarized in this report. A scope of work for this study was prepared jointly by the California Integrated Waste Management Board (CIWMB) and EMCON and was finalized at a meeting held on February 11, 1993. This work represents a modification of various tasks that are contained in contract dated August 17, 1992 between the CIWMB and EMCON for a variety of services related to the development of composting regulations at the State level.

BACKGROUND

Several pieces of legislation passed recently in California provide incentives for the production of compost from green waste, sewage sludge, and/or municipal solid waste. The quantity of compost that could be produced as a result of the legislation is unknown, but it may be larger than the amount of compost and other organics currently used as soil amendments in both urban and agricultural areas of the state. Market research has been conducted in various parts of the country into the demand for compost in metropolitan areas. However, comparatively little research has been performed into the demand for compost by agriculture. This investigation was designed to develop a preliminary estimate of the current usage of all organic soil amendments by agriculture, whether composted or not. Compost derived in whole or in part from green was assumed to be a substitute to or complement for other soil amendments in current use. The study was limited by focusing on a few selected crops and by surveying a small number of growers of each selected crop-type. Using a telephone survey technique, growers were queried about their use of organic amendments, if any, and under what conditions they may increase their use.



EMCON gathered background information for the study by contacting agricultural experts with the California Department of Food and Agriculture (CDFA) Statistics Services, University of California Cooperative Extension, various County Agricultural Commissioners, and the California Certified Organic Farmers (CCOF). Discussions with agricultural experts confirmed that no statistics are compiled regarding soil amendment usage. Most cooperative extension farm advisors working in the various California counties have an approximate feel for the use of organic soil amendments in their areas; however, they have not compiled any real data. Obtaining quantity estimates of organic soil amendment use required the gathering of original information from growers.

The various agricultural experts did provide some guidance regarding the crops with highest potential for compost usage. For the most part, they recommended selecting crops on the basis of acreage planted. Several experts indicated that current and potential organic amendment usage is more likely to be related to soil types than to crops grown.

Some information about organic soil amendment use was collected by CCOF as part of their certification process for "organic" plots. CCOF provided a large portion of their organic amendment use information to the study team. Some of the information was restricted by participating farmers as confidential and was not available for use by the study team. An "organic" certification has been sought for a very small fraction of California's agricultural land (less than one percent). Certified organic plots may not use conventional chemical fertilizers and, therefore, rely exclusively on organic soil amendments and cover crops for crop nutrition. CCOF information is not representative in general of soil amendment use by agriculture in California. However, the data from "organic" plots may provide a guide for maximum potential use under the current amendment price situation.

SURVEY PLANNING AND STRUCTURE

For this study, the CIWMB and EMCON chose to survey growers of 10 crops. Based on recommendations, the following crops were selected:

- Cotton
- Wheat
- Almonds
- Rice
- Tomatoes
- Grapes
- Oranges
- Lettuce

- Carrots
- Strawberries

For each of these crops, grower associations were contacted to explore potential cooperation with the study. Each grower association was asked to provide a list of 10 to 15 names and telephone numbers of their member growers that the study team could survey. A list of crops and grower associations contacted for this study is presented as Table 1.

The study team initiated contact with the 17 grower organizations identified in Table 1. Initial response to the proposed survey from associations for 6 crop-types was that member contacts are not made available as a matter of policy. Encouraging responses were received from the Almond Growers Council, Winegrape Growers, and Carrot Advisory Board, who felt the study would be beneficial and offered their enthusiastic participation to the request. The Wheat Growers Association, though apprehensive about the request for a list of their association members and phone numbers, did supply a list. The remaining organizations representing citrus, tomato, cotton, rice, lettuce and strawberry growers were unresponsive to the initial request for member contacts. In addition, the Table Grape Commission and Raisin Advisory Board refused to cooperate.

After considerable energies had been expended in an attempt to solicit a response from the non-cooperative organizations, it became apparent that it was necessary for the CIWMB to intervene on behalf of the study team. Board staff issued a letter explaining the intent and purpose of the survey to the organizations and requesting their participation.

Upon receipt of the request from the board staff, the citrus and rice grower organizations agreed to participate in the survey and submitted a list of growers to the study team.

The remaining agricultural organizations—representing tomatoes, cotton, lettuce, and strawberries—had been contacted several times. A response was received from the California Tomato Growers Association late into the project study. The Tomato Association responded that to protect their members from unwanted solicitation, the organization would issue a survey questionnaire directly. Survey information from the Tomato Growers was forwarded to the study team. The results are included in this report.

Response from numerous inquiries to the Strawberry Advisory Board, Lettuce Commission and Lettuce Research Board, was refusal to issue any list of member growers from their office. Instead, they directed the study team to the County Agricultural Commissioners for each County where the crops are grown. The Strawberry Growers

Association supplied a list of 11 California Agricultural Commissioner's names. Four county commissioners were selected from geographic areas with the largest acreage of strawberries grown in the State. Telephone calls were made to all the respective commissioner's offices to solicit a list of names and phone numbers of strawberry growers within their jurisdiction. The study team received cooperation from only one county agricultural commissioner. With regard to lettuce, names of growers were received from the commissioners representing the top two counties of production.

From the lists of growers names and telephone numbers received by the study team, a telephone survey was conducted. Each grower was asked if he/she had used an organic soil amendment in the last few years. If so, the grower was asked about average annual quantities. Growers were also asked about their concerns with the use of compost and under what circumstances they might use more.

SURVEY FINDINGS

Results of the telephone survey are summarized in Table 2. The results have a low degree of statistical certainty, due to the small sample size. However, with only one exception, the results are consistent with the anecdotal information reported by County farm advisors that we interviewed as an ancillary part of the study. The exception is the result for lettuce. A discussion of the survey findings is presented below separately by crop. A summary of information collected by the CCOF is also presented.

Oranges

Growers indicated their orchards are typically left untilled and that compost or manure, if used, is generally applied as a top dressing. Growers report better results in minimizing weed growth if fields are not tilled. Several growers also reported there is some evidence that top dressings, in particular organic mulches, increase the frost susceptibility of the trees. The most significant use of compost occurs when new areas of citrus orchard are planted.

The survey did identify the utilization of both uncomposted and composted manure as a top dressing. One citrus grower has used manure previously. The material was a combination of steer manure and plant materials and was used in planting a new orchard to supply young trees with additional nutrients. The manure was applied at 500 lbs per acre for a total of 80 tons over 320 acres. However, this represented a one-time purchase and would not be repeated for many years until another portion of the orchard required replanting. The grower indicated that he would be willing to use compost more often in place of raw manure if the cost was competitive.

Another citrus grower purchased composted manure and animal bedding every other year in planting new fields. The grower was not able to offer a quantity estimate for the compost use.

Although four of the seven orange growers reported the use of an organic soil amendment, none were able to report an average use rate. Information from county farm advisors and the grower's association indicate that compost and manure are used by a small fraction of growers.

Almonds

Almond growers also indicated their orchards are kept untilled. They do not till or mulch in order to keep weed growth down, which allows for easier harvesting. Because of increased weed growth, the use of a top dressing is also not a common practice with almond growers. Almond growers harvest their fields in one of two ways: (1) with a shaker that has a screen or net to capture the nuts as they drop; and (2) with the use of a shaker, nuts are dropped to the ground and swept into windrows for collection. Since many growers used the latter method, they felt that utilizing compost would require tilling the orchard rows or a loose top dressing in order to gain the most benefit. The benefits of compost use were judged not to be worth the extra difficulty in harvesting. None of the almond growers contacted reported any use of organic soil amendments. Representatives at the Almond Grower's Council indicated that the use of manure or compost by almond growers is rare.

Other frequent concerns reported by the growers regarding the use of compost were the transmission of fungus or disease in their orchard, as well potential as contamination from heavy metals. The growers also expressed concerns over hauling costs and the need to buy or rent additional equipment to spread the compost as a contributing factor toward not purchasing soil amendments.

Wheat

Only one of seven wheat growers contacted reported any use of organic soil amendments within the last few years. That grower reported using uncomposted chicken manure at a rate of 10 cubic yards (about 3.3 tons) per acre every other year. Despite this low usage rate, wheat growers seemed to be well informed about the use and benefits derived from compost. Several growers indicated they would be willing to use compost in their fields if the materials were economical.

Most commonly expressed concerns centered on cost, transportation, and the satisfying of required nutrient content for their specific crop type. Several concerns were expressed over the potential for contaminants in the compost. Several growers stated that they used cover crops to increase the organic content of their soils and that the cost of compost was unfavorable compared to the cost of applying conventional fertilizers.

Wine Grapes

Two of the surveyed grape growers are currently using compost in their grape vineyards for the first time during the 1992/93 growing year. This is an experimental application and they will assess the results in the following year. Of the two growers, one grower will likely continue to use compost in his fields and the other will continue use if the results are positive.

The survey results indicate there is interest in the use of compost materials, if affordable. One grower indicated that in order for soil amendments to be worth the expense of application, they must satisfy proper nutrient requirements for their particular crop type, and growers must be assured materials are free of contamination from undesirable elemental metals.

One grower noted that he also uses uncomposted grape pomace, (i.e., skins, seeds and any other remains) from the wine making process on his fields. The material is simply removed from the wine processing facility and spread onto the field where it is air dried.

Another wine grape grower formerly used uncomposted chicken manure in his fields. He stated that if compost were derived from manures, had the available nutrients for his crop type, and was affordable that he would have interest in its use.

Carrots

Carrots are routinely rotated with potatoes, alfalfa, onions, garlic, tomatoes, or lettuce in what is called intensive vegetable production. Most carrot production is reportedly dominated by a few large corporate growers. Some of the growers have a small portion of their production certified as "organic" by the CCOF.

The study team received a list of three large carrot producers from the Carrot Advisory Board. All three growers were contacted and reported no use of manure or compost on conventional plots. One grower reported using manure at 6 to 7 tons per acre per year on a plot certified as "organic". This information is not reported on Table 2 and is included in separate data from the CCOF.

Carrot producers were well informed about the advantages and disadvantages of the various organic soil amendments. The reason given for not using organic amendments in conventional carrot production was that the additional revenue from increased production was not worth the amendment expense. Producers are also well informed about the concentrations of heavy metals and pesticides in their produce and routinely perform laboratory tests on samples of their crops. Two of the producers reported that they insist on demonstration plots before making any change (no matter how small) to their growing practice.

Lettuce

The lettuce growers' association would not cooperate with the study team by providing a list of growers to contact. Instead, lists were obtained from the County Agricultural Commissioners for two of the largest producing counties, Monterey and Imperial. The list of 10 growers from Imperial County seemed to be out-of-date and we were unable to contact any of the growers on the list. Of the eight names provided by the Monterey County Commissioner, we were able to contact three growers. All three reported the use of uncomposted chicken or steer manure as a pre-plant amendment in their lettuce production. The average value reported by the three growers was 3.67 tons per acre per year. None of the growers was certified as "organic" by the CCOF. Discussions with county farm advisors from Monterey and Imperial Counties suggest that the survey result is much too high and is not representative of lettuce growing in general.

As with carrot growers, lettuce growers are well informed about the advantages and disadvantages of the various soil amendments. They also report routine testing of lettuce for pesticide residue and uptake of heavy metals.

Rice

Typically, rice farmers do not use compost. One grower reportedly tried using compost once and did not have good success. Increased weed growth from the compost was the reason for not continuing the practice.

Cotton

The four cotton growers associations in California refused to provide any member contacts as a matter of policy. However, they did state that there was little usage of compost or manure by their members. The study team developed one contact in the course of the investigation. It was a large corporate grower. In the growing of cotton they report no use of organic soil amendments, except for some test plots they are

experimenting with specifically to examine the benefit of increasing soil organic content at several levels. They report being approached by numerous current and potential producers of various types of compost. Results to date indicate the benefit of organic amendments in their cotton production is insignificant. They also have certified "organic" plots for a variety of non-cotton crops. On these "organic" plots, they routinely incorporate compost and manure.

Tomatoes

To protect their members from unwanted solicitations, the California Tomato Growers Association preferred to conduct a mail survey of member growers. A total of 100 surveys were mailed. Sixteen responses were received and forwarded to the study team. Three growers reported the use of manures in tomato production. Virtually all of the response from growers not using an organic amendment listed the price of amendments as the primary reason. Several growers recommended the development of test plots.

Strawberries

The results of the survey effort for strawberry growers was poor. Not only did the Strawberry Advisory Board refuse to provide a list of growers, three of four agricultural commissioners for the counties with highest strawberry production refused to provide lists of grower names. Of the 10 names of strawberry growers received from Monterey County, contact could be made with only 3 growers. One grower did indicate the use of steer manure as an amendment and was pleased with the results the manure produced in increasing production.

California-Certified Organic Farmers

At the time of our survey, CCOF had just over 500 growers in the state certified as "organic." This included about 52,000 acres, which represents about 0.8 percent of the total productive acreage in the state. Organic amendments and cover crops are the only source of nutrition supplements eligible under the program. A summary of the average reported organic amendment use by organic growers is presented by crop-type in Table 3. The listed results represent data from farmers who were able to report a use rate. Many of the farmers certified under the program were not able to make estimates of their organic amendment use rates. Table 3 only includes data from those growers providing an estimated use rate.

The results of the survey indicate average use rates for the various crops ranging from 2.8 tons per acre per year for apples to 12.2 tons per acre per year for vegetables. The average result for all crops listed is 5.4 tons per acre per year.

PRELIMINARY MARKET ESTIMATES

Using data collected in this study, an estimate of organic soil amendment use by both conventional and "organic" growers of the listed crops is presented in Table 4. The results indicate a calculated market for the listed crops at something over 1 million tons of organic soil amendment per year. The crops included in this study represent approximately 3.4 million harvested acres out of a state total of approximately 8.0 million acres. This represents approximately 40 percent of the total acreage harvested. By extrapolating from the usage rate identified in this study, a crude estimate can be made for the total amount of organic amendments used in California. Based on harvested acreage, the total agricultural market for organic soil amendments would be 2 to 3 times the approximately one million tons per year identified in this study. This yields a total market estimate of 2 to 4 million tons per year.

GROWER CONCERNS AND RECOMMENDATIONS

Several concerns about green waste compost were expressed by the majority of growers contacted. They include the following

- Weed seeds
- Plant disease transmission
- Low NPK

In addition, many, but not a majority, mentioned concerns about heavy metals and other undesirable elements and compounds. Most farmers had a good understanding of the advantages and disadvantages of applying compost. Some claimed to have experimented with compost or direct application of some organic waste at some point in their careers. All field and row crop farmers also report the use of nitrogen-fixing cover crops as a routine component of soil management. Many farmers and county farm advisors mentioned that they would probably consider the use of compost first on areas of problem soils they may have, if the price was right. A number of growers indicated that they purchased compost or manure only irregularly, when the price of manure was unusually low, for example.

Most farmers indicated that they believed the incorporation of a good quality compost to have marginal utility, considering the cost of buying, transporting, and spreading the material. Demonstration plots, similar to those conducted by seed suppliers, were recommended by many of the farmers. The purpose of the demonstration plots would be to provide clear information regarding the value of compost incorporation and evidence that the disadvantages feared (weed seeds, plant disease transmission, soil contamination) were tolerable. Many of the farmers said that demonstration plots would have to be run for many years to provide convincing evidence of overall compost utility. Moreover, the demonstration plots would have to be conducted with crops they grow. Considering that compost use is an operating expense, they are looking for guidance on optimum use rates that would lead to profitable incorporation of compost use into their farming practice.

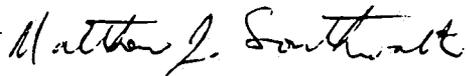
The biggest reported impediment to increasing the use of organic soil amendments was price. Assuring the production of an amendment that had acceptable elemental composition and no weed seeds or disease transmitting properties, most farmers indicated they would increase their use as the price dropped.

Several county farm advisors also noted that with the warm climate in California, microbiological activity is very fast at decomposing organics in soils. In southern California, experiments have indicated that substantial additions of organics in the form of crop residue are virtually gone (approach residual organic content) in about 3 months. A few of the farmers contacted claimed experience with growing crops in peat (100 percent organic) soils. If compost is properly stabilized and has acceptable properties, these farmers stated that compost application rates could be virtually unlimited.

Please call if you have any questions.

Sincerely,

EMCON Associates



Matthew J. Southworth, P.E.
Senior Engineer



Gail Karpinski
Senior Project Manager

Attachment: Tables 1 through 4

NOTE: Legislation (SB 63, Strickland, Chapter 21, Statutes of 2009) signed into law by Gov. Arnold Schwarzenegger eliminated the California Integrated Waste Management Board (CIWMB) and its six-member governing board effective Dec. 31, 2009.

CIWMB programs and oversight responsibilities were retained and reorganized effective Jan. 1, 2010, and merged with the beverage container recycling program previously managed by the California Department of Conservation.

The new entity is known as the Department of Resources Recycling and Recovery (CalRecycle).

This document was originally printed in hard-copy format and was declared out of print when all known copies had been distributed. A complete version of the report was located in 2011 and was scanned to a digital format, making it available for downloading.

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Table 1**Crops and Grower Associations Contacted**

Crop	1990 Acreage	Grower Associations
Cotton	1,155,000	Mid-Valley Cotton Growers AMCOT Calcot Western Cotton Growers Association
Wheat	614,000	California Wheat Commission
Almonds	411,000	Almond Growers Council
Rice	385,000	California Rice Industry Association Rice Research Board
Tomatoes	348,000	California Tomato Growers Association
Grapes	291,000	California Association of Winegrape Growers California Table Grape Commission California Raisin Advisory Board
Oranges	175,000	Sunkist Growers
Lettuce	162,000	California Iceberg Lettuce Commission Iceberg Lettuce Research Advisory Board
Carrots	56,000	California Fresh Carrot Advisory Board
Strawberries	20,000	California Strawberry Advisory Board

Table 2

Results of Grower Survey

Crop	Grower Contacts Received from Crop Association	Growers Contacted	Growers Using Compost or Manure	Use Rates Reported (tons/acre/year)	Average Use Rate ¹ (tons/acre/year)
Oranges	17	11	4	All unknown	Unknown
Almonds	10	7	0	0	0
Wheat	15	7	1	1.7	0.24
Wine grapes	16	9	2 ²	0.5, 8	0.94
Carrots	3	3	1	0.5	0.17
Lettuce	18 ³	3	3 ⁴	3, 4, 4	3.67 ⁴
Rice	20	5	0	0	0
Cotton	1 ⁵	1	0	0	0
Tomatoes	100 ⁶	16 ⁷	3	2.7, 3, 4	0.60
Strawberries	10	3	1	12	4

¹ Sum of use rates divided by the number of growers contacted.
² One additional wine grape grower reported the land application of uncomposted grape pomace
³ Grower contacts from County Agricultural Commissioners.
⁴ Estimates by County farm advisors indicate a much smaller use, on the order of 1 ton-acre-year.
⁵ Grower organizations refused to cooperate. One large corporate grower contacted coincidentally.
⁶ Mail surveys issued by the California Tomato Growers Association.
⁷ Mailed responses received by the Tomato Growers.

Table 3

Average Organic Soil Amendment Use by Growers Certified by CCOF

Crop	Average Use Rate (tons-acre-year)	Number of Data Points (n)
Almonds	6	3
Apples	2.8	19
Asparagus	3	1
Boysenberries	11	1
Cauliflower	4.5	1
Celery	4.5	2
Citrus	2.9	5
Corn	2.6	3
Dates	5	2
Figs	3	2
Misc. Fruit	4.3	26
Garlic	5	1
Grapes	5.1	25
Kiwis	5.3	9
Pears	2.3	3
Potatoes	6.4	2
Prunes	10.9	1
Raspberries	10	1
Rice	3.4	5
Strawberries	4.4	2
Tomatoes	4.3	5
Misc. Vegetables	12.2	156
Walnuts	5.5	3
Yams	<u>5.4</u>	4
	Average ¹ = 5.4	
¹ Unweighted average of all crop results.		

Table 4

**Preliminary Estimates of Organic Soil Amendment Use
by Agriculture in California**

Crop	Acreage	Average Use Rate from Survey (tons/acre/year)	Calculated Annual Consumption (tons)
Conventional Growers			
Oranges	175,000	Unknown	--
Almonds	411,000	0	0
Wheat	614,000	0.24	147,000
Wine grapes	291,000	0.94	274,000
Carrots	56,000	0.17	10,000
Lettuce	162,000	1 ¹	162,000
Rice	385,000	0	0
Cotton	1,155,000	0	0
Tomatoes	348,000	0.60	209,000
Strawberries	20,000	4	80,000
Organic Growers			
All Crops	52,000	5.4	281,000
Totals		3,369,000	1,163,000
¹ Excludes data from growers certified by the California Certified Organic Farmers (CCOF). ² 1.0 ton/acre/year selected from discussions with county farm advisors.			

GROWER ASSOCIATION CONTACTS

Crop	Association
Cotton	AMCOT P.O. Box 259 Bakersfield, CA 93302 (805)327-5961
	CALCOT, Ltd. P.O. Box 259 Bakersfield, CA 93302 Gene Lundquist (805)327-5961
	Mid-Valley Cotton Growers, Inc. P.O. box 901 Tulare, CA 93275 Stan Creelman, Manager (209)686-2823
	Western Cotton Growers Association 1900 N. Gateway Boulevard, Suite 156 Fresno, CA 93727 K.O. Smith, Executive Vice President (209)252-0688
Wheat	California Wheat Commission P.O. box 2267 Woodland, CA 95695 Robert Drynan, Executive Director (916)661-1292
Almonds	Almond Growers Council P.O. Box 577 McFarland, CA 93250 Jim Riles (805)792-2101

GROWER ASSOCIATION CONTACTS

Crop	Association
Rice	California Rice Industry Association 701 University Avenue, Suite 205 Sacramento, CA 95825-6708 Bob Herkert (916)929-3996
	Rich Research Board 335 Teagarden Street Yuba City, CA 95991 Melvin D. Androus, Manager (916)673-6247
Tomatoes	California Tomato Growers Association, Inc. P.O. Box 7398 Stockton, CA 95267-0398 Jack Snyder (209)478-1761
Grapes	California Association of Winegrape Growers 77 Cadillac Drive, Suite 100 Sacramento, CA 95825 Robert Hartzell, president (916)920-9187
	California Table Grape Commission P.O. Box 5498 Fresno, CA 93755 Bruce J. Obbink, President (209)224-4997
	California Raisin Advisory Board 3445 N. First Street, Suite 101 P.O. Box 5335, Fresno, CA 93755 Clyde E. Nef, Manager (209)224-7010

GROWER ASSOCIATION CONTACTS

Crop	Association
Oranges	Sunkist Growers, Inc. 14130 Riverside Drive Sherman Oaks, CA 91423-2392
	or
	P.O. Box 7888 Van Nuys, CA 91409-7888 Russell L. Hanlin, President (818)986-4800
Lettuce	California Iceberg Lettuce Commission P.O. Box 3354 Monterey, CA 93942 Wade Whitfield, President (408)375-8277
	Iceberg Lettuce Research Advisory Board 512 Pajaro Street Salinas, CA 93901 Edward A. Kurtz, Manager (408)443-3205
Carrots	California Fresh Carrot Advisory Board 531-D N. Alta Avenue Dinuba, CA 93618 Jim Melban, Manager (209)591-5675
Strawberries	California Strawberry Advisory Board P.O. Box 269 Watsonville, CA 95077 Dave Riggs, President (408)724-1301