



July 3<sup>rd</sup>, 2023

James Douglass  
Chemical Review Manager, DCPA  
Office of Pesticide Programs  
U.S. Environmental Protection Agency

**Re: EPA-HQ-OPP-2011-0374; AMVAC's Response for public comment period to DCPA on draft occupational and residential risk assessment plus additional regulatory documents named below**

Dear Mr. Douglass,

Amvac Chemical Corporation (AMVAC) appreciates the opportunity to comment on the EPA published suite of documents in the above docket and announced on June 1<sup>st</sup> 2023 via FRL 88 vol 105 p. 35869. Specifically, this set of comments is AMVAC response to the following 3 documents:

**BEAD Assessment:** *Assessment of Dimethyl Tetrachloroterephthalate (DCPA) (PC: 078701) Use, Usage, and Benefits* (May 26, 2023) EPA-HQ-OPP-2011-0374-0088

**ORE Assessment:** *DCPA. Occupational and Residential Exposure Assessment for the Registration Review of DCPA.* (OREA) (May 18, 2023) EPA-HQ-OPP-2011-0374-0081

**Companion Document:** *Companion Document to the Occupational and Residential Exposure Assessment for the Registration Review of DCPA* (May 26, 2023), EPA-HQ-OPP-2011-0374-0082

AMVAC does not request treatment of any of this information as confidential business information (CBI). If you have any questions I can be contacted per below.

Regards,

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# **AMVAC response to the public Docket EPA-HQ-OPP-2011-0374 dated July 3<sup>rd</sup>, 2023 in response to the following documents:**

**BEAD Assessment:** *Assessment of Dimethyl Tetrachloroterephthalate (DCPA) (PC: 078701) Use, Usage, and Benefits* (May 26, 2023) EPA-HQ-OPP-2011-0374-0088

**ORE Assessment:** *DCPA. Occupational and Residential Exposure Assessment for the Registration Review of DCPA.* (OREA) (May 18, 2023) EPA-HQ-OPP-2011-0374-0081

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This response document is divided into several sections:

- Introduction
- Key Points in AMVAC's response
- Benefits Discussion and Review of BEAD documentation
  - Usage of DCPA/Dacthal
  - Cultural practices in Key Crops
  - Assessment of Economics of Alternatives Proposed by EPA
  - Assessment of Agronomic Aspects of Alternatives Proposed by EPA
- CTA (Comparative Thyroid Assay) Toxicology Response and Proposal
- Mitigations Proposed by AMVAC
  - Impact Assessment of Proposed Mitigations on Brassica and Onion Cultivation
- References
- Appendix 1-ERA benefits assessment presentation conducted in 2018 for key crops in the state of California (15 pages)

[AMVACs comments throughout this response are directed towards, and will mainly reference, facts and information from the 2 EPA assessment documents - ORE and BEAD]

## **Introduction**

DCPA, is a long-established herbicide for brassica and onion growers who need crop safe weed control at the early sensitive stages of crop development from seed or transplant during the first weeks of growth in brassica and onion cultivation. AMVAC is ready to immediately implement the mitigations proposed below and concur with the agency that there are high stakes for the loss of DCPA in brassica and onion production systems as shown by the economic data presented herein.

EPA's statement that farmers could abandon some of its production of onions and brassica in the United States is concerning. Farmers switching to other crops that are more economical to produce in the absence of DCPA could make certain healthy vegetables in the diet less abundant. This would have an impact on the public who rely on having a plentiful variety of fresh vegetables in their diet. Relocating food production to other countries sets a dangerous precedence for our country's ability to feed our own people. The current herbicide alternatives to DCPA are shown to be lacking the horticultural benefits provided by DCPA - crop safety, excellent and comprehensive control of relevant weeds, preferential crop rotational characteristics and the longevity to suppress yield robbing weeds as crops establish themselves to a point where they can compete with weeds developing around them. Other alternative cultivation practices have distinct negative aspects to their use - crop damage potential, substantial costs to change to transplant starts and inability to source labor at the critical time it is needed. Much of this has been covered within EPA's BEAD document with a focus in California and AMVAC reiterates that the same challenges for finding alternatives for the unique functionality that DCPA provides for growers exist in the rest of the country too. There are many older chemistries that can be replaced by good alternatives, but the reliance of farmers on DCPA for the past 70 years is evidence that a sound replacement has not yet been identified.

EPA's methodology as laid out on page 3 and 4 of the BEAD document is well thought out and appropriate to the key use patterns including timing of DCPA in brassica and onions. In fact DCPA ticks a box for benefits that would be lost if DCPA is cancelled in every category noted by EPA on page 4-increased monetary costs without DCPA (see tables 2,3,4 and 5), simplicity of use (later application of post emergent herbicides when DCPA is used), flexibility (see examples with Treflan and Prefar 4-E in agronomic assessment section), utility in resistance management (no known weed resistance to DCPA), crop damage (alternate herbicides and hand weeding are known to damage these crops at sensitive seedling and transplant stages), yield reduction (from crop damage or weed competition ) and finally managerial efforts (difficulty in finding and hiring labor for hand weeding at critical times).

## **Key Points in AMVAC's Response**

- Retaining DCPA as a herbicide tool in specialty vegetable production is significant as it brings unique benefits to brassica and onion growers across the US. Annual economic benefits alone are calculated to be at least \$50M.
- EPA's BEAD document is comprehensive in its detailed analysis of the cultural practices and decision making by users of DCPA in California. AMVAC is providing further information in this document on agronomic practices as requested by EPA and where AMVAC believes clarifications and new considerations are important to the benefits analysis.

- AMVAC concurs with EPA's conclusion that DCPA provides high benefits in direct seeded specialty brassica including radish and furthermore we will show it delivers high benefit for all direct seeded brassica when broccoli is additionally taken into account.
- AMVAC is providing additional information to help EPA understand the high benefits of DCPA to brassica growers who initiate their production of brassica from transplants.
- AMVAC concurs with EPA's conclusion that DCPA provides high benefits in certain direct seeded onions called out by the agency and moreover we will show it delivers high benefit for all direct seeded onions.
- AMVAC will outline why there are no adequate alternative herbicides to DCPA in direct seeded and transplanted brassica and all direct seeded onion production systems.
- BEAD document significantly underestimates, by at least 6-fold, the usage for DCPA due, in much part, to the lack of inclusion of usage information for onions in PNW and specialty vegetables in AZ and TX compounded by a ca. 50% underestimation of percent crop treated in CA.
- AMVAC has requested a technical meeting in July with EPA Human Health Scientists. AMVAC is confident that there is scientific merit to evaluate a further refinement of the CTA NOAEL by testing additional dose levels, to more accurately define effects with incremental dose levels between the NOAEL at 0.1 and the LOAEL at 1 mg/kg/day.
- It is AMVAC's intention with the cumulative suite of mitigations proposed in this document to remove or substantially reduce the breadth and severity of potential risks to occupational workers and bystanders.
- AMVAC, with our detailed understanding of use of DCPA are proposing removal of turf and ornamental uses sites, removal of certain agricultural crops, reductions ranging from 20-36% in the maximum single use rates in remaining crops, removal of wettable power product offerings, removal of handheld spray equipment, removal of aerial applications, proposals for maximum PPE in addition to engineer controls, daily handler amounts and new re-entry interval restrictions.
- Banded application, as required in California for most applications, and practiced occasionally in other regions, reduces the on-field exposure to ca. 30% of broadcast rates evaluated within the ORE.
- Applications of DCPA by ground boom or chemigation are to seed beds (bare ground) or over the top of small crop transplants which minimizes post application on-field exposure when compared to calculated exposure from mature crop foliage. Product incorporation reduces this exposure even further.

- Setting of re-entry intervals based on entry timings needed for specific post-application activities by growers is discussed.
- AMVAC presents their evaluation of the expected impact of such mitigations to users of Dacthal Flowable (EPA registration number 5481-487) on the key crops, brassica and onions, whose registration will be defended for DCPA's continued use in US agriculture.

## **Benefits Discussion and Review of BEAD Documentation**

### **Usage of DCPA/Dacthal**

AMVAC concurs that Kynetec data is not reliable for specialty crops (EPA comment in footnote 2 page 7 of BEAD document), and this will be demonstrated below. This is because it is based on user survey data and responses from the specialty vegetable grower population is limited. As the only seller and distributor of DCPA end use products the proprietary sales numbers below can be relied on to encompass market volume of DCPA. AMVAC's total annual lbs of DCPA sold based on AMVAC sales data on all major and minor crops between 2019-2021 is on average 536,000 lbs. Sales in crops listed below account for >90% of sales of DCPA. Overall ca 50% of the product sold is within the state of California to support the specialty vegetable growers located in that state. This includes bordering areas of the neighboring states of OR and AZ. The next geographical concentration of growers who use DCPA are in WA state cultivating onions and AZ and TX for use for specialty vegetables. Finally, a suite of Eastern states including FL using DCPA for specialty vegetable cultivation (ca 15%) complete the geographical range of usage for DCPA. No commercial disparities occurred between 2018 - 2021 years that prevent a direct comparison of data EPA uses from 2018 and 2020 and AMVAC uses from 2019-2021.

AMVAC has cross referenced these values, as EPA had done, with crop acres from NASS and DPR's PUR databases. For CA, 'pounds DCPA applied' per crop and the 'acre rate' are taken from DPR CA Pesticide Use reporting (PUR) after validation with AMVAC proprietary information. For all other states 'pounds DCPA applied' per crop is calculated from AMVAC proprietary information and the 'acre rate' is gathered from personal communications between AMVAC and growers. Upon comparison of PCT (percentage crop treated) from EPA Table 2 (page 6 BEAD) versus the PCT numbers below it's clear there is a significant underestimation of percentage crop treated in numbers reported in the BEAD document. For California for Brassica and onions where numbers were estimated there is a 2-3-fold underreporting of PCT in brassica and onions and due to missing information in the EPA table the percentage of crop treated with DCPA in AZ, TX and WA in onions and brassica is not represented at all.

**Table 1  
Usage of DCPA**

<b>Crop</b>	<b>Geographic Region</b>	<b>Percent of plant national acres</b>	<b>USDA NASS crop acres (2022)</b>	<b>Pounds DCPA Applied</b>	<b>Average PCT</b>	<b>Average rate pints/A</b>	<b>Average application rate (lbs ai/A)</b>
<b>Broccoli</b>	<b>U.S. Total</b>	<b>100%</b>	<b>96,600</b>	<b>150,738</b>	<b>40.70%</b>	<b>5.11</b>	<b>3.83</b>
	California	88%	85,000	101,618	34.80%	4.58	3.44
	Arizona	12%	11,600	49,122	62.70%	9	6.75
<b>Cabbage</b>	<b>U.S. Total</b>	<b>100%</b>	<b>57,200</b>	<b>31,560</b>	<b>12.30%</b>	<b>6</b>	<b>4.5</b>
	California	25%	14,500	10,517	16.00%	6.04	4.53
	Florida	16%	8,900	2,826	7.10%	6	4.5
	Texas	11%	6,100	13,518	49.20%	6	4.5
	Michigan (DCPA not registered)	8%	4,500	-	0.00%	6	4.5
	Georgia	8%	4,300	534	2.80%	6	4.5
	Arizona	7%	3,900	3,822	21.80%	6	4.5
<b>Cauliflower</b>	<b>U.S. Total</b>	<b>100%</b>	<b>40,000</b>	<b>30,768</b>	<b>14.70%</b>	<b>7</b>	<b>5.25</b>
	California	87%	34,600	20,946	18.30%	4.4	3.3
	Arizona	14%	5,400	9,822	34.60%	7	5.25
<b>Onion</b>	<b>U.S. Total</b>	<b>100%</b>	<b>129,800</b>	<b>159,138</b>	<b>25.40%</b>	<b>6.43</b>	<b>4.82</b>
	California	31%	40,700	40,110	13.00%	10.13	7.6
	Oregon	18%	23,000	10,410	8.60%	7	5.25
	Washington	15%	19,000	64,219	64.40%	7	5.25
	Georgia	9%	11,500	4,596	8.90%	6	4.5
	Idaho	8%	10,100	4,182	7.90%	7	5.25
	Texas	7%	9,500	30,941	72.40%	6	4.5
	New Mexico	4%	5,700	1,248	4.90%	6	4.5
	Colorado	3%	3,500	3,432	21.80%	6	4.5
<b>Brussels Sprouts</b>	<b>U.S. Total</b>	<b>100%</b>	<b>9,445</b>	<b>17,112</b>	<b>43.50%</b>	<b>5.55</b>	<b>4.16</b>
	California	100%	9,445	17,112	43.55%	5.55	4.16
<b>Brassica (other)</b>	<b>U.S. Total</b>	<b>*</b>	<b>*</b>	<b>111,927</b>	<b>*</b>	<b>5</b>	<b>3.75</b>
<b>All other crops</b>	<b>U.S. Total</b>	<b>*</b>	<b>*</b>	<b>34,752</b>	<b>*</b>	<b>*</b>	<b>*</b>
<b>DCPA</b>	<b>U.S. Total</b>			<b>535,995</b>			

\*Insufficient data collected by DPR or USDA to complete table; states with lower than 500 lbs applied in 2022 have been removed. PCT is Percentage Crop Treated; NA-Not Applicable.

AMVAC confirms the current EPA assumptions that while labels do allow use on turf sites there is no turf or residential site usage to our knowledge. Usage in nursery stock or ornamentals is very minimal from our sales data and is confirmed with CA PUR data indicating, on average, less than 600 treated acres per year. There is no active participation in these markets by AMVAC for DCPA products.

Throughout this document when discussing the benefits case for DCPA, AMVAC, as done by EPA, will focus on brassica and onion cultivation with DCPA. We concur with the conclusion drawn by EPA from usage data that there is low usage and low benefits for use of DCPA for melons, strawberry, listed root crops, fruiting crops (tomato, eggplant etc) and propose to remove these terrestrial food/feed crops as use sites for DCPA.

## **Cultural Practices in Key Crops**

### **A. Cultural practices in Brassica (and Radish) when using DCPA**

#### **1. Direct Seeded:**

AMVAC confirms that broccoli is the only major brassica propagated by direct seeding currently. Ca. 40% of the DCPA applied on broccoli in CA is to the seeded crop. All other major brassica, cabbage, cauliflower and Brussels sprouts are transplanted. Specialty brassica, leafy brassica and radishes are also almost exclusively direct seeded as assumed in the BEAD document. Some brassicas can only be direct seeded, such as NAPA cabbage, due to their rooting systems being unsuitable for transplanting. Fields are cleared of weeds before seeding occurs. Once seed is planted, DCPA is applied with subsequent watering in used to incorporate it. Typically, 2 crop cycles of direct seeded brassica are planted per year in California.

#### **a. Banded**

Banded application is a label requirement in California for all brassica, direct seeded or transplant. A grower typically will plant and apply on average 60-80 acres a day in coastal regions of California but may achieve up to 120 planted acres per day. Banded applications are less common outside of California where they are not required by labelling but due to the cost of DCPA growers will utilize banded applications to protect the seeded bed lines rather than the full width of bed tops. AMVAC agrees with the field planting descriptions for brassica on page 8 of BEAD and remind EPA that a conversion chart for banded applications rates is on the Dacthal Flowable label to show banded equivalent rates/treated acre for various application band widths.

#### **b. Broadcast (outside of CA only)**

CA Grower interest remains to add broadcast use in certain CA counties at certain times of the year similar to the current label language for DCPA on onions in CA

and represented by pending label language in an amendment pending review at EPA. This flexibility is already available to brassica growers in other parts of the US. Growers in GA utilize both broadcast and banded applications and typically 30 to 40 acres per day is applied. TX growers' plant, on average, 20 acres of brassica a day.

c. **Chemigation (outside of CA only)**

Chemigation is currently only utilized in brassica crops in AZ where solid set and portable irrigation equipment is utilized. See below for typical acres of cultivation and application a day in AZ. Post seeding and application of DCPA soil incorporation by watering in is used to move DCPA into the soil.

2. **Transplant:**

All major brassica, other than broccoli in all regions of the US is planted via transplant. Transplanted broccoli is 60% of DCPA applications to broccoli in California. Fields are cultivated to remove all weeds and transplants are set and watered in. Then DCPA is applied per method below followed by watering in as best practice and preplant mechanical soil incorporation is not used. On average slightly more than 2 crop cycles of transplanted brassica are possible to plant per year in California.

a. **Banded**

Banded application is a label requirement in California for all brassica, direct seeded or transplant.

b. **Broadcast (outside of CA only)**

This is the predominant application method outside of California.

c. **Chemigation (outside of CA only)**

Currently only utilized in brassica crops in AZ. Chemigation acres are limited due to their close alignment with planted acres. Thus broadcast and chemigated acres are 30 acres/day on average in AZ. If a grower expects to plant 40 acres or above multiple applicators are typically called on.

B. **Cultural Practices in Onions when using DCPA**

To address EPA's question in footnote 6 of page 18 of the BEAD document the following is provided from AMVACs field representatives. Bulb onions in PNW are typically planted in April, and harvested September/October and in California typically planting occurs in mid-October and harvesting is in mid-May.

1. **Direct seeded:**

In the PNW application of DCPA is all broadcast applied with ground boom equipment and chemigation is not utilized. In CA is a mix of banded and broadcast applications due to regional/seasonal requirement to apply as banded applications. In all other regions (AZ, TX) broadcast applications predominate with some chemigation utilized due to the density of seed lines on the beds and center pivot irrigation equipment is utilized. When and where allowed in California broadcast application is preferred for the reason above. Fields are cultivated to remove



all weeds, seeds planted and DCPA applied. Incorporation of DCPA by watering in is practiced within 2-3 days of application. Mechanical incorporation is not used in onion cultivation to ensure that soil is not displaced that might promote weed seed germination.

Typical planted acres in CA are 160 acres a day while 100-300 acres a day are planted in PNW. In AZ and TX, the average planted daily acres is 20. For CA most of the use of DCPA in bulb onions is to produce fresh market onions and dehydrated onions whereas in PNW it is in dry bulb onion production. Seed line density in onion cultivation varies greatly by variety and type. For instance, 2-3 seed lines are planted for fresh market onions and the dehydrated onions are grown in 4-5 seed lines. For dry bulb onions in PNW the plant density is 125,000 plants per acre on average.

## **2. Transplant:**

AMVAC concurs that onions initiated by transplant is significantly less than direct seeded onions but we are aware that DCPA is used on some acres of transplanted onions in New Mexico. The practices described above are relevant for onion transplants as well.

## **Assessment of Economics of Alternatives Proposed by EPA**

EPA states that growers' willingness to pay a premium for DCPA *suggests* (emphasis added) that DCPA cannot be easily replaced with other available herbicides. More than just 'suggesting' that DCPA is of high value to these growers this fact *is* evidence that DCPA is not easily replaced.

There are both direct and indirect economic benefits for the use of DCPA. Greater yield losses, unpredictable labor reliability, and increased cost for any alternative options is difficult to summarize. The total economic benefit for the use of Dacthal Flowable is estimated to be at least \$50 million dollars for vegetable growers in the United States. It is also reasonable to assume that figure is multiplied several-fold downstream for what it will eventually mean to the American consumer in reliable supply and/or increased costs of impacted vegetables.

There is a lack of clarity on how EPA has categorized the benefit of DCPA in direct seeded major brassica—they make comments like 'important' (page 21 companion document) but then calls DCPA out as being of medium benefit only: page 2 of BEAD "*DCPA has medium benefits for growers of direct-seeded major Brassicas who can afford hand-weeding labor. DCPA's benefits may be higher for growers who are not able to hire additional hand labor for weeding in the absence of DCPA*". AMVAC don't agree with the inferences and differences drawn here between specialty brassica production and direct seeded broccoli and believe that just because a grower can afford hand labor doesn't mean they should accept lower profits. Added labor due to inferior weed control of alternates to DCPA reduces their net profit regardless of the crop they sow.

## Brassica – California

AMVAC presents below an updated version of EPA’s Table 6 (page 15 of BEAD document) with revalidated information.

**Table 2**  
**Impact of the Absence of DCPA in California Broccoli Production**

	Baseline	Scenario 1	Scenario 2	Scenario 3
<b>Assumptions</b>	<b>Direct-seeded, with DCPA</b>	<b>Transplanted, with Goal Tender</b>	<b>Direct-seeded, with Prefar 4-E and hand-weeding</b>	<b>Direct-seeded, with Prefar 4-E and yield loss 20%</b>
<b>Revenue*</b>	\$9,000	\$9,000	\$9,000	\$7,200
<b>Herbicide Cost</b>	\$141	\$16	\$136	\$136
<b>Hand-weeding Cost</b>	\$109	\$109	\$500	\$109
<b>Cultivation Cost</b>	\$38	\$38	\$38	\$38
<b>Other Costs</b>	\$8,526	\$8,526	\$8,526	\$8,526
<b>Transplant Costs</b>		\$900		
<b>Total Variable Costs</b>	\$8,814	\$9,589	\$9,200	\$8,809
<b>Net Operating Revenue</b>	\$186	(\$589)	(\$200)	(\$1,609)
<b>Change in Net Operating Revenue to DCPA</b>		\$(1,276)	\$(886)	\$(2,295)

\*Yield-500 26-lb. cartons @\$18 per carton

AMVAC had utilized estimated yield values for broccoli production from the Imperial County extension office in California. Even utilizing lower yields than those quoted by EPA from NASS in 2023 revenue is higher and growers utilizing DCPA may have a positive net revenue compared to other growers not using DCPA. Broadly speaking Table 6 published by EPA has been validated by AMVAC’s investigation of their analysis and showing that the increasing cost of hand weeding labor continues to increase the positive differential in economic benefit of DCPA over bensulide (Prefar 4-E) due to the latter’s inferior weed control and the requirement for supplemental hand weeding

EPA has commented that broccoli producers typically have slim profit margins per acre (page 13 BEAD) and AMVAC’s evaluation shows that only utilization of DCPA, in direct seeded cultivation, allows a broccoli grower to achieve a profit. This can be achieved even without considering an increased yield that can be further attributed to use of DCPA due to its superior weed protection and crop safety when compared to the alternate herbicides in the table.

While AMVAC have not focused on the economic aspects of switching to transplants as an option for growers who currently use direct seeded cultivation with DCPA personal communication with Dr. Steve Fennimore (UC Davis) indicates the reduction in weeding cost is more likely to be 33%,

but increases in other costs usually offsets these savings. Thus, AMVAC have used the same costs for hand weeding/other costs in the table when comparing baseline and scenario 1 rather than the approach by BEAD in their table 6.

Growers have informed AMVAC’s commercial team that the cost of Transplant equipment is estimated to be \$1 million approximately in 2023.

EPA comments that the economic impact assessment for direct seeded broccoli can be read across to direct seeded cabbage and cauliflower. However, all planting of cabbage and cauliflower in CA (and other states) are transplants and no direct seeding for these crops occurs so no further investigation on direct seeded major brassica was conducted by AMVAC.

Instead AMVAC have proceeded to generate Tables 3 and 4 below to conduct a side-by-side economic assessment of DCPA and alternate herbicides for transplanted brassica (not a comparison done by BEAD in tabulate form). While the cost of oxyfluorfen (Goal Tender/Goal 2XL) and napropamide (Devrinol) are much lower than DCPA and a side-by-side comparison of economic factors could lead to a conclusion of low benefits for DCPA in transplanted brassica it will be show below that use of oxyfluorfen and napropamide brings biological drawbacks to transplanted brassica which must be weighed against the established crop safety and efficacy of the more expensive DCPA herbicide.

**Table 3**  
**Impact of the Absence of DCPA in Cabbage Production**

	Baseline	Scenario 1	Scenario 2
<b>Assumptions</b>	<b>Transplanted with DCPA</b>	<b>Transplanted, with Goal Tender</b>	<b>Transplanted, with Prefar 4-E</b>
<b>Revenue*</b>	\$14,400	\$14,400	\$14,400
<b>Herbicide Cost</b>	\$169	\$32	\$136
<b>Hand-weeding Cost</b>	\$260	\$260	\$800
<b>Cultivation Cost</b>	\$38	\$38	\$38
<b>Other Costs</b>	\$11,701	\$11,701	\$11,701
<b>Transplant Costs</b>	\$900	\$900	\$900
<b>Total Variable Costs</b>	\$13,069	\$12,931	\$13,574
<b>Net Operating Revenue</b>	\$1,331	\$1,469	\$826
<b>Change in Net Operating Revenue to DCPA</b>		\$137	\$(506)

\* Yield-800 45 lb cartons per acre at \$18.00 per carton

**Table 4**  
**Impact of the absence of DCPA in Cauliflower Production**

	Baseline	Scenario 1	Scenario 2	Scenario 3
<b>Assumptions</b>	<b>Transplanted, with DCPA</b>	<b>Transplanted, with Goal Tender</b>	<b>Transplanted, with Devrinol</b>	<b>Transplanted, with Prefar 4-E</b>
<b>Revenue*</b>	\$13,680	\$13,680	\$13,680	\$13,680
<b>Herbicide Cost</b>	\$124	\$16	\$30	\$136
<b>Hand-weeding Cost</b>	\$109	\$109	\$109	\$800
<b>Cultivation Cost</b>	\$76	\$76	\$76	\$76
<b>Other Costs</b>	\$12,096	\$12,096	\$12,096	\$12,096
<b>Transplant Costs</b>	\$900	\$900	\$900	\$900
<b>Total Variable Costs</b>	\$13,305	\$13,197	\$13,211	\$14,009
<b>Net Operating Revenue</b>	\$375	\$483	\$469	\$(329)
<b>Change in Net Operating Revenue to DCPA</b>		\$108	\$94	\$(704)

\*Yield-760 23-lb cartons @ \$18.00 per carton

These purely economic driven tables do not account for expected yield drag from use of oxyfluorfen or napropamide when compared to DCPA. Yield loss is expected in cabbage production with oxyfluorfen when utilized in less than ideal growing conditions and the labels warns for pretransplant applications that severe crop injury can occur if transplants are under stress due to factors such as temperature, disease or insect pressure, Replacing DCPA exclusively with oxyfluorfen does not adequately represent the needs of risk averse growers who need alternative weed control options for times when forecast conditions would indicate that an application of oxyfluorfen would lead to severe crop damage and reduced yield. Of note for consideration is that yield loss is linear and is straight to the bottom line for a grower and a 20% yield loss is twice the decrease in net return of a 10% yield loss.

No auxiliary cost for additional herbicide treatments has been accounted for in these tables either which is expected to be a required due to the reduced weed control spectrum of each herbicide compared to DCPA. As acknowledged in the BEAD document (page 12) bensulide is often required as a complimentary herbicide to oxyfluorfen to address common chickweed weed issues. The incomplete weed spectrum of bensulide is acknowledged by EPA and confirmed by AMVAC throughout this document-this biological impact is accounted for in these tables by the significant increase in hand weeding costs when Prefar 4-E is utilized.

Brussels sprouts are a relatively small sized crop in respect to total area grown, but a very high value crop per acre. The production of Brussels sprouts is mostly in California and due to near perfect climate for growing it is concentrated in the three adjacent counties of San Mateo, Santa Cruz and

Monterey as these counties have ideal climatic conditions for Brussels sprouts. Due to the climate not many crop alternatives are available for growers in this area. As market demand increases the acres planted are set to increase to meet that demand. Hand weeding is generally more costly in Brussels sprouts than in other brassica. The weed control program typically followed by Brussels sprouts growers in coastal CA, due to the length of time Brussels sprouts are in the field, is to use DCPA at planting to suppress weeds and then follow with napropamide later at layby. From that point on crop canopy is sufficient for weed suppression.

### **Onions - Outside California**

A significant gap in the BEAD document is related to usage in onions and a review of the factors that drive use of DCPA in onions outside of CA. AMVAC addresses the missing information for usage with Table 1 above and within Table 5 below for the economic elements in play with side-by-side comparison. The Table below relates to direct seeded onions with DCPA compared to currently registered and utilized herbicides in the PNW.

**Table 5**  
**Impact of the Absence of DCPA in PNW Onion Production**

	<u>Baseline</u>	<u>Scenario 1</u>	<u>Scenario 2</u>	<u>Scenario 3</u>	<u>Scenario 4</u>
<b>Assumptions</b>	<b>with DCPA</b>	<b>no DCPA, with Pendimethalin (Prowl)</b>	<b>no DCPA, with Dimethenamid (Outlook)</b>	<b>no DCPA, with Oxyfluorfen (Goal 2XL)</b>	<b>no DCPA, with Bromoxynil (Buctril)</b>
<b>Revenue*</b>	35x150=\$5250	33x150=\$4950	33x150=\$4950	33x150=\$4950	33x150=\$4950
<b>Herbicide Cost</b>	\$198	\$12	\$20	\$16	\$11
<b>Hand-weeding cost</b>	\$200	\$600	\$600	\$600	\$600
<b>Cultivation cost</b>	\$100	\$100	\$100	\$100	\$100
<b>Other Costs</b>	\$3,500	\$3,500	\$3,500	\$3,500	\$3,500
<b>Transplant Costs</b>	\$-	\$-	\$-	\$-	\$-
<b>Total Variable Cost</b>	\$3,998	\$4,212	\$4,220	\$4,216	\$4,211
<b>Net Operating Revenue</b>	\$1,252	\$738	\$730	\$734	\$739
<b>Change in Net Operating Revenue to DCPA</b>		\$(513)	\$(522)	\$(517)	\$(513)

\*Unit of sale: ton weight of onions

The table includes the yield improvement that growers experience with DCPA (35 tons versus 33 tons) over other herbicides shown due to lack of weed pressure competing with the crop from the superior

herbicidal activity of DCPA. Even using only a modest yield gain the positive economic outcome per acre is dramatic when DCPA is utilized. The higher yield with DCPA additionally illustrates the crop phytotoxicity inherent with the use of alternatives to DCPA, pendimethalin (Prowl), dimethenamid (Outlook), oxyfluorfen (Goal) and bromoxynil (Buctril). AMVAC has not included bensulide or ethofumesate in the PNW economic impact assessment below as no one uses it in onions in PNW due to crop safety concerns and ethofumesate is not used often due to plant back restrictions.

While AMVAC has not placed bensulide in the side-by-side comparison above supplemental hand weeding is likely to be required if it is used on brassica. AMVAC also believes there is an error on page 21 in the economic statement for onions in California as it relates to the use of bensulide as an possible alternate to DCPA. The BEAD document on page 19 table 7 has bensulide at \$44 per acre for onions - AMVAC believe the correct value is \$90 as on page 12 (table 5) as the use rate of Prefar 4-E is equivalent in onions and brassica. Thus, even without delving any deeper into the validity of conclusions on page 21, cost savings of bensulide over DCPA have been overstated and should be \$108 (DCPA:\$198 – Bensulide:\$90) not \$126.

Based on the clear economic advantage DCPA brings to growers as evidenced in Table 6 above and further discussions of biological benefits below AMVAC cannot agree with the overall summary statement in the BEAD document on page 2 that DCPA has low benefits in dry bulb onion and shallots. The difficulties experienced by onion growers to be successful establish their crop transcends variety and the cultural propagation method and even when available registered herbicides are not adequate alternatives to DCPA.

Finally, AMVAC agrees with all concerns expressed on increasing labor costs and sporadic nature of availability of labor outlined in the BEAD document. There continues to be commentary and articles in industry journals on the difficulty of finding labor and bureaucratic complexity to bring in foreign workers (reference 1).

In one further personal communication with Dr. Steve Fennimore Professor of Cooperative Extension, Extension Specialist for Vegetable Weed Management, University of California Davis he notes that the “*The cost of labor is spurring the dramatic rise in sales of \$1.4 million laser weeders.*”

## Assessment of Agronomic Aspects of Alternatives Proposed by EPA

Page 17 of BEAD document: *Herbicide recommendations for states other than California generally do not recommend DCPA. Recommendations from the Pacific Northwest (Idaho, Oregon, Washington) say that DCPA ..... Therefore, DCPA likely has low benefits in onion production in the Northeast and Midwest as those onions are typically produced on muck and mineral soils with high organic matter (Bradford et al., 2023; Hay et al., 2021; Zandstra, 2019).*

Page 18 of BEAD document: *Because extension recommendations for onion weed control outside of California caution against or do not recommend using DCPA and there is little to no reported DCPA usage on onions outside of California, BEAD assesses DCPA's benefits specifically in California onion production, including in dry bulb onions, green onions, shallots, and leeks.*

There has been a significant incorrect conclusion drawn on recommendations that are available for DCPA in states other than CA. Firstly, the availability of the UC IPM documents on brassica and onion crops signify the importance of these crops in that state with research and publications of a depth to match the support needed by growers. The second suite of publications by UC Davis are the exception rather than the rule on availability of quality of information available and the economic and biological assessment of the use of DCPA in CA cropping systems. However, EPA seem to have come to the conclusion that because such extensive literature is not available elsewhere there are no other state extension officials or agricultural organizations recommending DCPA for use in onions or brassica. This is not the case. If a herbicide is listed in a crop guide or any literature from a state Ag organization then it means that it is a RECOMMENDATION. Only an absence from a guide can be considered not to be an endorsement of an active ingredient by the state extension office or equivalent organization operating in that state. If a product is not listed in the guide then that institution does NOT recommend it.

Often this literature will contain specific information on how to use it to preserve crop safety and increase weed control based on existing label language and/or research the weed scientists conducted on that herbicide in the local region. A few of the cited specifics examples are discussed in more detail to illustrate this point and AMVAC urges EPA to reexamine the references listed in their document where DCPA is recommended in various crops in the states of GA, ID OR, WA, AL, TN, AK, NC, OK, MS and NJ states to understand that these are recommendations with the addition of local or general aspects that local growers need to be considering when using the product.

The following is an example of the weed control guide for the PNW. Note the wording that that guide is a reference or recommendation for herbicides in cropping systems in ID, OR, and WA and it is for extension agents, company field representatives, commercial spray applicators and consultants, herbicide dealers, teachers, and producers. Each herbicide listing is a recommendation. The term “*not used*” does not apply to the entire PNW. The citation by Murray is from a working group discussion in

2019 (only one year) from academia and industry and pertains only to small area of the PNW called “Treasure Valley”. It is not the standard weed control guide for the entire 3 state region.

*“Performs erratically west of Cascades. Results improve with rain or overhead irrigation immediately after application.”* Incorporating DCPA with rain and/or irrigation is a standard practice in areas of production. All soil applied herbicides will perform erratically without activating moisture either from precipitation or from irrigation. It is not correct to just isolate DCPA’s requirement for moisture activation when this principle applies to all soil-applied herbicides. Most onions in WA are grown with some type of irrigation thereby dismissing the erratic herbicide soil activation by lack of timely rainfall. Irrigation at the optimum timing would activate DCPA giving optimum weed control. The entire statement gives context to the statement about erratic weed control and is promoting use per the label application directions.

Growers in the Pacific Northwest are also cautioned against applying DCPA in cold and wet soil conditions to reduce the risk of crop injury (Felix, 2022). *“Where onion emergence is expected to be slow due to cold and wet soil condition, delay application until seed begins to germinate to reduce the risk of crop injury.”* In the full context growers are being reminded of practices to achieve adequate crop safety and optimum weed control and reiterating current label recommendations to delay application until seed begins to germinate.

### **Crop Safety Concerns of Registered Alternatives to DCPA**

DCPA is very safe on registered crops. Crop suppression and phytotoxicity from other herbicides were not clearly identified and compared to DCPA in the BEAD document. A research report from Arizona testing weed control from DCPA in onions. The research showed excellent onion safety and weed control (reference 2) reinforcing the experiences of growers from the last 70 years.

Prefar 4-E (bensulide) – Contrary to the statements on pages 10 and 12 of the BEAD document AMVAC finds that *“hardly anyone uses it on brassica”* in CA as it is considered to reduce the stand. It can cause reduction in germination in cold, wet conditions like those that occur in coastal California as stated on the label *“Application of Prefar 4 E to soil that is cold and/or wet for an extended period of time due to rains or poorly drained soil during the germination period may result in reduction of crop stand or yields”*. In fact the Georgia Extension reference quoted in the BEAD document not only shows DCPA is recommended on onion but does not list or recommend bensulide (Table 8 page 32).

Devrinol (napropamide) - Root growth of brassica crops including Brussels sprouts may be inhibited resulting in wilting during periods of stress. Young, tender crop foliage may exhibit contact-burn-type injury. In rare cases, plant height and vigor of herbaceous ornamentals is reduced (reference 3). Again, the Georgia extension literature not only shows DCPA recommended on onion but does not recommend napropamide. (Table 8 page 32).



Goal Tender/Goal 2XL (oxyfluorfen) – Oxyfluorfen can cause issues in brassica transplants when growing conditions are not ideal – which is often the case. More injury can also be caused by oxyfluorfen in postemergent applications to brassica. On any of the brassicas oxyfluorfen is only applied prior to planting in transplanted broccoli, cabbage and cauliflower in CA. *“It can cause serious crop injury if the plants are under stress from cold weather, disease, etc.”* Dr. Fennimore has indicated growers prefer DCPA which does not carry this risk of injury due to poor growing conditions.

In general, small onions are sensitive to herbicides and additional cultivation may have to include fungicide applications if infection caused by herbicide damage occurs in the onion crop bringing added cost to the grower.

This following statement from the MI guide (referenced in BEAD document but where DCPA is not actually registered) demonstrates onions grown on mineral soils are more prone to herbicide damage compared to onions grow on muck (high organic matter soils) and the care growers should take to manage their use of pendimethalin on onions.

*“Weed control in onions on mineral soil is more difficult because of greater potential for crop injury from the herbicides. Most of the preemergence herbicides labeled for onion are labeled for use at the onion two leaf stage on mineral soil. Onions are very sensitive to weed competition during the first few weeks of onion growth. Pendimethalin label allows application preemergence to onions on mineral soil and the label warns not to apply before the loop stage if heavy rains or excess irrigation are expected. Growers on mineral soil should use the lowest rate of pendimethalin and work up to a rate that is safe on their soil. After the 2 leaf stage, onions on mineral soil are tolerant of pendimethalin but rates above 1.5 lb ai may cause slower onion growth.”*

### **Key Issues with Registered Alternative Herbicides Not Discussed in BEAD Document That Prevent Their Selection By Brassica and/or Onion Growers**

Treflan (trifluralin) – trifluralin must be immediately incorporated as it is volatile and photodegrades. Mechanical incorporation immediately after application avoids rapid loss from UV degradation and volatilization. Trifluralin cannot be used on transplanted crops because of the mechanical incorporation requirement. DCPA is stable on the soil surface and is not degraded by UV light and is not volatile giving growers’ flexibility on timing to mechanically incorporate (direct seeded) or water in (transplants) post application. The flexibility in timing of the application of water post DCPA applications for up to 2-3 days is of high benefit to growers.

Prefar 4-E (bensulide) - can only be applied through chemigation in California and Arizona which reduces the application options brassica and onion growers have when using the product in those states.

Goal Tender/ Goal 2XL (oxyfluorfen) - oxyfluorfen is not a desired herbicide for application where lettuce field occur in the same area/timing of cultivation as brassica. Co-distillation to spinach and leafy vegetables is a known problem. There have been many instances where this has occurred, especially co-distillation drift on organic leafy production. There is no tolerance set for oxyfluorfen on lettuce so drift could cause an adulterate lettuce crop. The geographical proximity of brassica and lettuce cultivation is indirectly noted in the BEAD document in 2 ways-as a common rotational program in the region including both brassica and lettuce (page 9 of BEAD) and on page 14 (BEAD) noting that transplant equipment in that region is typically employed for planting of lettuce transplants (and consequently is unavailable for brassica transplants). A key benefit for growers in proximity to lettuce fields is that DCPA has an indirect tolerance set for lettuce, a valuable insurance for growers for both sets of crops in CA.

### **Pivotal weeds for DCPA and Weed Spectrum of DCPA Outside of California**

Much of the information listed and validated for California is relevant for other key brassica growing areas including for cabbage in Texas and Washington-see usage Table 1 in this document.

The BEAD document focused on the key weeds in California for brassica crops and feedback from other regions of the country validates the commercial importance of DCPA for common chickweed, purslane and annual sowthistle. Additionally, upon expansion regionally (TX, AZ, OR, WA, GA, FL) the commercially relevant weed spectrum that DCPA provides control/suppression for Brassica crops includes grasses-foxtails, panicum, crabgrass, goosegrass and Carpetweed, FL pusley, nightshades and pigweeds.

BEAD document focused on the key weeds in CA for onions and feedback from other regions of the country validate the commercial importance of DCPA for dodder and annual bluegrass.

Additionally, upon expansion of consideration regionally (TX, AZ, OR, WA, GA, FL) the commercially relevant weed spectrum that DCPA provides control/suppression for brassica and onions expands to include grasses, pigweeds, common Lambsquarters, Kochia and Nightshades.

EPA's BEAD assessment does not adequately acknowledge the consistent control of most annual grasses (strong crop competition) and common lambsquarters that DCPA provides. Even partial control of redroot pigweed, annual spurge, carpetweed, nightshade, and significantly reduces competition to the crops. Other herbicides do not have the same spectrum of control as DCPA.

The EPA document treated all weeds equally which is over simplistic. Each weed has a competitive value with crops. The grass and broadleaf weeds on the Dacthal Flowable label, especially common lambsquarters and redroot pigweed compete strongly with crops. On a single plant basis broadleaf weeds are more competitive than grass plants. The larger and taller the plant can grow the more competitive it will be with crops. In contrast, it's the high population of grass weeds that can exert a

greater competition value than broadleaf weeds. Soil-applied DCPA prevents emergence of many pivotal grass and broadleaf weeds thus preventing crop competition from occurring.

DCPA consistently controls common purslane (*Portulaca oleracea*) as is acknowledged in Table 4 in the BEAD document. Purslane is an example of a weed with physical characteristics that are different from other broadleaf weeds which explains why chemical control in the field is very important. Purslane cannot be eradicated by hand weeding once larger than 1 inch tall. Hoeing and cultivating dissects plants and results in fragments re-rooting and creating a multiplicity of additional plants. Any soil disturbance results in new flushes of the weed. Season-long control of this weed is important and it is a pivotal weed targeted effectively by DCPA with longevity of soil residual able to control multiple flushes of purslane.

Another commercially relevant weed that leads growers to choose DCPA are the nightshades. DCPA stunts nightshades allowing it to keep the weeds from competing with the crop. Its impact is also evident at later timings of crop development when a grower may choose a postemergent herbicides as the stunted weeds are more susceptible to those post emergent herbicides. When onion growers in CA are utilizing two herbicide application timings, pre- and post- emergence, the following have been stated: *“While DCPA doesn’t control nightshade it stunts it and then when post herbicides can be used the nightshade is small enough that the post products work on it.”* (Richard Smith, Cooperative Extension Monterey County – personal communication) In general growers have found that using DCPA on less susceptible weeds, while not killing them, reduced their ability to compete with the crop and made it easier to control with subsequent herbicide applications. The timely application of DCPA on onions and leafy vegetables reduces the volume of pesticides used in comparison to other less effective herbicides.

*“DCPA holds back weeds. The major agronomic challenge is getting an onion crop to the point where the onions can tolerate a post emergence herbicide application. DCPA is instrumental in early weed control and even in weeds that are not controlled it keeps them suppressed so that when post herbicides can be applied the weeds are still susceptible to post application.”*- Personal communication with Dr. Steve Fennimore Professor of Cooperative Extension, Extension Specialist for Vegetable Weed Management, University of California Davis.

*“Weed control in onions can be particularly difficult due to the early emergence of weeds and the slow emergence and growth of onions (average 30 days from planting to emergence). Thus hand-weeding and herbicides are the two main weed control methods in processing onions. Tulelake growers are heavily reliant on herbicides for weed control, as labor intensive hand-weeding is only economical when weed populations are extremely low. Preemergence herbicides applied shortly after planting often provide the best weed control in onions because they control rapidly growing weeds before they compete with the crop. However, early herbicide applications increase the risk of injury, as small onions are especially sensitive to herbicides. DCPA (Dacthal) applied post plant applied at or before the loop stage significantly reduces the most problematic weed, kochia as well*

*as lambsquarters and hairy nightshade. Dacthal when combined with pendimethalin reduced kochia by 84%. Without the use of Dacthal growers will lose the only effective post plant herbicide available to processed onion growers. Without Dacthal, growers will incur excessive hand labor costs as well a significant reduction in yield and quality of harvested onions.” – Bob Ehn Director, California Garlic and Onion Research Advisory Board.*

Despite over 70 years of use AMVAC is unaware of any weeds that have demonstrated resistance to DCPA.

## **Weed Spectrum of Registered Alternatives to DCPA**

Treflan and Prowl (trifluralin and pendimethalin) - AMVAC does not agree with the statement on page 11 of the BEAD document that trifluralin has an adequate weed spectrum to replace DCPA in brassica production. Trifluralin, a grass herbicide, only controls pigweed and has some activity on lambsquarter. *“It is used with DCPA because it is cheap but it isn’t a DCPA replacement.”* (Personal communication with Dr. Steve Fennimore UC Davis). AMVAC does agree with University of California’s assessments quoted on page 9 of the BEAD document that pendimethalin is an inadequate alternate as it also does not have the weed spectrum that DCPA does. Later statement that pendimethalin has equivalent efficacy to DCPA (page 21 BEAD) and better efficacy than DCPA (page 20 of companion document) contradicts each other and are contrary to experiences in the field that pendimethalin is not a replacement for DCPA. However, in some areas the two herbicides complement each other to broaden the weed spectrum and provide needed preemergence weed control in onions, while reducing adverse crop effects and carryover from pendimethalin.

Prefar 4-E (bensulide) - EPA has stated several times that supplemental hand weeding may be required or likely to be needed when bensulide is used as an alternative to DCPA or an auxiliary herbicide to fill in the weed spectrum missed by other alternate herbicides. AMVAC however believes that supplemental hand weeding will always be required if bensulide is used in place of DCPA. It is an inferior herbicide to DCPA and will require supplemental hand weeding to avoid yield loss by weed pressure competing with the crop. *“Hardly anyone uses it on brassicas because of performance it is very specific in what it controls – purslane it is good on, but beyond that it isn’t very useful and nightshades come through it”* (R Smith, Cooperative Extension Monterey County)

Devrinol (napropamide) - does not have the spectrum of weed control that DCPA does. The label states that for broccoli, Brussels sprouts and cauliflower there is suppression only of barnyardgrass, purslane, and pigweed which are major weeds that DCPA claims controls of. AMVAC does not agree that it is an adequate alternative to DCPA from a weeds-controlled perspective.

Goal Tender/ Goal 2XL (oxyfluorfen) - In addition to the lack of control of oxyfluorfen on common chickweed discussed on page 11 of the BEAD document oxyfluorfen is weak on control of grassy weeds.

## **Rotational Aspects of Registered Alternatives to DCPA**

AMVAC's has recently proposed PBI table developed in late 2022 and available for review in EPA memo dated December 9<sup>th</sup> 2022 (DP Barcode D466682). PBIs for nearly all the key rotational crops called out in the BEAD document in CA brassica are proposed from 1 month to the current advisory 8 months but with many relevant rotational crops set at 3 months. This PBI table will replace the current advisory 8-month replant statement on the Dacthal Flowable label.

Treflan and Prowl (trifluralin and pendimethalin) - both trifluralin and pendimethalin have long soil residue of greater than 1 year to grass crops and 24 months rotation to sugar beet. *"Trifluralin has issues with follow crops and crop safety."* (S. Fennimore personal communication)

Devrinol (napropamide) While it may have a 12-month PBI for some rotational crops (page 9 BEAD) it is known to injure follow on crops from use on brassica *"The problem is carry over to rotational crops and this keeps it from being a replacement for DCPA. Napropamide has long residual and can injure rotational crops."* *"Hardly any is used on Brussels sprouts in California."* - Richard Smith, Farm Advisor, Cooperative Extension Monterey County

## **Weeding as An Alternative to Herbicides**

Mechanical weeding in onions (between the seed lines) poses significant challenges due to the planting density in onions-from seed to transplant and as they mature. In fact, they are difficult to weed even by hand/hoeing as onions are grown on wide beds with close onion spacing, which prevents mechanical cultivation between seed-lines. Any physical damage caused by weeding can additionally add to the cultivation costs if a fungicide is required to counter disease promoted by root damage. As noted in the BEAD document on page 13 care is required on specialty brassica when weeding due to delicate root systems.

Further, for crops such as onions which are planted in fall hand weeding in winter is difficult or impossible as rainy wet fields are impossible to cultivate or hand weed, so weeds will grow and compete with the crop without challenge and yield losses from weed competition are expected to be higher for fall planted crops.

Hand weeding needs to be evaluated in 2 different circumstances. Firstly, is the role it plays when it's the only possible cultivation due to no appropriate herbicide registered for a specific crop at the critical preemergence stage of application. This is the case, as noted by BEAD on page 16 for some specialty brassica including bok choy. This is additionally the case, which has not been highlighted by EPA, for radish. AMVAC believes radish should be included in the determination of high

benefits for specialty brassica which are direct seeded. AMVAC intends to maintain the use directions on radish in CA on the label for Dacthal Flowable. All other EPA comments for specialty brassica when direct seeded and banded are relevant for radish. We have personal communication from growers who operate in CA and AZ that, because of the ability to utilize DCPA in California for radish production, they locate their radish fields on the California side of the border. Anecdotes such as these outlining logistical efforts growers will take to use DCPA and show the importance of this herbicide to radish growers.

The second scenario where hand weeding plays a role is as a supplemental tool to fill the gap in weed control left by low performing herbicides utilized if DCPA were not available as an early management tool in weed suppression or the weed spectrum is not completed addressed throughout the crop's life cycle. The economic impact is seen in the section above where hand weeding costs increase but statements above about the yield loss due to damage in onions is valid in this scenario as well.

## **CTA Toxicology Response and Proposal**

Page 6 of companion document: *The effects observed in the CTA with DCPA included decreased levels of the thyroid hormones T3 and T4. More details on the study findings are located in "DCPA – Data Evaluation Record (DER) of a submitted definitive study to fulfill the Comparative Thyroid Assay (CTA) study requirement". The highest dose administered to the maternal rats at which the adverse thyroid effects did not appear in the fetus was 0.1 mg/kg/day (identified as "the point of departure," or POD). The next highest dose tested, 1 mg/kg/day, was the lowest dose at which the adverse fetal effects occurred. These are the doses relevant to adult humans. For human children, the Agency selected the relevant dose for risk assessment from the CTA as 10 mg/kg/day, the highest dose level at which no adverse effects were observed in the rat juveniles. The adult female rats themselves were not affected at the dose where the adverse thyroid hormone effects were observed in the fetuses.*

The Comparative Thyroid Assay (CTA) has shown changes in serum thyroid hormone levels in gestation day 20 rat fetuses at 1 mg/kg/day. AMVAC has requested a scientific technical meeting with key EPA experts to discuss some additional scientific studies. AMVAC believes there is scientific merit to evaluate a further refinement of the CTA NOAEL by testing additional dose levels, to more accurately define these developmental effects with incremental dose levels between the NOAEL at 0.1 and the LOAEL at 1 mg/kg/day. A modified CTA study design would be followed to monitor these relevant toxicity end points and determine at what specified dose level effects on fetal development could be seen. AMVAC would like to collaborate with EPA on this protocol to ensure that the methodologies would be accepted.

Thyroid-related effects have only been observed in rat toxicity studies and not in mouse or dog studies. Experimental data have been generated to demonstrate that DCPA induces liver metabolizing enzymes. Available data support the proposal that DCPA interacts with thyroid homeostasis via the extrathyroidal mechanism of enhanced excretion of thyroid hormones by hepatic UDP-GT conjugation. In addition to the study above, some Mode of Action (MoA) work is also being proposed to investigate potential neurodevelopmental toxicity adversity, human relevance and other potential MoAs.

To identify potential adverse effects in the brain, behavioral testing, immunohistochemistry, gene expression of selected marker genes, and brain thyroid hormone levels are being considered. This would allow a further understanding of the developmental neurotoxicity changes, as a consequence of thyroid hormone changes, following exposure with DCPA.

To investigate the human relevance of thyroid hormone changes induced in rats secondary to liver enzyme induction, an *in vitro* assay assessing liver enzyme induction of Phase I Cyps and Phase II UGTs in rat and human hepatocytes is proposed. Increased glucuronidation is a relevant Key Event leading to decreased thyroid hormones in blood. Consequently, if it can be shown that the thyroid effects caused in rats are due increased glucuronidation of thyroid hormones and that a rat versus human difference in the induction of Phase II liver UGTs is demonstrated, the T3/T4 decreases observed in rats would not be expected to occur in humans.

In addition, it is proposed to conduct *in vitro* assays to investigate other potential thyroid-related MoAs. To investigate the potential of DCPA to directly affect the thyroid, *in vitro* inhibition assays assessing thyroid peroxidase and sodium/iodide symporter activity are proposed as well as inhibition of deiodinase enzymes.

Therefore, to enable a more complete assessment of the risks to human health associated with exposure to DCPA additional toxicology and mechanistic work is being designed to investigate potential adversity, developmental neurotoxicity, human relevance and alternative MoAs.

AMVAC would like to discuss all study options with EPA in the near future and reach agreement on the value of such data to thoroughly answer all uncertainties.

## **Mitigations Being Proposed by AMVAC**

AMVAC have taken a careful look at uses that remain on labels, both active and archaic, risks driven by those uses and application methods and benefits for control of grass and broadleaf weeds with the use of DCPA. AMVAC proposes to remove uses, application methods and cultivation methods where the marketplace has shifted away from using DCPA.

The proposed mitigations include prior agreed to mitigations that may already be on labels pending decision making at EPA or within official EPA memos on label changes AMVAC has committed to previously (some examples include removal of aerial application, addition of specific rotational crop intervals, removal of 8 month ‘replant’ statement, removal of the use in turnip). The additional and newly proposed mitigations below will reduce risk for mixers, loader, applicators, post application workers and bystanders. It is AMVAC’s intent with all below proposals to mitigate calculated risk to humans and modernize the label without removing the core value and maintain benefits to growers for critical uses.

(All table numbers in this section refer to the table designations in the ORE document except for Tables 6, 7 and 8 which are presented in this document)

### **A. Non-Agricultural Label changes:**

1. **Remove uses in Turf-**This will be implemented by a voluntary cancellation of registrations 5481-490, 5481-491 and removal of the following use sites on the technical label (5481-495) and the end use product Dacthal Flowable (5481-487). This mitigation will have the following impact on the risk assessment:
  - a. Remove post-application risk concerns (dermal) for children and adults due to contact with athletic fields and additionally for adults to golf courses (non-cancer endpoint) Table 5.2.1
  - b. Remove post-application risk concerns (dermal) for adults due to contact with athletic fields and golf courses (cancer endpoint) Table 5.2.3
  - c. Removes non-occupational spray drift risk concerns for children from application to turf (sod/golf course/athletic field) Table 6.1.2
  - d. Removes non-occupational indirect spray drift risk concerns for adults from application to turf (sod/golf course/athletic field) Table 6.1.1
  - e. Removes occupational Handler (non-cancer) risk concerns for applications to turf Table 8.1.1
  - f. Modifies currently acceptable occupational handler (cancer) risk concerns for applications to turf to an improved margin of safety Table 8.1.2
  - g. Removes occupational post-application (non-cancer and cancer) risks concerns for applications to sod Table 8.2.2.2
  - h. All the above reductions in risk concern pertain to liquid and wettable powder formulations.
2. **Remove nursery/ornamental uses-** This will be achieved by a voluntary cancellation of registrations 5481-490, 5481-491 and removal of the following use sites on the technical label (5481-495) and the end use product Dacthal Flowable (5481-487). This mitigation will have the following impact on the risk assessment:



- a. Removes non-occupational spray drift risk concerns for adults from application to nursery stock Table 6.1.1
- b. Removes occupational Handler (non-cancer) risk concerns for applications to nursery stock Table 8.1.1
- c. Modifies currently acceptable occupational handler (cancer) risk concerns for applications to nursery stock to an improved margin of safety Table 8.1.2
- d. Removes occupational post-application (non-cancer and cancer) risks concerns for applications to nursery stock Table 8.2.2.2
- e. All the above reductions in risk concern pertain to liquid and wettable powder formulations.

## **B. Agricultural Labels:**

3. **Remove the products formulated as wettable powders from the marketplace.** This will be implemented by voluntary cancellation of 5481- 490 Dacthal W-75 herbicide. (The cancellation of 5481-491 Dacthal W-75 Turf, which is also formulated as a wettable powder is discussed above under non-Ag label section). This mitigation will have the following impact on the risk assessment:
  - a. Removes occupational Handler (non-cancer) risk concerns for applications to field crops (typical) Table 8.1.1. The Mixer/Loader MOEs for wettable powders was, on average, 2 - 4 times lower than the liquid formulation indication higher risk for those occupational handlers.
  - b. Reduces occupational handler (cancer) risk concerns for M/L/A for applications to field crops (typical) to an acceptable margin of safety Table 8.1.2
4. **Remove aerial application-**This will be implemented by voluntary cancellation of 5481-491, Dacthal W-75 herbicide and removal of this application method from Dacthal Flowable label (5481- 487). Note that a label amendment for Dacthal Flowable pending at EPA that precedes the publication of this risk assessment already requests the removal of aerial application from DCPA end use product(s). This mitigation will have the following impact on the risk assessment:
  - a. Remove the risk concerns for children (combined dermal and incidental oral screening-level) for applications to typical acreage field crops from aerial applications (Table 6.1.2)
  - b. Remove the risk concerns for adults (dermal) for applications to typical acreage field crops from indirect spray of DCPA from aerial applications (Table 6.1.1)
  - c. Removes the risk concerns for occupational workers-flaggers (non-cancer) Table 8.1.1
  - d. Modifies currently acceptable for occupational workers (cancer) to an improved margin of safety Table 8.1.2

5. **Remove small area use and specifically state that backpack and handgun/mechanical wand applications are not allowed.** This will be implemented by voluntary cancellation of 5481-491, Dacthal W-75 Herbicide and removal of this small area application instructions from Dacthal Flowable label (5481- 487). A restriction will be placed on the label for 5481-487: (Do not apply by Liquid, Mechanically pressurized Handgun, Drench/Soil-/Ground-directed). This mitigation will have the following impact on the risk assessment:
  - a. Removes occupational Handler (non-cancer) risk concerns for liquid applications using this equipment to M/L/A Table 8.1.1
  - b. Reduces occupational handler (cancer) risk concerns for M/L/A for liquid applications using this equipment to M/L/A to field crops (typical) to an acceptable margin of safety Table 8.1.2
6. **Remove uses in the following crops:** This will be implemented by voluntary product cancellations and voluntary use site cancellations in EPA Registration Number 5481-495 (technical label)- turnip, melons (cantaloupe, honeydew, watermelon), sweet potato, eggplant, strawberry and tomato and voluntary use site cancellations in EPA Registration Number 5481-487- seeded watermelons, horseradish, sweet potatoes, tomatoes, tomatillos, eggplant, strawberries, fruits of the gourd (footnote only-see clarification section below). The intent above is to remove the same suite of crops from the technical and end-use label but they have been listed slightly differently to align with the exact crop terminology on each label for avoidance of doubt. All these crops had equal or lower maximum use rates to the crops discussed below and were discussed under typical field crop scenarios in the ORE. This mitigation will have the following impact on the risk assessment: precludes use and expansion of DCPA use in multiple crops.
7. **Change the single application rate ranges for all brassica to 6 - 9 pints:** This will be implemented by changing the rate range on Dacthal Flowable 5481-487 from the current rate of 6-14 pints and instituting a maximum rate of 9 pints (6.75 lbs ai/A). This is a **36% rate reduction** on the maximum rate. This mitigation will have the following impact on the risk assessment:
  - a. Mixer loader and applicator occupational (non-cancer) risk concerns reduced- see EPA Table 8.1.1 and Table 7 of this document.
  - b. Modifies currently acceptable for occupational workers (cancer) to an improved margin of safety Table 8.1.2
8. **Change the single application rate ranges for onions to 6 – 8 pints:** This will be implemented by changing rates on Dacthal Flowable 5481-487 from the current maximum rate of 10 pints to maximum rate of 8 pints (6 lbs ai/A). This is a **20% reduction** on the maximum rate for onions. This mitigation will have the following impact on the risk assessment:
  - a. Mixer loader and applicator occupational (non-cancer) risk concerns reduced- see EPA Table 8.1.1 and Table 7 of this document.

- b. Modifies currently acceptable for occupational workers (cancer) to an improved margin of safety Table 8.1.2
- 9. **Change the single application rate ranges for radish to 6 - 9 pints:** This will be implemented by changing the rate range on Dacthal Flowable 5481-487 from the current rate of 6-14 pints and instituting a maximum rate of 9 pints (6.75 lbs ai/A). This is a **36% rate reduction** on the maximum rate. This mitigation will have the following impact on the risk assessment:
  - a. Mixer loader and applicator occupational (non-cancer) risk concerns reduced - see EPA Table 8.1.1 and Table 7 of this document.
  - b. Modifies currently acceptable for occupational workers (cancer) to an improved margin of safety Table 8.1.2
- 10. **Implement a requirement for closed handling system and engineering controls for mixers and loaders and applicators (enclosed cab).** This will be implemented by adding language such as the following to the Dacthal Flowable 5481-487 ‘‘ENGINEERING CONTROLS- Closed System Loading and Mixing and Enclosed Tractor Cab Required’’ and no derogation for reduced PPE when engineering controls are utilized. This mitigation will have the following impact on the risk assessment: EPA has already utilized and calculated the contribution of such engineering controls in their ORE assessment for mixers/loaders and applicators. However, the Agency has not yet considered combining engineering controls with other higher levels of dermal PPE protection level proposed in the next bullet point. AMVAC believes by employing full dermal protection, in conjunction with engineering controls, that occupational workers would be properly safeguarded for handling additional amounts of chemical and increasing the spray acreage being applied. We request that a dermal unit exposure reduction factor be applied with such additional PPE changes.
- 11. **Implement the highest level of PPE (related to dermal exposure) for mixers, loader and handlers (in cases of spills/equipment failures).** This will be implemented by adding language such as the following to the Dacthal Flowable 5481-487: ‘‘Mixer/Loaders must wear: coveralls over long-sleeved shirt and long pants, chemical resistant apron when mixing and loading product, waterproof gloves, chemical resistant footwear plus socks and face shield. Applicators must wear: coveralls over long-sleeved shirt and long pants, waterproof gloves, chemical-resistant footwear plus socks and chemical resistant hat if overhead exposure expected. Handlers engaged in those activities for which use of an engineering control is not possible, such as cleaning up a spill or leak and cleaning or repairing contaminated equipment, must wear: coveralls over long-sleeved shirt and long pants, waterproof gloves, face shield, chemical-resistant footwear plus socks, chemical-resistant apron if exposed to the concentrated product and chemical-resistant hat if overhead exposure expected.’’ This mitigation will have the following impact on the risk assessment: EPA has already considered high levels of hand and body protection (G/DL) in their ORE assessment and additional dermal protection for

the body, feet and face can be considered by refinements facilitated through reduced dermal absorption and protection with this additional PPE.

12. **Implement the highest level of PPE (related to dermal exposure) for post applications activities within the REI.** This will be implemented by updating PPE language in the WPS box to ‘‘chemical resistant coveralls/waterproof suit, waterproof gloves, chemical resistant footwear plus socks, face shield and chemical resistant hat if overhead exposure expected.’’ This mitigation will impact the risk assessment to further safeguard applicators entering before the newly proposed reentry interval has been reached as the highest level of PPE suitable to field reentry.
13. **Implement a daily amount that can be handled by Mixer/loaders.** This will be implemented by adding language such as the following to the Dacthal Flowable 5481-487: ‘Mixer/loaders may only handle 20 gallons of product a day to prepare application sprays.’ This mitigation will reduce the risk to mixer/loaders as described:
  - a. See Tables 6 and 7 below for calculated acres that can be treated with 20 gallons of product per crop and application type and its subsequent calculated MOE.(20 gallons = 960 lb AI) as a first step where we still excluding consideration of the balancing role of benefits. At a maximum allowance of 20 gallons and proposed crop use rates mixer/loaders can prepare spray for 17-54 acres for brassica and 19 acres for onions --see impact discussion below for more details.

**Table 6**

Amount in gallons/cases	Treated acres - broadcast @ 9 pints	Resulting MOE	Treated acres - broadcast @ 8 pints	Resulting MOE
	(Brassica rate)		(Onion rate)	
<b>20 gallons/4 cases</b>	17.7	96	20	95
	20	85	20	95
<b>25 gallons/5 cases</b>	22.2	76	25	76
<b>30 gallons/6 cases</b>	26.67	63	30	64
	30	56	30	64
	40	42	40	48
	60	28	60	32

14. **Implement a daily maximum treated acres for applicators.** This will be implemented by adding language such as the following to the Dacthal Flowable 5481-487: Maximum daily acres will be added to the existing conversion chart for broadcast and banded rates. This mitigation will reduce the risk to applicators as described:

- a. See Table 7 for some calculated treated acre allowances (that are importantly not yet balanced by benefits that AMVAC believes would justify further increase in acreage beyond what is calculated below). In this manner applicators can treat 13-45 acres for brassica at the 9 pint rate and 15 acres for onions at the 8 pint rate and not exceed EPA’s Level of Concern (LOC)-see impact discussion below for more details and discussion.

**Table 7**

<b>Occupational Handler Non-Cancer Dermal Exposure and Risk Estimates for DCPA</b>				
<b>Exposure Scenario</b>	<b>Crop Target</b>	<b>Max App. Rate (lb ai/A)</b>	<b>Area Treated or Amount Handled Daily</b>	<b>Dermal</b>
				<b>MOE (LOC = 100)</b>
<b>Mixer/Loader</b>				
<b>Liquid, Chemigation, Broadcast</b>	<b>Field crop typical acreage</b>	<b>10.5</b>	<b>350</b>	<b>3.1</b>
Liquid, Chemigation, Broadcast	Brassica/Radish	6.75	350	4.8
Liquid, Chemigation Broadcast	Onion	6	350	5.5
Liquid, Chemigation, Broadcast	Brassica/Radish	6.75	40	42
Liquid, Chemigation, Broadcast	Onion	6	40	48
Liquid, Chemigation, Broadcast	Brassica/Radish	6.75	17	100
Liquid, Chemigation, Broadcast	Onion	6	19	100
<b>Liquid, Groundboom, Broadcast</b>	<b>Field crop typical acreage</b>	<b>10.5</b>	<b>80</b>	<b>14</b>
Liquid, Groundboom, Broadcast	Brassica/Radish	6.75	80	21
Liquid, Groundboom, Broadcast	Onion	6	80	24

Liquid, Groundboom, Broadcast	Brassica/ Radish	6.75	17	100
Liquid, Groundboom, <b>BANDED</b>	Brassica/ Radish	6.75x 0.3	54	100
Liquid, Groundboom, Broadcast	Onion	6	19	100
Applicator				
<b>Spray (all starting formulations), Groundboom, Broadcast</b>	<b>Field crop typical acreage</b>	<b>10.5</b>	<b>80</b>	<b>11</b>
Spray (all starting formulations), Groundboom, Broadcast	Brassica/ Radish	6.75	80	17
Spray (all starting formulations), Groundboom, Broadcast	Onion	6	80	19
Spray (all starting formulations), Groundboom, Broadcast	Brassica/ Radish	6.75	13.4	100
Spray (all starting formulations), Groundboom, <b>BANDED</b>	Brassica/ Radish	6.75x 0.3	45	100
Spray (all starting formulations), Groundboom, Broadcast	Onion	6	15.1	100

15. **Implement mandatory spray drift language.** This will be implemented by adding a mandatory spray language box to the Dacthal Flowable 5481-487 label which will include the following restrictions:

<p><b>SPRAY DRIFT</b></p> <p><b>GROUND BOOM APPLICATIONS</b></p> <ul style="list-style-type: none"> <li>• Users must only apply with the release height recommended by the manufacturer, but no more than 18 inches above the ground or transplant.</li> <li>• For applications prior to the emergence of crops and target weeds, applicators are required to use a coarse droplet size (ASABE S572.1).</li> <li>• For all other applications, such as over transplants applicators are required to use a coarse or coarser droplet size (ASABE S572.1).</li> <li>• Do not apply when wind speeds exceed 10 mph at the application site.</li> <li>• Do not apply during temperature inversions.</li> </ul>
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This mitigation will have the following impact on the risk assessment to calculated buffer zones when utilizing with the new maximum rate of 9 pints with other current assumptions-see next mitigation point for actual calculated outcome. The introduction of new spray application requirements for coarse spray should additionally be considered as providing for an important means for lowering exposure to field applicators who typically are exposed to finer droplets carried by the wind.

**16. Implement a residential buffer zone for (adult) bystander protection.** This will be implemented by adding a buffer zone from residential areas to the Dacthal Flowable 5481-487 label which should be calculated using the proposed 9-pint rate and mandatory spray language elements listed above. This mitigation will have the following impact on the risk assessment:

- a. Table 6.1.1: The calculated buffer zone is currently published with an MOE of 7 - 10 at for 100-200 feet with ground boom application utilizing high boom very fine to fine spray and the current maximum rate of 10.5 lb AI/A. Upon recalculation utilizing fine to medium/coarse spray at a 9 pint rate an MOE of 76 is calculated at 150 feet and an MOE of 114 at 200 feet. AMVAC is unable to refine this further when the coarse only type of spray parameter is applied, but would anticipate a buffer of ca. 150 feet may be achievable under these conditions.

**17. Remove current 12-hour reentry interval and propose REI per relevant grower activities** in WPS box. This will be implemented by replacing the 12-hour reentry interval with mandatory activity driven REIs to the Dacthal Flowable 5481-487 label which will include the following restrictions which are based on common and reasonable grower requirements to return to the treated acres ---see impact discussion below on relevant post application activities.

**For post application activities such as hand setting irrigation, do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of > 3 days.**

**For post application activities such as scouting do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of >3 days.**

**For post application activities, such as thinning, tying/training, topping do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of > 10 days.**

**For post application activities such as weeding do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of >21 days**

18. **Remove layby applications.** This will be implemented by removing all references to layby applications from the use directions on the Dacthal Flowable 5481-487 label. This mitigation will have the following impact on the risk assessment for calculation of reentry intervals in that at all applications will be early applications at seeding or transplanting when the soil is bare or the transplant size is small with a very low-density canopy.

- a. For example, for activities in broccoli shown in Table 8.2.2.2 (page 38 of ORE), the transfer coefficient for scouting and weeding of 4200 cm<sup>2</sup>/hr would be highly exaggerated for the type of canopy associated with a transplant field and exposure can even be considered *de minimis*.

Table 8.2.2.2. Occupational Post-application Non-Cancer and Cancer Exposure and Risk Estimates for DCPA						
Crop	Activity	Transfer Coefficient (cm <sup>2</sup> /hr)	MOE (LOC = 100)		DAT at which MOE ≥ LOC (MOE)	Cancer Risk Estimate
			0 DAT	30 DAT		30-Day Average Dose
Onion, bulb/green	<del>Weeding Hand</del>	<del>4200</del>	<del>0.08</del>	<del>7.5</del>	—	<del>2E-05</del>
	Irrigation(hand set)	1900	0.18	17	--	7E-06
	<del>Scouting</del>	1400	0.24	22	--	5E-05
	<del>Weeding Hand</del>					
	<del>Harvesting Hand</del>					
	Scouting	330	1	95	31 [110]	1E-06
Thinning Plants						
Broccoli	<del>Scouting</del>	<del>4200</del>	<del>0.08</del>	<del>7.5</del>	—	<del>2E-05</del>
	<del>Harvesting Hand</del>					
	<del>Weeding Hand</del>					
	Irrigation (hand set)	1900	0.18	17	--	7E-06
	Weeding Hand	1400	0.24	22	--	5E-05
	Scouting	330	1	95	31 [110]	1E-06
Thinning Plants						

19. **Change ambiguous product incorporation statements to mandatory statements,** mechanical soil incorporation (direct seeded) and watering in statements (direct seeded and transplants). This will be implemented by adding a ‘must’ statement in use directions for brassica, radish and onions on the Dacthal Flowable 5481-487 label. This change permits soil incorporation to be factored into the exposure calculations for post application activities. Product that is mechanically incorporated to the recommended vertical depth of 2 inches essentially eliminates available material on the soil surface to be a source of exposure to workers in the treated acres. Product that is watered in post



application with the recommended ½ to 1 inch of water reduces available material on the transplant foliage and soil surface as DCPA has solubility in water and product is moved into the soil. AMVAC is unable, with available risk models, to estimate or factor the impacts of product incorporation into the post application worker exposure assessments.

20. **Dacthal Flowable will be proposed as an RUP, a restricted use product:** While this proposal will not impact the quantitative risk assessment outcome it will ensure application by certified applicators only.
21. **Typical rates for all remaining crops** are additionally being provided as anticipated within the new rate ranges to facilitate in refinement of the cancer risk assessments for occupational workers per acre (see page 24 ORE):  
Brassica (All): typical rate 9 pints which translates to 2.7 pints/A for banded applications.  
Onions: typical rate 7 pints.  
Radish: typical rate 9 pints which translates to 2.7 pints/A for banded applications.

#### **Clarification of identified label uncertainties and crop use patterns:**

1. Cucumber/edible fruits of the gourd/'melons' -the last references to cucurbits/fruits of the gourd/generic melons group are on the product Dacthal W-75 Herbicide and will be addressed by voluntary cancellation of that product and a footnote 2 (no use directions) on 5481-487 which is being removed by a label amendment pending at EPA.
2. Taro, Turmeric and other root is being addressed by voluntary cancellation of 5481-490 Dacthal W-75 Herbicide.
3. DCPA does not have a labeled use on Ginseng except on an obsolete SLN (expired in WI in 2009) exists at federal level only WI-05002 and which will be cancelled.
4. Page 4 companion document footnote 4:Residential uses – this is currently being addressed with a pending amendment to the technical label 5481-495 to clearly state outdoor non-residential sites. However, that is now superseded by the wider scope of voluntary cancellation of the terrestrial nonfood and outdoor (non-residential sites). The voluntary cancellations for 5481-485, 5481-486 and 5481-491 address the footnote comments on potential for use on residential sites page 4 of the companion document.
5. 'Treating small acres' use directions is associated with nursery stock use patterns and is being removed with the voluntary cancellation of ornamental/nursery use patterns (page 4 companion document).

#### **Impact Assessment of Proposed Mitigations for Dacthal Flowable 5481-487 on Brassica and Onion Cultivation (including consequential label changes not related to worker ORE mitigation but relevant for impact assessment)**

1. **Banding versus Broadcast applications in Brassica and Onions– treated acres**  
Table 7 shows the various allowed acres that can be treated with 20 gallons of product per crop and application type and its subsequent calculated MOE (20 gallons = 960 lb

AI). Mixer/loaders can prepare spray for 16-54 acres for brassica depending on whether the application is broadcast or banded. Typical acres treated per day for key crops in different regions is discussed in the cultural practices section and depending on the region this amount of spray preparation may be feasible as a daily allowance for brassica cultivation. Growers that choose to use DCPA at lower rates within the 6 - 9 pint rate range will be able to treat even more acres a day.

For applicators where the allowed acres they can treat with a ground boom at the highest rate for brassica is ca 13 acres this number also increases when product is applied banded. The 'treated acres' factor is 0.3 for banding which represents application to a 12'' band on a 40'' bed top. Thus, acres applicators treat in a banded application range from 45 acres at effective rates of 2.7 pints (equivalent to 9 pints on a broadcast basis) to 67 acres at effective rates of 1.8 pts per acre. Again, these daily acres may be feasible as a daily allowance for brassica cultivation when compared to typical acres planted in a day. Applicators treating crops at lower rates within the 6 - 9 pint rate range will be able to treat more acres a day.

Note that for onions broadcast is by far the most predominate application type due to the density of seeded plant lines therefore we have not provided banded applications calculations for onions. If application is banded reduced exposure again does occur but due to the broader bands used for onion rows the relative ratio of sprayed bed is higher than for brassica.

## 2. **Chemigation and Groundboom applications**

Typical acres treated per day for chemigated applications in specialty vegetables should align with the daily planted acres of the crop. Larger acreages, such as 350 acres typically associated with chemigation applications, are not appropriate for these crops. Planting is the daily limiting rate on how much chemigation application of DCPA will occur in a day (see crop cultivation section above). Thus, information provided in table 7 above aligns chemigation generally with acres more typically assigned to ground boom applications and not the exaggerated acreage per day of 350 acres used by EPA in their earlier published risk assessment. AMVAC believes it is sensible and practical to set expectations of treated chemigated acres to align with the acreage more typically associated with Groundboom coverage per day.

3. **All remaining labelled crops will have a maximum annual rate of 2x single application rate** with one application per crop cycle and allowing 2 applications per year for those crops with a short crop cycle. This is informational only as there is no relevance for this restriction to the current ORE risk assessment.
4. **The rate range to use on different soil types will be adjusted to align with the new rates.** The current label lists different application rates to be used in soils of different textures. An advisory on weed efficacy for heavy and clay soils as well as with organic content >3% will now be added to the label. This is an outcome of the reduction in rate and will be impactful to some growers with mixed field soil conditions. This will have a

limited effect as use in mineral soils is the predominant and labelled soil type for DCPA. DCPA is a soil active herbicide not a foliar absorbed herbicide. It is subject to soil conditions for activity. There is a universal principle that soil active herbicides are subject to soil adsorption effects. Herbicide molecules are adsorbed to some extent on soil colloids and organic matter based on cation exchange capacity. Degree of adsorption to binding sites are in the following order: 1. organic matter, 2. clay content in soils, 3. silt content in soils and 4. sand content in soils. Organic matter content can impact soil binding properties of herbicides by orders of magnitude over a simple sand matrix. DCPA has a Koc of 5,000 mL/g and is strongly adsorbed to organic matter. The rate structure for DCPA is based on the amount of herbicide molecule adsorption to soil and organic matter binding sites. Lowering the rate used by growers will reduce the proportion of molecules that are available and free for uptake by weed roots. The Koc of DCPA is nearly the highest Koc value of all soil active herbicides making it critical for growers to continue to pay attention to the specified rate that considers soil type and percent organic matter. A secondary impact in reduction of rate is longevity of weed control/suppression post rate reduction but the proposed rates are expected to continue to provide weed control and suppression of sufficient longevity to allow the developing crop to compete with weeds.

5. **Mandatory spray drift language and residential buffer zones**-Because the treated field has either no crop canopy (in the case of treatment of seeded fields), or a very low, open canopy (in the case of treatment of crop transplants), the spray release height for DCPA application can be lowered to less than 18 inches from the soil surface within impact to growers. Additionally, growers who utilize DCPA by banded applications are strictly managing their spray deposition pattern via nozzle management techniques such as angle and height of application. This also has the benefit of reducing drift. Because there is minimal crop canopy associated with the treated transplants, there is no need for the application to penetrate the foliage; thus, a coarse spray can be employed. EPA has not yet considered the drift potential of a coarse spray, but instead has assessed drift under a range of spray types from fine to medium/coarse. AMVAC is modifying its label to only utilize coarse spray. With the proposed lowering of application rates and modification of application practice, only small buffers should be required for ensuring an appropriate safety standard for bystanders. AMVAC believes buffer zones in the range of 100 ft is practical for growers of brassica and onions in agricultural areas.
6. **Removal of layby applications**-This is an example where growers no longer use this timing of application. No grower impact is expected from the removal of layby applications in onions.
7. **Mandatory mechanical soil incorporation or incorporation by watering in.** There is no expected impact from making this practice mandatory as it is already practiced by growers as a matter of getting the best results from DCPA. Soil incorporation is

important for proper activity of DCPA and current label directions direct users to soil incorporate mechanically to a vertical depth of 2 inches to the weed germination zone or watering in after seeding to avoid disturbing soil and to achieve best efficacy of the product in the weed germination zone.

8. **Increased Post application PPE.** Professionals such as crop advisors that scout fields already wear rubber boots as well as waterproof coveralls and hats. Handlers involved in irrigation equipment manipulations wear rubber boots and waterproof coveralls due to the presence of water/mud. Extending the required level of PPE appropriately is not anticipated to have a big impact and ensures key initial re-entry activities can be safeguarded.
9. **AMVAC has evaluated the post-application needs for the remaining crops** and their variable cultural practices and provides a table below to show typical required entry onto the treated acres and note the following practices in the field. (a) Irrigation - piping once it's no longer needed post-application of DCPA is removed from the field by mechanical retrieval means. For ground boom applications of DCPA irrigation piping is handset prior to application. The workers do not need to reenter treated areas as the irrigation is commenced by preset pipe connectivity outside of the treated acres and piping remains in place post application. There is no requirement for entry to any fields post application unless there is an irrigation equipment failure. (b) scouting-this is a key post application activity and needs to occur for insect pressure monitoring as soon as practically possible and a proposed REI of 3 days is the longest interval that can be entertained. (c) in crop activities e.g. thinning, topping, tying etc. 10 days or not required for >30 days (d) weeding -21 days. As noted below harvesting REIs are not being mandated as harvest occurs at greater than 30 days.

The application of DCPA at direct seeding yields no potential for exposure to workers entering the field after application. The fields are initially carefully cultivated to remove weeds that would otherwise provide competition for the intended crop as it emerges from the soil. Following application to the bare ground, DCPA is either preplant incorporated mechanically to a depth of 2 inches prior to seeding or it is watered into the soil to eliminate potential sprouting of competitive weeds.

DCPA is also applied to young transplants. This type of application does yield residue on the treated foliage that may yield exposure to workers; however, at application there is little foliage on the young transplants. Further, at planting, the transplants are spaced in the field spaced in a manner that produces a low density of soil coverage. The chemical is watered in within 2-3 days of application, reducing foliar surface residues further.

EPA does not have an exposure scenario for post application exposure to treated transplants, but it is very evident to any field observer that the exposure potential is *de minimis*. Although this is the case, AMVAC still would mandate the use of chemical resistant footwear to lessen any potential for exposure for field reentry activities ahead of the reentry intervals below. We would also be willing to set such PPE for the earliest post

application activities such as managing irrigation equipment or scouting as it is our understanding that the use of rubber boots and a waterproof suit is already utilized for both activities. Over time and as the transplant matures, the percentage of treated foliage on the plant rapidly decreases. This is accompanied by the normal decline in residue due to environmental conditions.

**Table 8**  
**Proposed REI Timing by Crop and Activity**

<b>Crop</b>	<b>Planting practice</b>	<b>Activity</b>	<b>Current calculated MOE<sup>1</sup></b>	<b>Proposed timing of first REI</b>	<b>Foliage on field at time of application</b>	<b>Foliage on the field at time of activity</b>
<b>Brassica (including radish)</b>	Direct seeded	Handset irrigation	17	3 days	none	none
	Transplant	Handset irrigation	17	3 days	<i>de minimis</i>	<i>de minimis</i>
	Direct seeded	Scouting	95-150	3 days	none	none
	Transplant	Scouting	95-150	3 days	<i>de minimis</i>	<i>de minimis</i>
	Direct seeded	Thinning	95 - 450	10 days	none	minimal
	Transplant	Thinning	95 -450	Not done	NA	NA
<b>Brassica (specific to cauliflower or Brussels sprouts)</b>	Transplant	Topping/tying/ training	Not calculated	>30 days	<i>de minimis</i>	Not done when in transplant stage
<b>Brassica (including radish)</b>	Direct seeded	Harvest	Not calculated	NA*	NA	NA
	Transplant	Harvest	Not calculated	NA*	NA	NA
	Direct seeded	Weed	22	21 days	none	minimal
	Transplant	Weed	22	21 days	<i>de minimis</i>	minimal
	Direct seeded	Handset irrigation	17	3 days	none	none
	Transplant	Handset irrigation	17	3 days	<i>de minimis</i>	<i>de minimis</i>
	Direct seeded	Scouting	95	3 days	none	none
	Transplant	Scouting	95	3 days	<i>de minimis</i>	<i>de minimis</i>

<b>Onions</b>	Direct seeded	Weed	22	21 days	None	minimal
	Transplant	Weed	22	21 days	<i>de minimis</i>	minimal
	Direct seeded	Thinning	95	10 days	none	minimal
	Transplant	Thinning	95	Not done	NA	NA
	Direct seeded	Harvest	Not calculated	NA**	NA	NA
	Transplant	Harvest	Not calculated	NA**	NA	NA

\*See footnote 1 page 9 of BEAD and AMVAC concurs that harvest is > 60 days post planting

\*\* Harvesting of bulb onions is 150-200 days after planting

<sup>1</sup>EPA values from pages 38-42 ORE utilizing low crop height, minimum foliage and reporting MOE at 30 DAT

## References

Reference 1-

[April 2023 \(nxtbook.com\)](https://nxtbook.com)

Reference 2-

[Dacthal® Herbicide Rate Comparison for Preemergence Weed Control in Onions \(arizona.edu\)](https://arizona.edu)

Reference 3-

[Crop Injury Caused by Herbicides \(researchgate.net\)](https://researchgate.net)

## Appendix 1

Dacthal Economic Benefits Analysis conducted by ERA in 2018 for key crops in state of California (15 pages)

# Dacthal Economic Benefits Analysis

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August 29, 2018



# Overview

- The economic analysis quantifies the direct and indirect economic benefits of Dacthal
- Standard economic benefit-cost analysis:
  - Compare net farm income pre/post Dacthal restrictions considering the next best (least cost) alternative to Dacthal
  - Quantify other indirect benefits, including retail supply chain value
- Benefits
  - Avoided cost (labor cost, alternative materials)
  - Gross revenue (minimal yield and/or crop quality losses)
  - Indirect economic effects



# Acreage and Value Overview

- Acreage typically treated with Dacthal includes:
  - Onions, broccoli, cauliflower, cabbage, Brussels sprouts, and Asian vegetables
- Acreage that could be treated with Dacthal generates total annual gross value of \$1.7 – \$3.8 billion per year
  - The share of acreage treated with Dacthal ranges from 12 to 30 percent
  - Acreage treated with Dacthal generates gross farm value of \$350 - \$800 million per year
- Dacthal sales supply chain generates gross value of \$5 - \$6 million/year

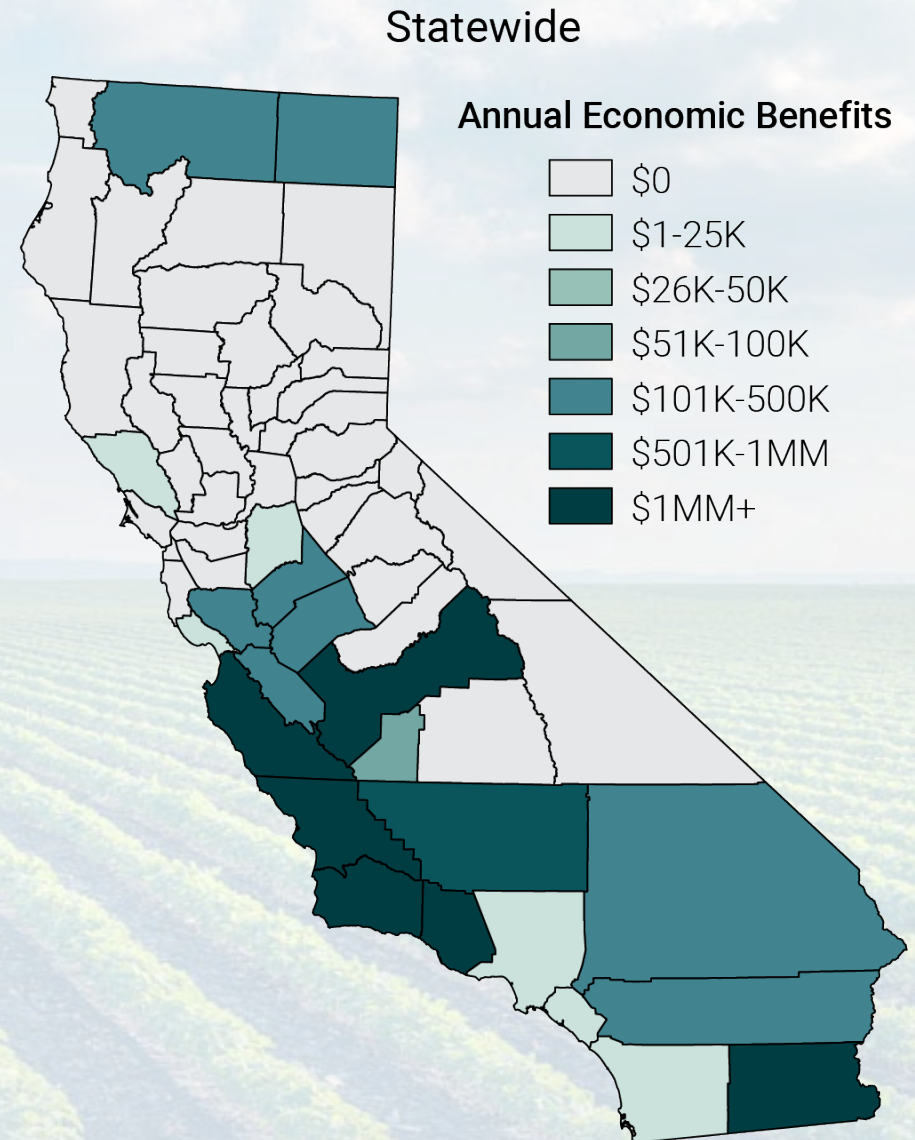


# Economic Methodology

- Identify acreage, crops, regions, typically treated with Dacthal
  - DPR Pesticide Use Reports (2005-2016)
- Quantify cultural practices, Dacthal use, alternative herbicides, and costs
  - Literature review, UCCE cost studies
  - Survey/interviews of UCCE Farm Advisors, PCAs, industry experts, growers
  - Identify the least-cost alternatives to Dacthal
- **Direct benefits:** Stochastic farm budget models measure the effect of Dacthal on net farm income and profit risk
  - Dacthal and least cost alternative
- **Indirect benefits:** Changes in economic activity in industries that are linked to agriculture
  - Also called “multiplier” effects
  - Additionally include the retail supply chain economic value

# Statewide Benefits Summary

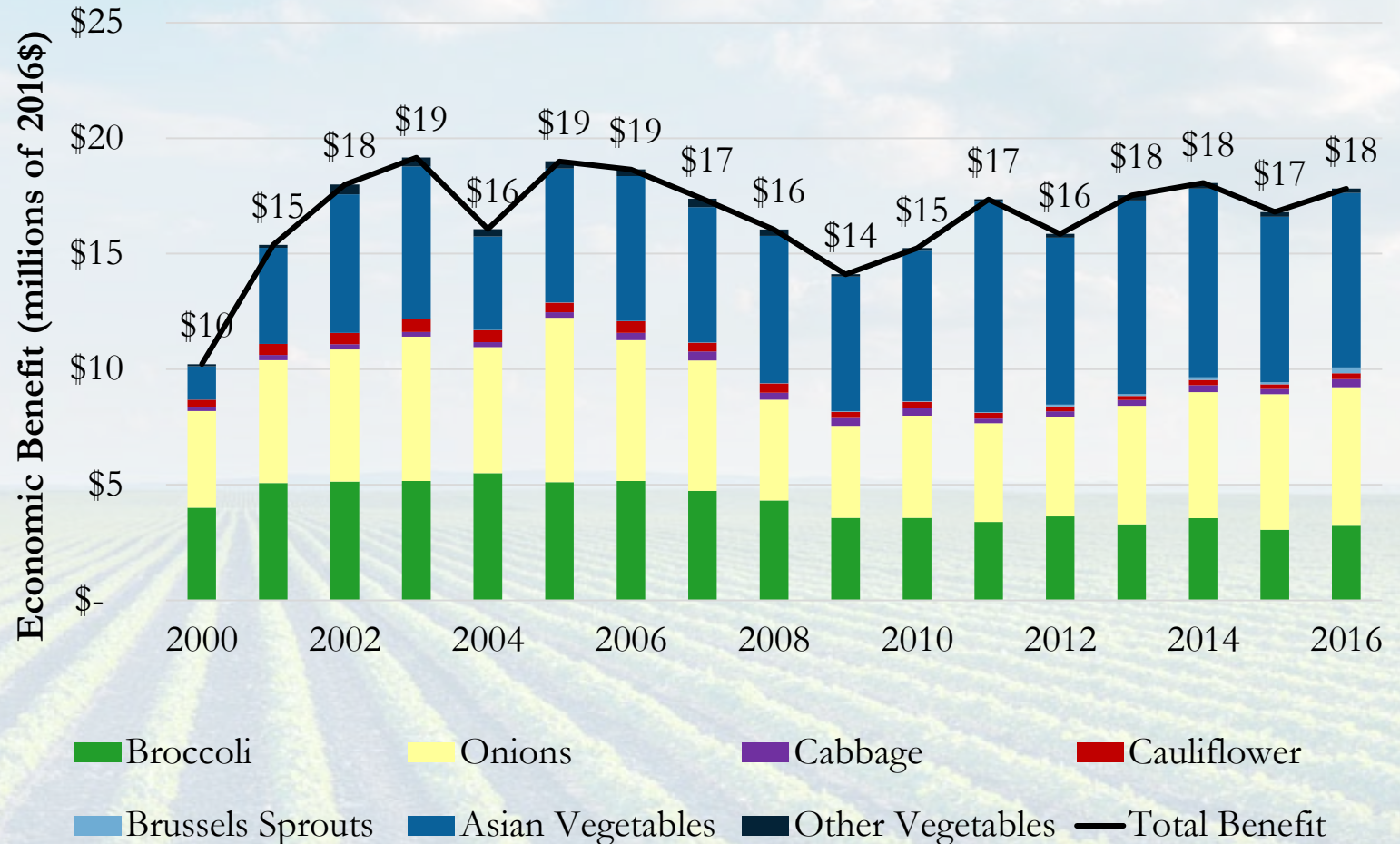
- Crop benefits: \$10 - \$17.0 million/yr (total including multiplier effects)
  - Labor scarcity
  - Yield and quality losses
- \$5 - \$6 million per year in sales generates \$10 - \$11 million per year in total economic benefits
- Total benefit range of \$20 - \$37 million per year
- Important result
  - There are alternatives to Dacthal, but these require additional labor
  - Labor is scarce and increasingly costly





# Dacthal Statewide Benefits

- Benefits concentrated in high value vegetables:
  - Onions: 31%
  - Broccoli: 23%
  - Asian vegetables: 41%
- Brussels sprouts small, but growing
- Annual benefit range
  - \$10 - \$17 million

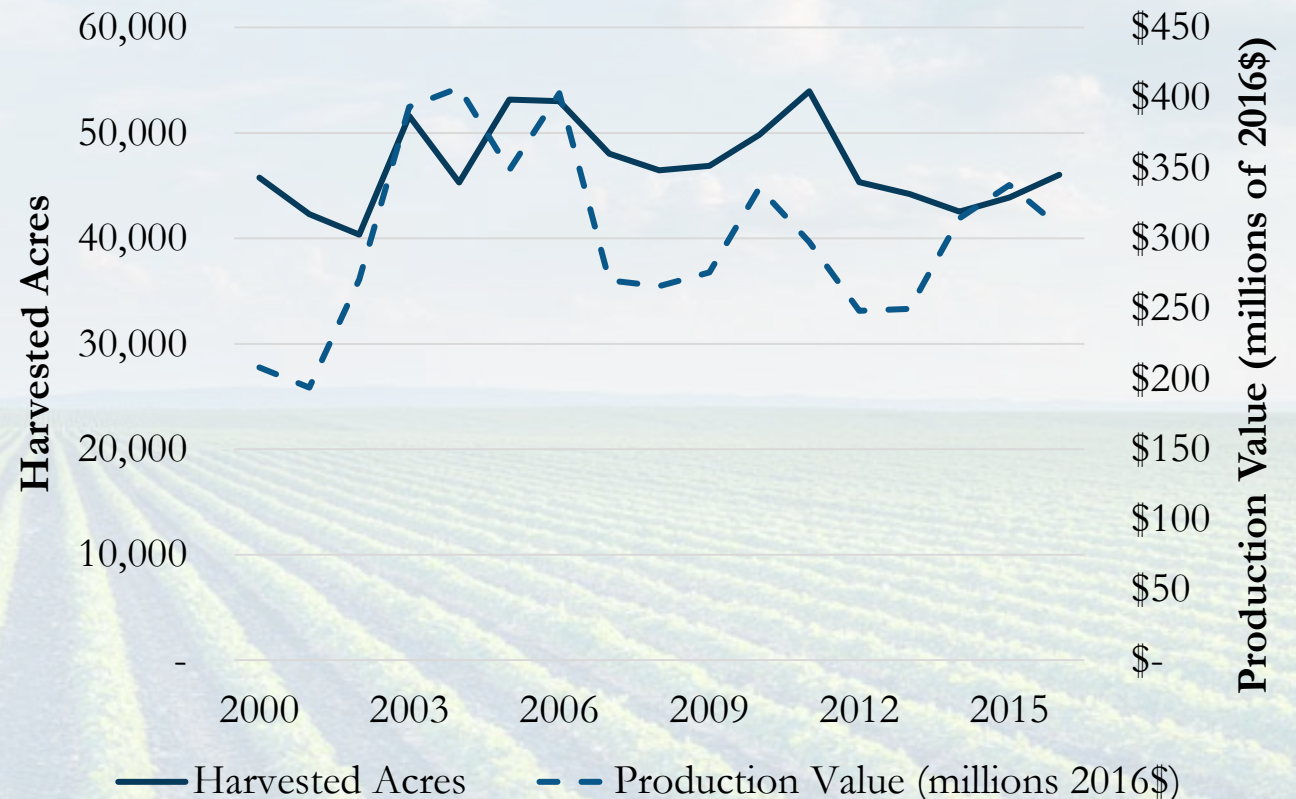


<b>Total Economic Benefit</b>	
<b>2000-16 per acre average</b>	<b>\$340</b>

# Onion Overview

- 47,000 acres; \$301 million value
- 89% of acreage in 4 counties
  - Fresno: 17,000 acres
  - Imperial: 13,700 acres
  - Kern: 7,600 acres
  - Monterey: 2,200 acres
- 45% of crop to fresh market
  - US consumption per capita up 16% since 2000, total consumption up 34%
- Approximately 1/3 of California onions are exported (\$83 m)
- Acreage and total value steady

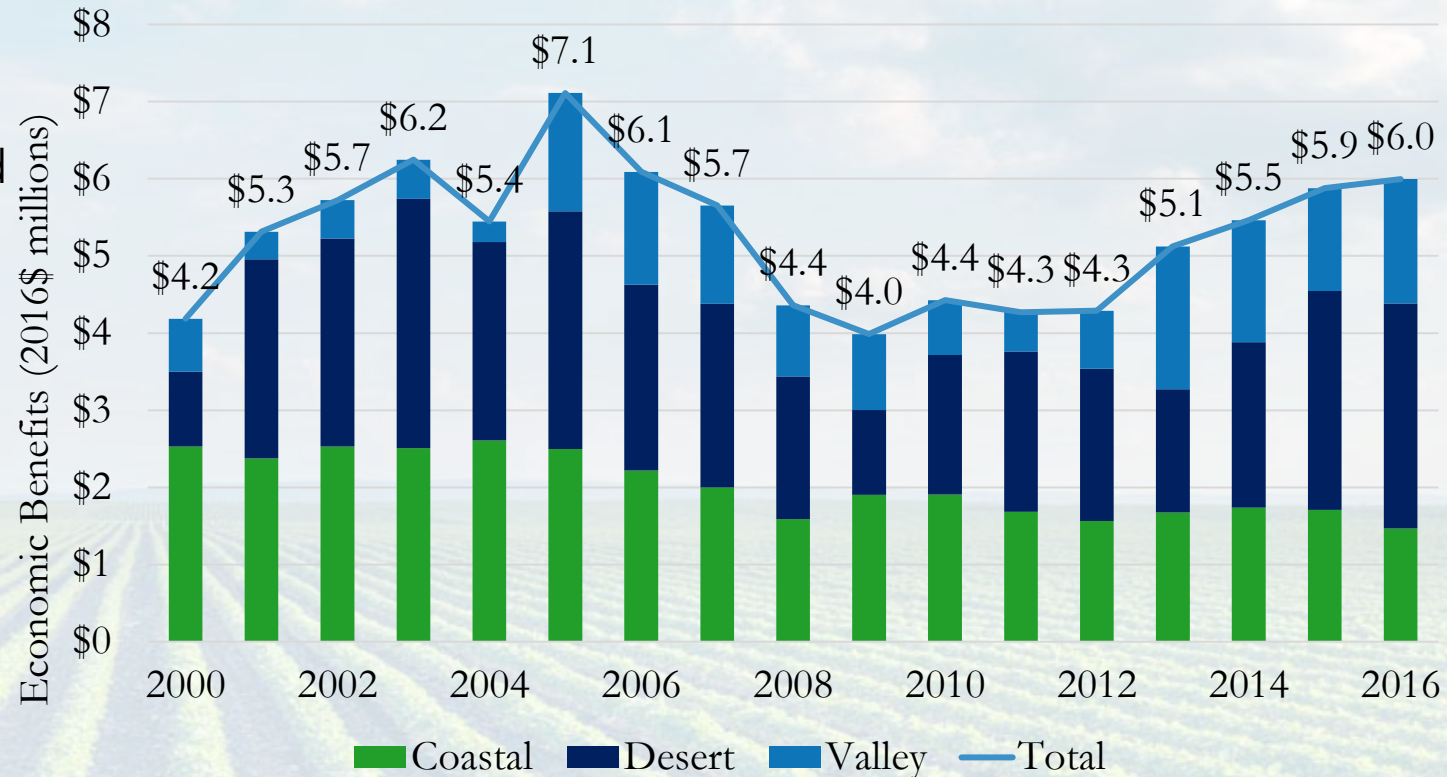
California Onion Harvested Acres and Farmgate Value, 2000-2016





# Dacthal Onion Benefits

- Dacthal alternatives increase production cost by \$51/acre
  - Reduced material cost, increased hand-weeding cost
- Alternative reduces yield by 5%, resulting in loss of \$606/acre
- Annual benefit range
  - \$4 - \$7 million

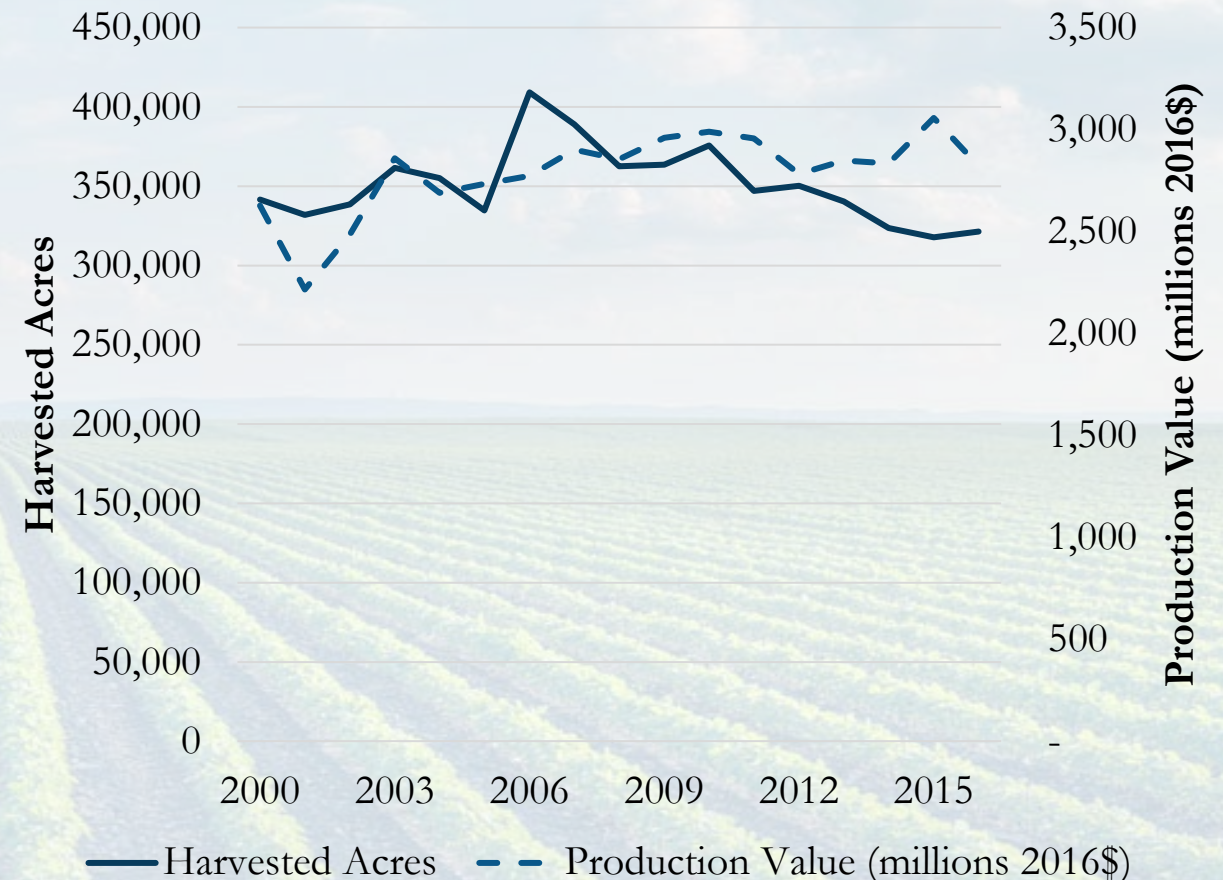


Total Economic Benefit	Onion
2000-16 per acre average	\$657

# Broccoli Overview

- 120,000 acre; \$785 million value
- 83% production in 3 counties
  - Monterey: 58,000 acres
  - Santa Barbara: 25,000 acres
  - Imperial: 15,000 acres
- Typically grown in lettuce, melon, or other vegetable rotations
- Acreage steady; value growth
  - Per capita consumption up 20% since 2000 (10.1 lbs)

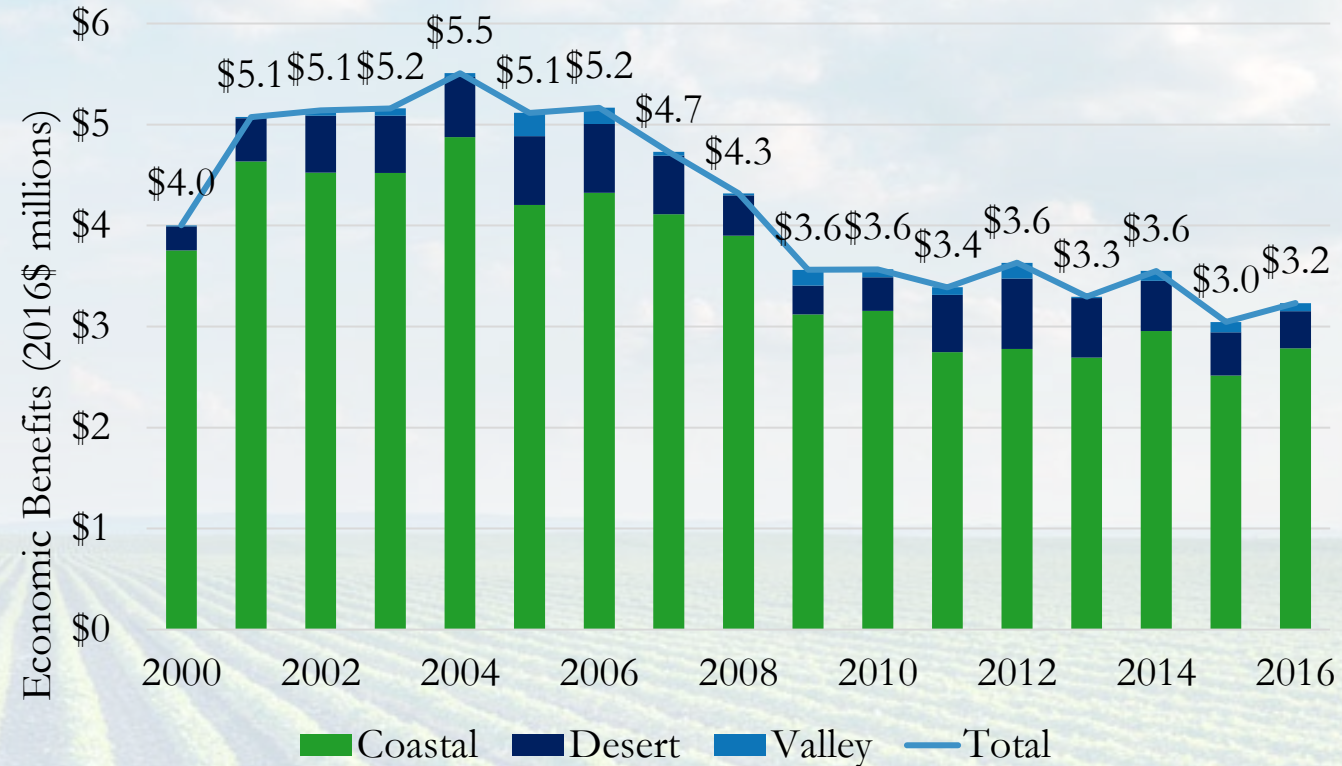
California Broccoli and Lettuce Harvested Acres and Farmgate Value, 2000-2016





# Dacthal Broccoli Benefits

- Dacthal alternatives increase production costs by \$143/acre
  - Reduced material cost, increased hand-weeding cost
  - Alternatives herbicides have lower material cost, but higher hand weeding requirements
- Annual benefit range
  - \$3 - \$5.5 million



Total Economic Benefit	Broccoli
2000-16 per acre average	\$143

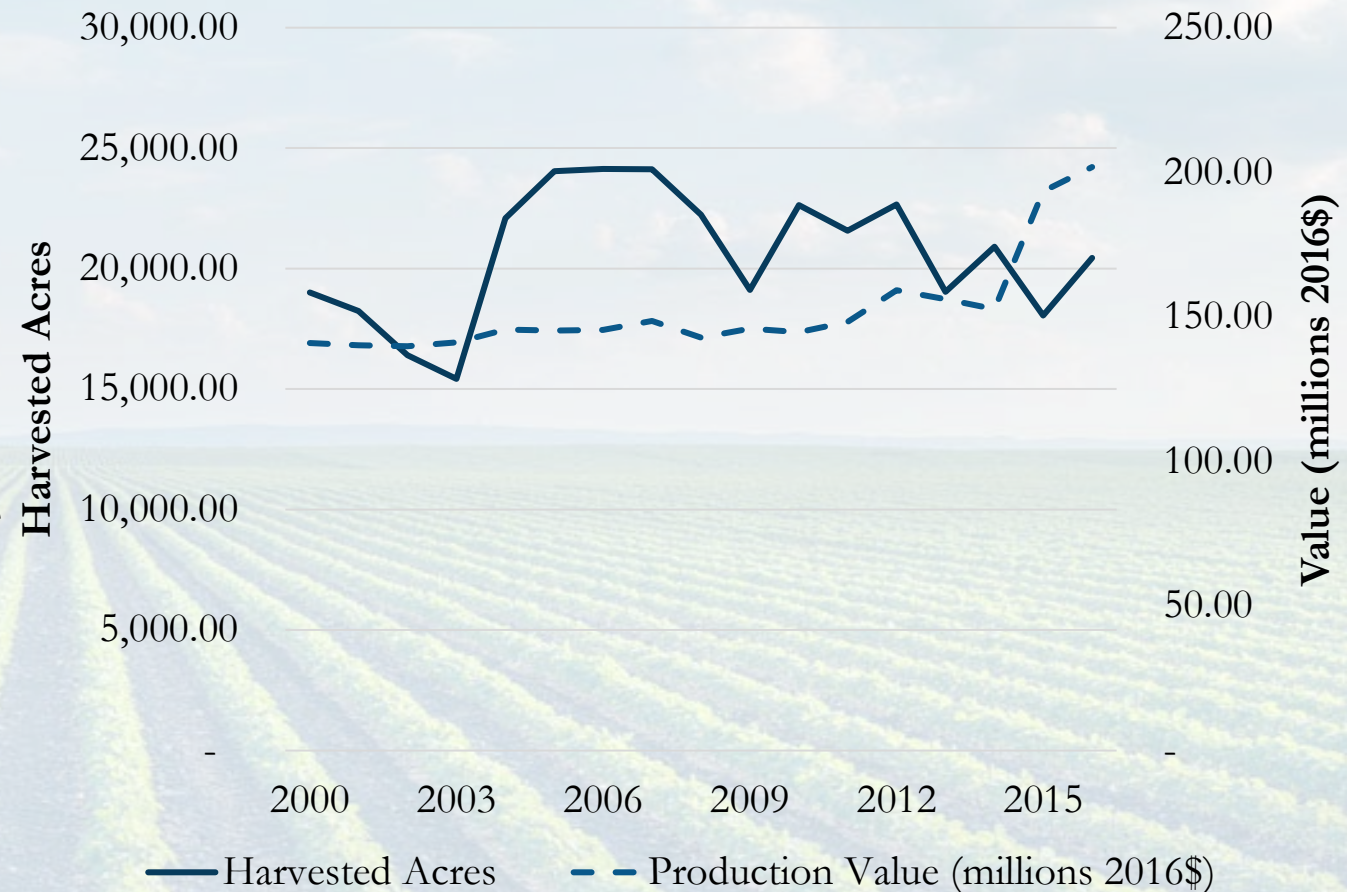


# Brussels Sprouts and Asian Vegetables

## Overview

- Brussels sprouts
  - 5,300 acres; \$74 million value
  - Produced in coastal counties
  - Strong growth in fresh market
    - Consumption/capita up 72% since 2014 (0.8 lbs)
- Asian vegetables
  - 15,000 acres; \$152 million value
  - Acreage varies
  - Market growth in recent years
    - Nearly exclusive for the domestic fresh market

California Brussels Sprouts and Asian Vegetable  
Harvested Acres and Farmgate Value, 2000-2016



# Dacthal Brussels Sprout and Asian Vegetable Benefits

- Dacthal alternatives increase production cost by
  - \$120/acre (Brussels Sprouts)
  - \$128/acre (Asian Vegetables)
  - Reduced material cost, increased hand-weeding cost
- Potential crop damage for Asian Vegetables (modeled at 5%)



Total Economic Benefit	Brussels Sprouts
2000-16 per acre average	\$120

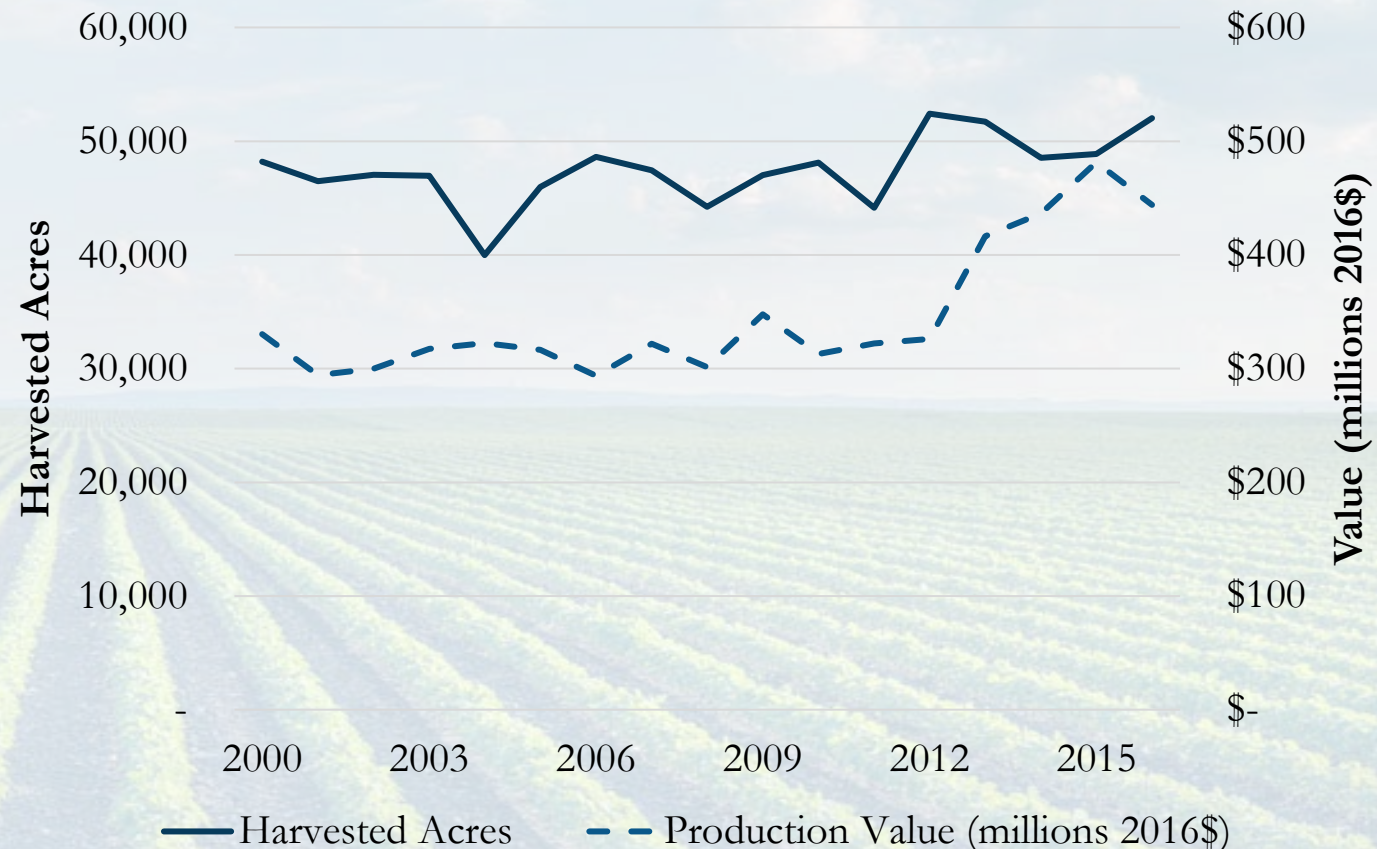
Total Economic Benefit	Asian Vegetables
2000-16 per acre average	\$1,360



# Cauliflower and Cabbage

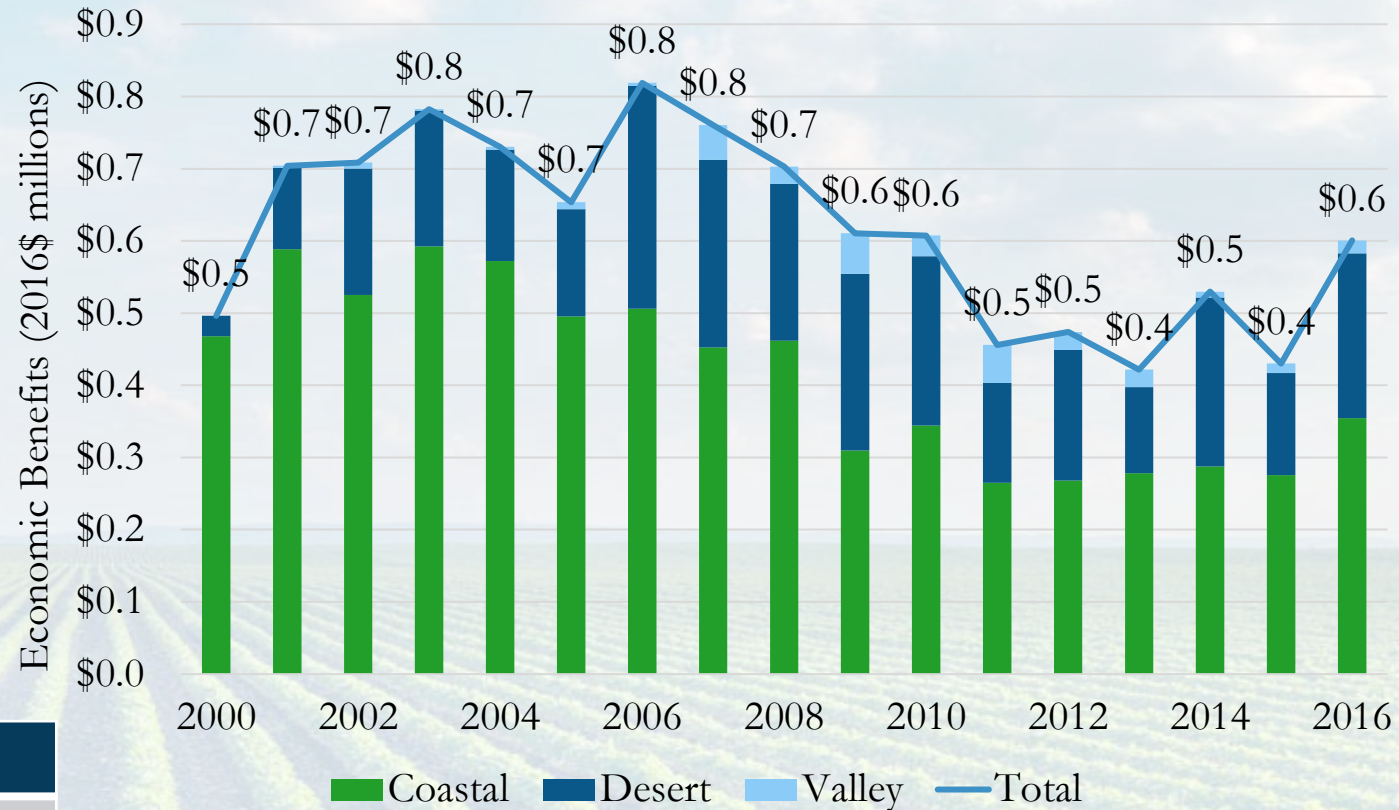
- 52,000 acres; \$445 million value
- Over 85% of cauliflower and cabbage acreage in Monterey, Santa Barbara, Imperial, and Santa
- Fresh market cauliflower demand growth
  - Consumption/capita up 25% since 2000 (2.18 lbs)
  - 88% of US exports are from California
- Cabbage consumption per capita has stabilized, exports are currently around \$12 million annually

California Cauliflower and cabbage Harvested Acres and Farmgate Value, 2000-2016



# Dacthal Cauliflower and Cabbage Benefits

- Dacthal alternatives increase production cost by:
  - \$87/acre (cauliflower)
  - \$125/acre (cabbage)
  - Comparable material cost, increased hand-weeding cost
- Annual benefit range
  - \$400K - \$800K



Total Economic Benefit	Cauliflower
2000-16 per acre average	\$87

Total Economic Benefit	Cabbage
2000-16 per acre average	\$125



# Dacthal Benefits Summary

- Dacthal Benefits:
  - \$10 - \$17 million/year for crop production
  - **\$20 – \$37 million/year in total**
- Dacthal increases variability in net farm income by 4% on average (1.5% – 9%)
- Uncertainties
  - Labor is increasing scarce and costly in California; economic benefits increase if growers are not able to secure labor supply
    - AB 1066 and immigration reform
  - The joint effect of other regulations
  - Greater yield losses will increase benefits

