Western U.S. Leafy Greens Industry Research Priorities Survey Data Summary

DEMOGRAPHICS

Respondent Growing Region	**N=**	**%**
Arizona Only	14	17.9%
CA Only	10	12.8%
CA and AZ	54	69.2%
Total	78	

Respondent Growing Region	**N=**	**%**
AZ and CA Desert Only	35	44.9%
Non-Desert	43	55.1%
Total	78	

Acres of leafy greens grown by respondents	**N=**	**%**
1-1000	9	1-1000
1001-5000	15	1001-5000
5001-10000	4	5001-10000
1000-20000	10	1000-20000
Total	38	

Crops grown by respondents	**N=**	**%**
Lettuce (Conventional, Organic, Iceberg, Romaine, Leaf)	38	100.0%
Spinach (Conventional & Organic)	24	63.2%
Other Leafy Greens (Conventional & Organic)	26	68.4%
Lettuce Organic (Iceberg, Romaine, Leaf)	25	65.8%
Lettuce Conventional	35	92.1%
Leaf lettuce Conventional	32	84.2%
Other leafy greens Conventional	30	78.9%
Leaf lettuce Organic	28	73.7%
Romaine Organic	26	68.4%
Spinach Organic	18	47.4%
Other leafy greens Organic	27	71.1%
Spinach Conventional	26	68.4%
Total	38	

Crop Type	**Maximum Reported Acreage**	**Minimum Reported Acreage**	**Median Reported Acreage**	**Mean Reported Acreage**		**Standard Deviation**
Head lettuce Conventional	10000.00	10.00	1100.00	2162.50	±	2663.61
Head lettuce Organic	500.00	20.00	90.00	123.64	±	133.37
Romaine Conventional	8700.00	10.00	1000.00	1935.85	±	2193.80
Romaine Organic	2500.00	1.00	250.00	311.82	±	508.02
Leaf lettuce Conventional	3100.00	1.00	500.00	721.11	±	750.21
Leaf lettuce Organic	1650.00	1.00	100.00	265.79	±	408.05
Spinach Conventional	3200.00	4.00	500.00	884.94	±	873.83
Spinach Organic	8000.00	1.00	200.00	960.06	±	1893.35
Other leafy greens Conventional	4000.00	2.00	400.00	671.80	±	866.15
Other leafy greens Organic	5000.00	1.00	350.00	801.07	±	1237.72

N=38

Area of the Industry Represented by Respondents
(Multiple answers per respondent)

	N=	**%**
R & D (gov. or university)	2	2.6%
Nursery production	5	6.4%
Ag equipment	5	6.4%
R & D (industry)	6	7.7%
Processor	9	11.5%
Ag chemicals	10	12.8%
PCA	10	12.8%
Seed distributor	13	16.7%
Seed/Variety development	14	17.9%
Shipper	21	26.9%
Grower	41	52.6%
Total Responses	136	
Total Respondents	78	

QUESTIONS OF RESEARCH NEEDS

1. What are the top three pests that impact your operation?

All Respondents	N=	%
Thrips	53	70%
Aphids	52	68%
Whiteflies	23	30%
Diamondback moth	16	21%
Bagrada bug	14	18%
Leafminer	12	16%
Beet armyworm	9	12%
Flea beetle	8	11%
Nematodes	7	9%
Seedling pests	6	8%
Cabbage looper	5	7%
Corn earworm	4	5%
Lygus bug	3	4%
Springtail	2	3%
Cabbage maggot	1	1%
Mites	1	1%
Total Responses	216	
Total Respondents	76	

Desert Respondents	N=	%
Aphids	23	68%
Thrips	20	59%
Whiteflies	12	35%
Bagrada bug	6	18%
Diamondback moth	6	18%
Flea beetle	5	15%
Beet armyworm	4	12%
Cabbage looper	4	12%
Nematodes	4	12%
Leafminer	3	9%
Lygus bug	3	9%
Corn earworm	1	3%
Seedling pests	1	3%

2. What are the top three areas of pest management that need more focus?

All Respondents	N=	%
New pest-resistant plant varieties	46	61%
Pesticide resistance prevention and management	37	49%
Pesticide resistance screening and monitoring	25	33%
New OMRI-listed insecticides	24	32%
New conventional modes of action	23	31%
Efficacy of natural enemies as biological controls	15	20%
Efficacy trials of conventional insecticides	12	16%
Efficacy trials of OMRI-listed insecticides	7	9%
Total Responses	189	
Total Respondents	75	

Desert Respondents	N=	%
New pest-resistant plant varieties	18	53%
Pesticide resistance prevention and management	17	50%
New OMRI-listed insecticides	12	35%
Efficacy trials of OMRI-listed insecticides	11	32%
Pesticide resistance screening and monitoring	10	29%
New conventional modes of action	9	26%
Efficacy of natural enemies as biological controls	6	18%
Efficacy trials of conventional insecticides	6	18%
Total Responses	89	
Total Respondents	34	

3. What are the top three plant diseases that you are most concerned about?

All Respondents	N=	%
Bacterial leaf spot	4	5%
Bottom rot (Rhizoctonia)	5	7%
Corky root	1	1%
Downy mildew of leafy brassicas	5	7%
Downy mildew of lettuce	45	59%
Downy mildew of spinach	23	30%
Fusarium wilt of lettuce	59	78%
Fusarium wilt of spinach	2	3%
Powdery mildew	12	16%
Pythium wilt of lettuce	6	8%
Sclerotinia	34	45%
Seedling damping-off diseases	7	9%
Verticillium wilt	14	18%
Total Responses	217	
Total Respondents	76	

Desert Respondents	N=	%
Fusarium wilt of lettuce	28	82%
Downy mildew of lettuce	21	62%
Sclerotinia	20	59%
Downy mildew of spinach	8	24%
Powdery mildew	5	15%
Verticillium wilt	4	12%
Bottom rot (Rhizoctonia)	3	9%
Downy mildew of leafy brassicas	2	6%
Pythium wilt of lettuce	2	6%
Seedling damping-off diseases	2	6%
Bacterial leaf spot	1	3%
Fusarium wilt of spinach	1	3%
Total Respondents	34	

4. What are the top three areas of plant disease management that need more focus?

All Respondents	N=	%
Breeding for resistance	55	73%
Soil health for disease suppression	44	59%
Soil disinfestation (fumigation alternatives)	34	45%
New tools for detecting plant pathogens	26	35%
Biopesticide efficacy trials	14	19%
Disease forecasting (climate-based)	14	19%
Biostimulants and systemic acquired resistance product trials for preventing disease	12	16%
Non-chemical management strategies	12	16%
Conventional pesticide efficacy trials	8	11%
Total Responses	219	
Total Respondents	75	

Desert Respondents	N=	%
Breeding for resistance	23	70%
Soil health for disease suppression	21	64%
Soil disinfestation (fumigation alternatives)	15	45%
New tools for detecting plant pathogens	10	30%
Biostimulants and systemic acquired resistance product trials for preventing disease	8	24%
Disease forecasting (climate-based)	7	21%
Biopesticide efficacy trials	4	12%
Conventional pesticide efficacy trials	4	12%
Non-chemical management strategies	4	12%
Total Responses	96	
Total Respondents	33	

5. What are the top three areas of soil health that need more focus?

All Respondents	N=	%
Salinity management	32	42%
Integrated strategies for improving soil health	29	38%
Effects of water sanitizers on soil health	28	36%
Importance of soil microbe communities to soil health	27	35%
General nutrient management	23	30%
Nitrogen management	23	30%
Use of cover crops to improve soil health	12	16%
Building organic matter in soils	10	13%
Microbial product evaluations for improved soil health	10	13%
Micronutrient management	10	13%
Phosphorus fertilizer management	8	10%
Tip burn management	8	10%
Low or no till practices	6	8%
Management of heavy metals in soil	1	1%
Total Responses	227	
Total Respondents	77	

Desert Respondents	N=	%
Salinity management	15	44%
Effects of water sanitizers on soil health	14	41%
Importance of soil microbe communities to soil health	14	41%
Nitrogen management	9	26%
General nutrient management	8	24%
Integrated strategies for improving soil health	8	24%
Building organic matter in soils	7	21%
Use of cover crops to improve soil health	7	21%
Microbial product evaluations for improved soil health	5	15%
Micronutrient management	5	15%
Phosphorus fertilizer management	4	12%
Low or no till practices	2	6%
Tip burn management	2	6%
Management of heavy metals in soil	1	3%
Total Responses	101	
Total Respondents	34	

6. In your opinion, what are the most important benefits of soil health?

All Respondents	N=	%
Nutrient management	47	61.0%
Soil resiliency	41	53.2%
Building soil organic matter	38	49.4%
Soil compaction	32	41.6%
Improve water infiltration	29	37.7%
Improving water holding capacity of soil	26	33.8%
Water quality	21	27.3%
Soil aggregate stability	21	27.3%
Erosion control	8	10.4%
Total Responses	263	
Total Respondents	77	

Desert Respondents	N=	%
Building soil organic matter	20	58.8%
Soil resiliency	19	55.9%
Nutrient management	19	55.9%
Soil compaction	15	44.1%
Improve water infiltration	13	38.2%
Improving water holding capacity of soil	10	29.4%
Soil aggregate stability	9	26.5%
Water quality	7	20.6%
Erosion control	2	5.9%
Total Responses	114	
Total Respondents	34	

8. What are the top three areas of water management that need more focus?

All Respondents	N=	%
Irrigation efficiency	60	77.9%
Salinity management	52	67.5%
Water conservation	45	58.4%
Nitrate management	33	42.9%
Off-farm movement of sediment nutrients and pesticide resi	17	22.1%
Water accounting	13	16.9%
Total Responses	220	
Total Respondents	77	

Desert Respondents	N=	%
Salinity management	27	79.4%
Irrigation efficiency	24	70.6%
Water conservation	21	61.8%
Nitrate management	13	38.2%
Water accounting	10	29.4%
Off-farm movement of sediment nutrients and pesticide residue in runoff	2	5.9%
Total Responses	97	
Total Respondents	34	

7. What are the top three production-related areas of food safety that need more focus?

All Respondents	N=	%
Rapid pathogen-specific detection methods for raw product	36	46.2%
Water treatment efficacy to reduce pathogens	31	39.7%
Rapid pathogen-specific detection methods for water	27	34.6%
On-farm risk modeling	24	30.8%
Aerial movement of human pathogens into fields	20	25.6%
Plant breeding for reduced human pathogen colonization	20	25.6%
Wildlife deterrents	19	24.4%
Non-chemical irrigation water treatments	15	19.2%
New sanitizers for water treatments	13	16.7%
Risk in the use of biological soil amendments of animal origi	13	16.7%
Rapid pathogen-specific detection methods for soil amendm	4	5.1%
Total Responses	222	
Total Respondents	78	

Desert Respondents	N=	%
Rapid pathogen-specific detection methods for raw product	18	51.4%
Water treatment efficacy to reduce pathogens	15	42.9%
Wildlife deterrents	13	37.1%
Rapid pathogen-specific detection methods for water	10	28.6%
New sanitizers for water treatments	9	25.7%
Non-chemical irrigation water treatments	7	20.0%
On-farm risk modeling	7	20.0%
Plant breeding for reduced human pathogen colonization	6	17.1%
Risk in the use of biological soil amendments of animal origin	6	17.1%
Aerial movement of human pathogens into fields	5	14.3%
Rapid pathogen-specific detection methods for soil amendments	2	5.7%
Total Responses	98	
Total Respondents	35	

9. What are the top three areas of agricultural mechanization that need more focus?

All Respondents	N=	%
Automated harvesting-head lettuce	34	44.7%
Automated weeding-conventional	33	43.4%

Desert Respondents	N=	%
Automated weeding-conventional	17	51.5%
Automated harvesting-head lettuce	12	36.4%

Automated harvesting-romaine	27	35.5%	Automated thinning-conventional	12	36.4%
Automated weeding-organic	24	31.6%	Automated weeding-organic	12	36.4%
Automated thinning-conventional	23	30.3%	Automated harvesting-romaine	9	27.3%
Precision agriculture-variable rate technologies	15	19.7%	Precision agriculture-variable rate technologies	8	24.2%
Spray systems technologies	13	17.1%	Automated thinning-organic	5	15.2%
Automated harvesting-other leafy greens	11	14.5%	Automated harvesting-leaf lettuce/spinach	4	12.1%
Automated harvesting-leaf lettuce/spinach	10	13.2%	Automated harvesting-other leafy greens	4	12.1%
Automated transplanting	9	11.8%	Reduced/conservation tillage	4	12.1%
Reduced/conservation tillage	9	11.8%	Spray systems technologies	4	12.1%
Automated thinning-organic	8	10.5%	Automated transplanting	3	9.1%
Total Responses	216		**Total Responses**	94	
Total Respondents	76		**Total Respondents**	33	

10. What are the top three topics that you would like to be prioritized for research funding?

All Respondents	**N=**	**%**	**Desert Respondents**	**N=**	**%**
Plant disease management	51	65.4%	Plant disease management	19	55.9%
Mechanization	29	37.2%	Soil health management	16	47.1%
Soil health management	29	37.2%	Mechanization	14	41.2%
Pest management	27	34.6%	Post-harvest food safety	11	32.4%
Post-harvest food safety	23	29.5%	Pest management	10	29.4%
In-field food safety- non-water source focus	16	20.5%	Water conservation	10	29.4%
Water conservation	16	20.5%	In-field food safety- non-water source focus	6	17.6%
In-field food safety- water source focus	12	15.4%	In-field food safety- water source focus	6	17.6%
Nutrient management	10	12.8%	Nutrient management	4	11.8%
Salinity management	8	10.3%	Salinity management	3	8.8%
Improved decision-making tools	6	7.7%	Improved decision-making tools	2	5.9%
Respondents who chose one of the 3 food safety topic	38	48.7%			
Total Responses	265		**Total Responses**	101	
Total Respondents	78		**Total Respondents**	34	

11. What resources have been most useful to you in the past?

All Respondents	**N=**	**%**	**Desert Respondents**	**N=**	**%**
Field days	48	61.5%	Workshops	19	55.9%
Workshops	44	56.4%	Field days	16	47.1%
Extension publications	29	37.2%	Extension publications	10	29.4%
In-person presentations	23	29.5%	In-person presentations	10	29.4%
Email newsletters	20	25.6%	Email newsletters	9	26.5%
In-person consultations	20	25.6%	In-person consultations	8	23.5%
Webinars	12	15.4%	Webinars	7	20.6%
Educational websites	8	10.3%	Videos	4	11.8%
Videos	6	7.7%	Educational websites	3	8.8%
Social media	3	3.8%	Social media	2	5.9%
Total Responses	213		**Total Responses**	88	
Total Respondents	78		**Total Respondents**	34	