



DEPARTMENT OF LAND, AIR AND WATER RESOURCES

VEIHMAYER HALL
DAVIS, CALIFORNIA 95616

July 1, 1991

TO: Participants of Meeting on BMP Assessment Project

FROM: Ken Tanji
Ken Tanji, P.I. *slr*

Attached is the time schedule of project activities that was inadvertently left out in the June 27, 1991 packet of materials.

Also attached is a tentative list of potential best management practices for nitrogen and salinity. We have also developed a list of potential best management practices for on-farm water management since it has major impacts on nitrogen and salinity management.

Please review these management practices. It should be recognized that a given set of crop, soil, water and climatic condition, a combination of management practices would be recommended to minimize agricultural NPS pollution effects.

KKT:slr



**Land, Air & Water
Resources**

Best Management Practices (BMP) Assessment Models for Agricultural Nonpoint Source (NPS) Pollution.

SWRCB Interagency Agreement No-0-141-250-0

Phase	Task	Subtask	Scope Description	1991												1992												
				M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D					
1			NITRATES AND SALINITY																									
	1		Appoint and Consult with Study Teams																									
	2		Review Existing Models																									
	3		Review Site-Specific BMP Data																									
	4		Select and Formulate Models																									
	5		Model Sensitivity Analysis & Calibration																									
	6		Model Validation—Case Studies																									
	7		Apply Model to Sensitive Areas of State																									
	8 a		Progress Report																									
	8 b		Draft Project Report																									
	8 c		Final Project Report																									

Sustained Effort

Intermittent Effort

Single Day or Less Events

Goals: Minimize deleterious impacts of salinity on crop yield; control and minimize salt loading to off-site environments.

<u>Practice</u>	<u>Effect</u>
Evaluate salt balance in crop root zone	Consider sources and sinks for better water and salinity management strategies
Management of saline soils	Control soil salinity in crop root zone to achieve acceptable crop yield; but in so doing, discharge of salt load to off-site environment is unavoidable.
Measure initial soil salinity status	Gives information on distribution of soluble salts in the crop root zone and presence of salt-producing minerals such as gypsum; use this knowledge to select leaching and drainage practices
Select most efficient leaching practice	Use water application method that will use the least amount of water to desalinate soils in the crop root zone, e.g., unsaturated flow, cyclic leaching, changing quality of leaching waters, soil and water amendment
Assess drainability of soils	Use practices that will allow for adequate drainage and salinity control in the crop root zone, e.g., underdrainage, deep plowing, shallow water table management
Monitor soil salinity	Useful for crop selection and water management strategies such as leaching, drainage, drainwater reuse.
Seed and seedling placement	Plant in areas of beds where surface salt accumulation is not likely to accumulate for seed germination and early plant growth
Planting salt tolerant plants	For areas of elevated soil salinity and/or high salt irrigation waters; also for drain water reuse.
Management of saline waters	Utilize waters to the fullest extent possible to minimize salt loading to off-site environment
Assess leaching fraction	Evaluate water salinity for use on specific crops, and soil and climatic conditions, guided by crop salt tolerance data and leaching fraction estimation
Assessing irrigation water quality	Provide appraisal on suitability of given water for crop production
Salinity	Affects availability of water to crops; crops vary in their salt tolerance

PracticeEffect

Sodicity/salinity

Affects water infiltration rates into soils and soil permeability; may affect irrigation practice, leaching and drainage

Specific toxic ions

Affects crops sensitive to boron, sodium, chloride; may restrict certain crops and use of sprinkler application method

Diagnosing Salt Problems:

Visual indications

May provide indication of salt problem but in most probability not the extent of salt damage or the contributing causes of salinity; needs to be followed up with more definitive diagnosis and measurements

Salinity measurements

Will give spatial and temporal distribution of salinity; use soil saturation extracts, salinity probe and/or eng. device

Assess potential causes of salinity

Evaluate irrigation water salinity, adequacy of leaching and drainage, and primary sources of salinity to ameliorate the salt problem

Assess other related problems

Evaluate crusting of surface soils, slow water penetration, specific ion toxicity, etc. to take corrective action

Potential Best Management Practices for On-Farm Water Management

Goals: To use water as efficiently as possible and prevent excessive leaching of nitrates and salinity.

<u>Practice</u>	<u>Effect</u>
Irrigation System Evaluations	Improve application efficiency and better uniformity of application
Irrigation Scheduling Using Real Time Weather Data	Aids in proper timing of irrigation
Evaluating Crop ET, Fallow ET	Assesses vegetated and fallow surface water losses
Monitoring Soil Water Status	Provides information on available soil water from irrigation and rainfall
Monitoring Water Flows and Duration of Application	Gives estimate of amount of applied water and minimizes deep percolation and runoff losses
Selection of Proper Irrigation Method for Site Specific Conditions	Method used is somewhat dependent on crop type, soil and climatic conditions
Surface Irrigation Methods:	
Land grading, slope modification	Produce more uniform slope
Shorten furrow length	Improves uniformity coefficient
Tail water recovery system	Increases water use efficiency
Cut-back irrigation for furrow, border, and basin irrigations	Controls advance/recession times for better uniformity
Surge flow irrigation	Improve uniformity distribution
Furrow compaction to reduce infiltration rates	Improve uniformity distribution
Sprinkler Irrigation Methods:	
Proper water pressure, sprinkler head and nozzle	Improves areal uniformity, prevent runoff losses
Proper layout/spacing, accounting for wind effects	Improves areal uniformity

<u>Practice</u>	<u>Effect</u>
Drip/Trickle Irrigation Methods:	
Proper design, filtration system and water pressure	Improve uniformity and operating life of the system
Water treatment to prevent plugging by mineral deposits, and microbial debris.	Aids in precise applications of water
Proper irrigation scheduling and operation	Increase water use efficiency and uniformity distribution
Checking variability of emitter discharge from wear and manufacturing variability	Decreases nonuniformity
Practice flushing of lines	Reduced plugging and increases system operation life
Subsurface Irrigation Methods:	
Monitoring shallow water table for draining excess water and/or crop water supply	Important for drainage impacted lands
Proper design, spacing and depth	Improves application and uniformity distribution
Subsurface drainage systems	Prevents waterlogging and associated salt buildup
Proper design, spacing and depth	Considers soil, crop and depth of water table; minimize draining of poorer quality water from deeper depths in water table
Drainwater reuse for salt-tolerant crops, trees, halophytes	Increases overall water usage

Potential Best Management Practices for Nitrogen Management

Goals: To improve efficiency of N use and prevent excessive losses of N to off-site environment.

<u>Practice</u>	<u>Effect</u>
Fertilization amount:	
Application of recommended rate of N for each crop	Reduces excessive concentrations of soil nitrate
Inclusion of nutrient credits for:	
Residual inorganic N in soil	Reduces fertilizer N required for optimal crop yield
Inorganic N in irrigation water	Reduces fertilizer N required for optimal crop yield
Mineralization of soil organic N	Reduces fertilizer N required for optimal crop yield
Biologically fixed N	Reduces fertilizer N required for optimal crop yield
Animal Manures	Reduces fertilizer N required for optimal crop yield
Crop tissue nitrate analysis	Matches temporal crop N requirements to increase efficiency of N use via mid-season feedback for fertilization timing/amount
Fertilization timing:	
No application of N during periods of low crop N requirement and high leaching potential	Increases crop N use efficiency, reduces leaching of nitrate Timing depends on crop and climate
Split application	Increase efficiency of fertilizer N use by applying when crop need is greatest
Minimal or no late season N applications	Reduces excessive concentrations of soil nitrate
Fertilization method:	
Banding/incorporation	Reduces loss of N in runoff compared to broadcast application
Fertilization	Increases efficiency of crop use of N; can vary application rate to coincide with crop growth rate
Fertilizer form:	
Ammonia-based forms	Reduces leaching potential in the short-term than nitrate forms
Slow release fertilizers	Matches N release rate more closely with growing season crop requirement

<u>Practice</u>	<u>Effect</u>
Nitrification inhibitors	Reduced rate of nitrate formation results in less N leaching potential
Organic N:	
Storage of manure for spring application	Reduces nitrate leaching
Application of manure at rates to meet crop N requirements not for manure disposal	Avoids excessive soil nitrate and salinity buildup
Irrigation management:	
Use of BMP's for on-farm water management	Reduces nitrate leaching and surface runoff losses
Collection and reuse of nitrate in tailwater	Reduces nitrate loading of surface waters
Agronomic management:	
Crop selection:	
Use of deep-rooted crops	Extracts nitrate more efficiently from deeper soil depths
Rotation of deep-rooted, high N uptake crops after shallow-rooted high N requiring crops	Extracts residual nitrate from deeper soil depths
Cover crops	Absorbs residual nitrate during winter season
Residue management:	
Management of residues so nitrate is not released before or during rainy season	Reduces nitrate leaching losses and increased N availability to crops

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DEPARTMENT OF LAND, AIR AND WATER RESOURCES

VEIHMEYER HALL
DAVIS, CALIFORNIA 95616

June 27, 1991

TO: Participants of Meeting on BMP Assessment Project

FROM:

Ken
Ken Tanji, P.I.

Attached is the agenda for our July 16, 1991 meeting to be held from 10:00 a.m. to 4:00 p.m. in Room 2124, Wickson Hall, Davis Campus.

A map for Davis campus, parking permit and recommended parking lot is enclosed.

An interim list of potential BMPs is being developed and will be mailed to you before the meeting.

The following is asked of members of the Study Team:

- (1) A 3-minute briefing of your technical background with particular focus on nitrates or salinity.
- (2) A brief oral report on past and soon-to-be-completed studies involving BMPs for nitrates or salinity in designated areas (Salinas and SJV east side for nitrate, SJV west side and Imperial Valley for salinity). We are particularly interested in databases on current practices as well as potential BMPs.
- (3) For item (2) above, a copy of reports or publications would be appreciated. Study team members who do not have access to site specific studies will have other opportunities to contribute in the near future.

Please contact Ken Tanji at 916-752-0683 or Bruce Warden at 916-752-2503 if you have any questions.

KKT:slr

BMP Assessment Project Meeting

July 16, 1991
10:00 a.m. to 4:00 p.m.

2124 Wickson Hall
Davis Campus

Agenda

10:00 a.m. Introductions

Project Description: background, tasks and schedule

Technical Background of Research Staff (3 min. each)

Responsibilities of Study Teams (Task 1)

Technical Background of Members of Study Team (3 min. each)

Overview on Research and Management Models (Task 2)

Potential BMPs for Nitrates (Task 3)

Potential BMPs for Salinity (Task 3)

12:00 p.m. Hosted Lunch

1:00 p.m. Site-Specific Studies and Available Data Base for Potential BMPs
(Task 3)

Nitrate Study Team (Salinas Valley, SJV east side)

Salinity Study Team (SJV West side, Imperial Valley)

Appraisals on Availability of Data Bases

Initial Assessments on Candidate Models for Nitrate and Salinity
BMPs (Task 4)

Schedule for Next Meeting

4:00 p.m. Adjourn

Attachments: Project Description, Activity Schedule, Project Staff, Nitrate
Study Team, Salinity Study Team

Best Management Practices (BMP) Assessment Models for Agricultural Nonpoint Source (NPS) Pollution. (SWRCB Interagency Agreement No-0-141-250-0)

Background

Surface and ground water quality impacts from agricultural NPS pollution is a growing problem in California and elsewhere. Best Management Practices (BMPs) are a means of controlling agricultural NPS pollution. But, what are site-specific BMPs for impacted areas? How much do they cost or profit the farmer? This project assesses BMPs for salinity and nitrate NPS pollution control using conceptual farm-scale management and economic models.

Scope of Work

The work is subdivided into eight tasks:

- Task 1—appoint and consult with a nitrate study team and a salinity study team (schedule of meetings in Fig. 1).
- Task 2—review existing conceptual salinity and nitrate models. Required outputs of the model are annual or seasonal drainage volume, and nitrate and salinity concentration as a function of inputs and outputs and sources and sinks. The model must assess BMPs as a function of cropping, fertilization, irrigation, and drainage management practices, and climate and soil conditions.
- Task 3—review site-specific data on salinity and nitrate for prospective BMPs.
- Task 4—select or formulate conceptual leaching and economic models for BMP assessment. Existing models will be used if feasible. Otherwise, a new main program will be coded and subprograms will be incorporated from existing models or coded as necessary.
- Task 5—calibration and sensitivity analysis of models using data from task 3.
- Task 6—model validation using: Salinas Valley and eastern San Joaquin Valley for nitrates; western San Joaquin Valley and Imperial Valley for salinity.
- Task 7—determine applicability of models to areas sensitive to leaching of nitrate and salinity.
- Task 8—quarterly progress reports, draft project report, and final project report.

Project Schedule

The schedule for execution of tasks is given in Figure 1. Phase 1 tasks will be completed in eighteen months. Anticipated Phase 2 tasks will include analysis of BMPs for pesticides.

Project Budget

The total budget for Phase 1 is \$102,829 of which \$6,000 has been budgeted for study team support. Funding of \$64,351 has been allocated in FY 90-91.

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