Nutrient and Pesticide Management in the HUA

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The Idaho Snake-Payette Rivers Hydrologic Unit Area (HUA) Water Quality Project was one of 74 projects funded nationally by the United States Department of Agriculture (USDA) designed to protect and improve water quality. The purpose of these 8-year, federally funded projects was to accelerate the transfer of technology necessary to protect ground and surface water quality while maintaining farm profitability. This project had three phases: (1) the determination of surface and groundwater quality problems in the study area; (2) the development of best management practices (BMPs) to solve identified problems; and (3) the implementation of state-of-the-art BMPs on farms in the study area to improve surface and groundwater quality. **BMPs are management strategies that protect water quality without adversely impacting the profitability of farms**. Three USDA agencies-the Natural Resource Conservation Service (NRCS; formerly the Soil Conservation Service), the University of Idaho Extension System (ES), and Farm Services Agency (FSA; formerly the ASCS) provided leadership for this project.

The Idaho Snake-Payette Rivers (HUA) Water Quality Project includes more than 840,000 acres in Canyon, Gem, Payette, and Washington counties in southwestern Idaho (Figure 1). Within this geographic area are more than 3,400 farms covering more than 500,000 acres. Virtually all of the highly productive farmland is irrigated and the type of agriculture practiced is diverse, as more than 40 different crops are grown. The largest acreage crops include: alfalfa (76,000 acres), wheat (52,400 acres), sugarbeets (39,100 acres), barley (25,100 acres), corn (20,800 acres), beans (12,100 acres), orchard crops (12,090 acres), peppermint (11,000 acres), oats (9,800 acres), seed crops (8,800 acres), onions (7,700 acres), potatoes (5,000 acres), hops (2,600 acres), and spearmint (2,000 acres). A competitive USDA grant awarded to the NRCS, FSA, and University of Idaho Cooperative Extension System allowed the HUA project to hire staff located in a centrally located office. NRCS personnel provided the technical assistance necessary for BMP implementation. The FSA provided cost-share assistance for BMP implementation and the University of Idaho Cooperative Extension System provided educational and technical BMP information to individual growers.

Nitrate-N and pesticides have been detected in groundwater and surface waters within the Snake-Payette Rivers HUA and across the USA. The public requires that agriculture

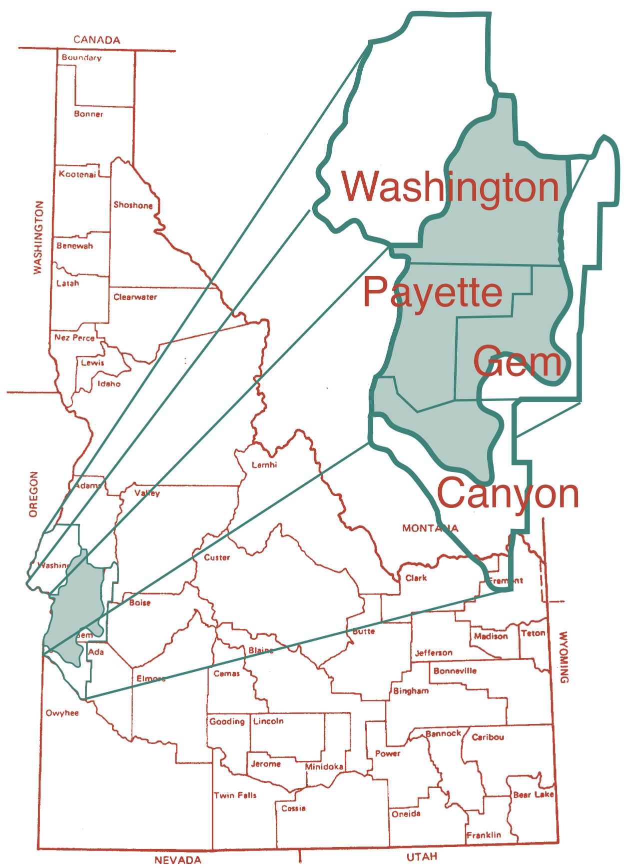

Figure 1.
Map of HUA area in Southwestern Idaho encompassing Canyon, Gem, Payette and Washington counties.

judiciously use nutrients (such as N and P) and pesticides to minimize potential environmental contamination. Leaching losses of Dacthal and NO_3-N into groundwater are of special concern in southwestern Idaho. The groundwater beneath much of the Snake-Payette Rivers HUA is particularly vulnerable to nutrient and pesticide contamination because groundwater depth is shallow and irrigation and agrichemical use are intense.

Degradation products of Dacthal (a herbicide) have been detected at low concentrations in the aquifer of the Snake-Payette Rivers HUA. The herbicides 2,4-D and metribuzin, and the insecticide Diazanon have also been found in rural water samples. In a recent study conducted by the Idaho Department of Agriculture it was determined that the primary cause for pesticide residue in groundwater was extended durations of irrigation sets that are common with furrow irrigation. These extended irrigation sets result in excessive water percolation below the crop root zone. Such percolation can leach agrichemicals beyond the root zone and eventually contaminate groundwater.

The Environmental Protection Agency (EPA) drinking water standard for nitrate-N of 10 parts per million (ppm) is exceeded in about 10 percent of the wells in the HUA. This compares unfavorably to the rest of the United States on the whole where the drinking water standard is exceeded in only 2.4 percent of the wells.

Surface water quality is also a primary concern in the HUA project area. Both federal and state agencies have data that show agrichemicals have a negative impact on surface waters (rivers) in the HUA. Soil losses average approximately 15 tons per acre per annually under furrow irrigation systems in the HUA. Each ton of sediment removed from those croplands contains approximately 3 lb of phosphate in addition to nitrate-N and other nutrients and pesticides. Consequently, each acre of irrigated cropland contributes about 45 lb of phosphate to the Snake and Payette Rivers each year. This eroded sediment has the potential to carry agrichemicals such as nitrogen, phosphate, and pesticides directly into these rivers limiting water quality in downstream reservoirs along the way.

A major goal of the HUA project was to protect both surface and groundwater quality through improved nutrient and pesticide management. This report summarizes four major areas of progress: (1) cropping practices surveys to determine actual patterns and use rates of pesticides and nutrients; (2) development of a field record book and management system for the judicious use of agrichemicals, particularly nitrate-N; (3) educational programs integrating nutrient, pesticide, and water management; and (4) educational programs to bring patterns and rates of agrichemical use in balance with economic and environmental concerns.

Cropping Practices Surveys

A survey of current grower pesticide and nutrient management practices was a necessary initial step for development of education and management plans focused on the improvement of agrichemical management in the HUA. Specific survey objectives were to: (1) quantify the amounts and types of agrichemicals (pesticides and nitrogen) used on important crops in the HUA, (2) determine the use of pesticide and nutrient BMPs on selected crops, (3) involve key industry and agency personnel who commonly make pesticide and fertilizer management decisions or supply pesticides and fertilizers to growers in the survey process, and (4) collect data to prioritize educational and management implementation efforts over the remaining years of the HUA.

Nutrient and pesticide use practices were surveyed for eleven of the more than 40 crops grown in the HUA that collectively represent about 80 percent of the agricultural land within the HUA. The average annual planted acreage for each crop and the number of fields included in this survey are shown in Table 1.

Thirty-five local fieldmen and representatives of 19 private companies actively participated in this survey. Data that represented 13,000 acres of cropland (3.5 percent of the irrigated acres in the HUA) were collected using both grower interviews and field records. All data were collected in January and February of 1992.

Pesticide Use Survey

Growers in the HUA rely on multiple applications of pesticides for chemical pest control on intensively managed crops. Depending on the crop, between two and 12 pesticide applications are made each year (Figure 2). Onions are the most intensively managed crop with an average of 12 pesticide applications per season. Conversely, field corn receives an average of only two pesticide applications per season. Fumigation prior to planting is common for both onions and potatoes. Fumigants suppress nematodes and soil-borne root diseases. Use of fumigation on sugarbeet fields and new orchards has increased in the past 20 years.

Between one and six separate herbicide applications are applied each season to crops in the HUA (Figure 3). Sugarbeets receive the greatest number of herbicide applications, while sweet corn, hops, and small grains generally receive only one herbicide application each year.

One to five annual applications of insecticides are common on crops in the HUA (Figure 4). Onions and

Crop	Acres in the HUA	Fields surveyed
Alfalfa	88,700	90
Bean-dry	12,100	38
Corn-field	25,900	56
Sweet	7,000	107
Hops	1,800	9
Mint	13,000	23
Onion	7,700	43
Orchard	7,800	35
Potato	5,000	28
Small grains	82,000	107
Sugar beets	39,000	85
Total	290,000	541

Table 1. The average annual planted acreage of the eleven most commonly grown crops in the HUA project area and the number of fields surveyed for each crop.

orchard crops receive the greatest number of insecticide applications primarily to reduce onion thrip and codling moth pressures. Field corn and small grains receive approximately one insecticide application each season.

Fungicides are routinely applied to six of the 11 crops surveyed (Figure 5). With an average of 3.5 fungicide applications per year, onions receive the greatest number of fungicide applications, which are primarily directed at powdery mildew.

Miticides are routinely applied to alfalfa, beans, hops, mint, orchard crops, potatoes, and sweet corn in the HUA (Figure 6). The greatest miticide use is on sweet corn for processing primarily to control spider mites.

Nutrient Use Survey

A major purpose of the nutrient use survey was to determine the basis for applying N to a field. Through this survey, soil and/or plant tissue samples were found to be the basis for applying N on only 55 percent of the acreage surveyed (Figure 7). Nitrogen recommendations are based on soil samples only on 33 percent of the acreage, while both soil and tissue sampling are used to determine nitrogen application rates on 19 percent of the acreage.

The crop grown has a major impact on the use of soil and/or plant diagnosis for determining the N fertilizer application rate. Virtually all potato, onion, and sugarbeet growers utilized soil and/or plant tissue diagnosis for N management. Conversely, only 25 percent of the cereal acreage (wheat and barley) was soil tested (Figure 8). Plant and/or soil sampling was limited on the alfalfa acreage. The likelihood of testing was related primarily to the economic value of the crop.

Expense did not appear to be the primary reason for not using soil testing for N management on the 45% of the acreage that is not routinely sampled (Figure 9). In fact, 88 percent of the growers believed soil sampling was not necessary. These findings contrast with data that show higher yields were reported by growers using soil testing for five of the six crops evaluated (data not shown). Thus, expense and the practicality of using soil sampling are not major obstacles facing education programs directed at increasing the frequency of soil sampling in the HUA for the farmers interviewed.

The amount of N applied to farmland in the HUA is crop dependent. Average N application rates on onions, mint, potatoes, and sugarbeets are 297, 248, 204, and 187 lb/acre, respectively (Figure 10). Nitrogen application rates on cereals averaged 131 lb/acre. Nitrogen applications on legume crops (beans, alfalfa, and

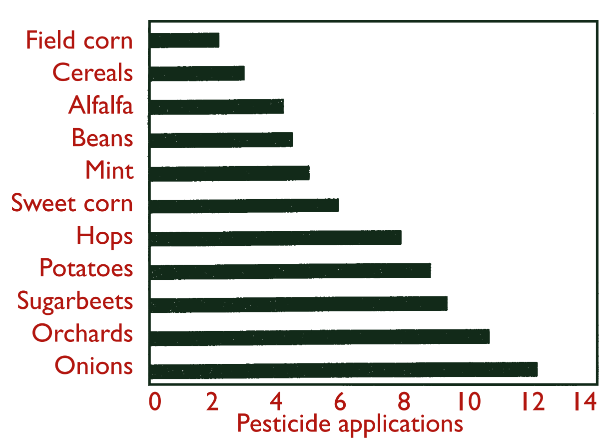

Figure 2. Average number of pesticide applications on field corn, cereals, alfalfa, beans, mint, sweet corn, hops, potatoes, sugarbeets, orchards and onions in the HUA based on a survey conducted in 1991-1993.

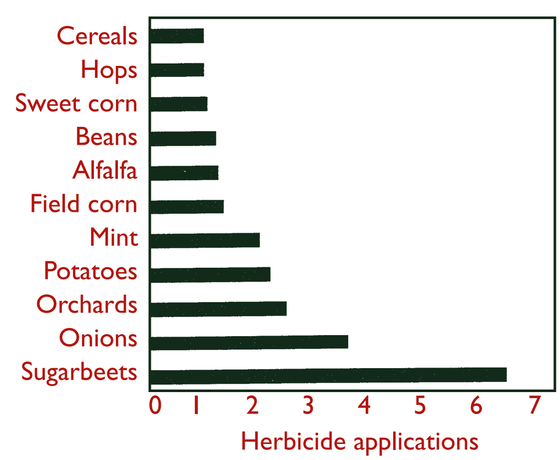

Figure 3. Average number of herbicide applications on cereals, hops, sweet corn, beans, alfalfa, field corn, mint potatoes, orchards, onions, and sugarbeets in the HUA based on survey conducted in 1991-1993.

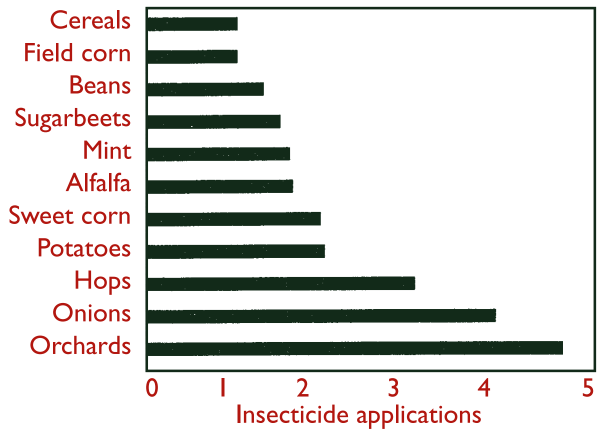

Figure 4. Average number of insecticide applications on cereals, field corn, beans, sugarbeets, mint, alfalfa, sweet corn, potatoes, hops, onions, and orchards in the HUA bases on survey conducted in 1991-1993.

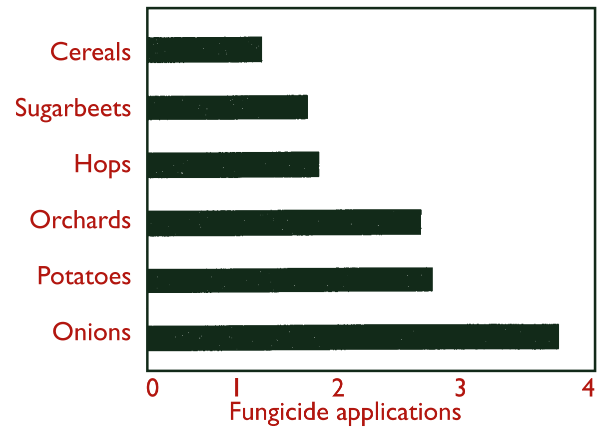

Figure 5. Average number of fungicide applications on cereals, sugarbeets, hops, orchards, potatoes, and onions in the HUA based on a survey conducted in 1991-1993.

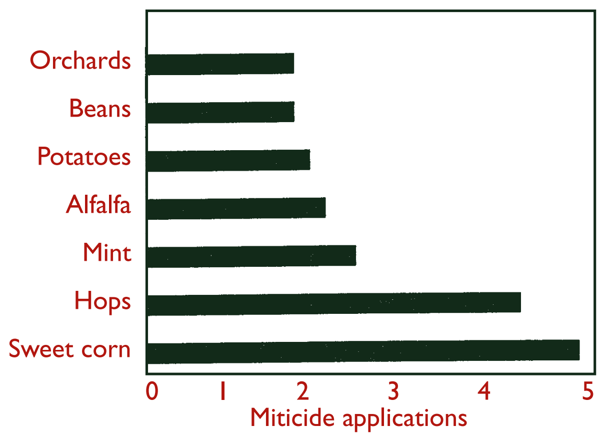

Figure 6. Average number of miticide applications on orchards, beans, potatoes, alfalfa, mint, hops, and sweet corn in the HUA based on a survey conducted in 1991-1993.

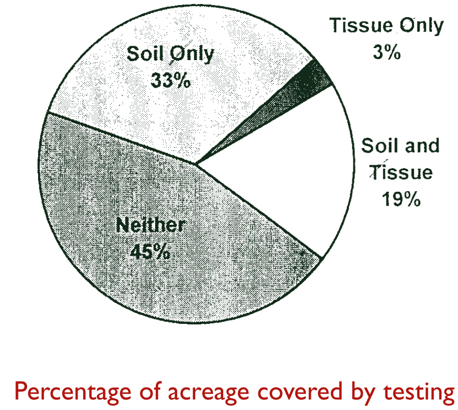

Figure 7. Use of soil testing and/or plant tissue testing on cropland in the HUA based on a nutrient use survey conducted in 1991-1993.

clover) were less than 100 lb/acre. The average rate of N applied to cropland in the HUA was 108 lb/acre in 1991. The average ranged from 45 lb N/acre for legumes to 240 lb N/acre for shallow rooted high value crops (onions, potatoes, and mint). Deep-rooted perennials (orchards and hops) and deep-rooted annual crops (sugarbeets, small grains, and corn) had intermediate application rates of 135 to 175 lb N/acre.

Nitrogen fertilizer is most likely to be split-applied on high value crops such as potatoes, mint, and onions. Because these crops are shallow rooted, and present water management often leaches nitrates, an average of three to five applications of N is required on these crops. Conversely, split applications of N on corn, sugarbeets, and small grains are less common.

Field Record Book and Nitrogen Management Plan

Recognizing there are many advantages for growers to record all agronomic measurements and management practices, a pocket-sized record book for fertilizer use, irrigation scheduling, and pesticide use was developed and distributed to more than 900 growers in the HUA project area.

With an accurate set of records, growers can analyze the effectiveness of past agrichemical applications and determine the best pest and/or nutrient management program. By referring to past records, growers can estimate future purchases of the correct amounts of pesticide and fertilizer for each growing season, thus eliminating stockpiling which, at its worst, creates a hazard and, at best, requires additional storage and handling.

Record keeping also becomes important considering that the use of

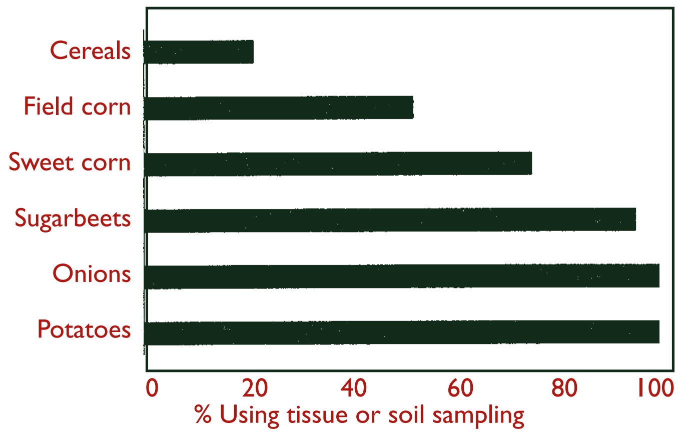

Figure 8. The likelihood of using soil and/or tissue sampling as a basis for applying N on cereals, field corn, sweet corn, sugarbeets, onions and potatoes based on a nutrient use survey conducted in 1991-1993.

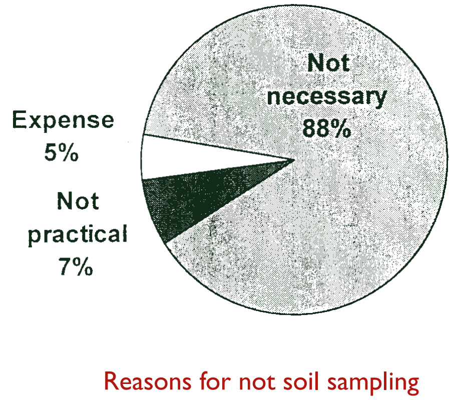

Figure 9. Grower reasons for not taking soil samples in fields in the HUA based on nutrient management survey conducted in 1991-1993.

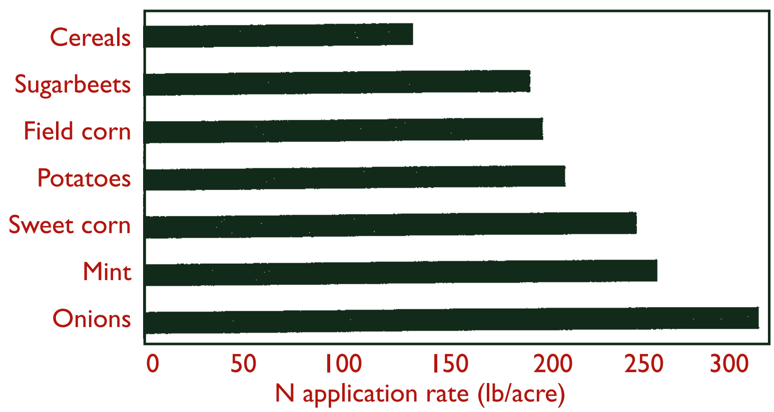

Figure 10. Average N fertilizer application rates on cereal, sugarbeets, field corn, potatoes, sweet corn, mint, and onions in the HUA based on nutrient survey conducted in 1991-1993.

some herbicides may restrict crop choices in subsequent years. With adequate records, a grower can easily determine crop options for planting each year. Nutrient management decisions are also positively influenced by detailed record keeping. Records are also a safeguard if a grower is accused of an improper application that causes drift, personal injury, or potential water quality impairment.

The record book distributed to HUA growers consisted of four main components: (1) field identification; (2) nutrient management and water quality; (3) irrigation water management; and (4) recommended pesticide practices. In the nutrient management and water quality section, methods for determining accurate nitrogen and phosphorus application rates were outlined. These recommendations consisted of BMPs that included:
(1) basing fertilizer applications on research based recommendations;
(2) adjusting fertilizer inputs to yield goals; (3) timing fertilizer application to match crop uptake; (4) placing fertilizer to maximize plant uptake;
(5) preventing over irrigation;
(6) minimizing soil erosion;
(7) crediting N from legumes and manure applications; and (8) considering buffer strips, sediment ponds, and other practices that clean waste water before it leaves the field.

Nitrogen Management Plan

Controlling nitrogen (N) losses from agricultural systems requires attention to site vulnerability, irrigation management, and nutrient management. These factors influence processes within the nitrogen cycle, which occurs in all natural soil systems. Agricultural practices affect both nitrogen additions and subtractions from the N cycle. Examples of additions are manures, fertilizers, crop residues, and N fixation by legumes. Examples of N subtractions from the N cycle are crop removal, erosion, denitrification, volatilization, losses in irrigation runoff water, and leaching below the root zone. When N additions exceed crop removal year after year, losses through runoff and leaching increase threatening both ground and surface waters.

Utilization of a nitrogen management strategy that is flexible and field specific is important because the fate of residual soil N and applied fertilizer N is unpredictable. Each field has irrigation limitations and an efficiency potential that may largely determine N fertilizer required to obtain high yields. One approach emphasized during the HUA project was the Nitrogen Budgeting and Monitoring

Figure 11.

Nitrogen Budget and Fertilizer Plan

Grower:____________ Field:___________ Year:__________ Crop:____________

I Total N Requirements (Additions)	**lbs N/acre**
1. Crop N requirement	______
2. N needed for breakdown of field corn and grain residue	______
3. Total additions (add lines 1 and 2)	______

II N Credits (Subtractions)	**lbs N/acre**
4. Available N in the soil	______
Sample timing: (fall/winter/pre plant spring/post plant)	______
Sample depth: (6, 12", 18", and 36")	______
Analysis: (Nitrate-N/Ammonium-N/both)	______
5. Expected N from mineralization	______
6. N from manure or other organic additions	______
7. N from irrigation water	______
8. N credit from legumes and sweetcorn	______
9. Total subtractions (add lines 3, 4, 5, 6, 7, and 8)	______

III Total N Fertliizer Requirement	**lbs N/acre**
10. Fertilizer requirement line 3 minus line 9	______

IV Record of N Fertilizer Additions

Timing (date)	Method of Application	Comments: Plant growth stage or crop appearance	Rate applied lb N/acre
______	______	______	______
______	______	______	______
______	______	______	______
______	______	______	______

11. Total of all N fertilizer applied ______

V Self Evaluation	
12. Rate of N fertilizer applied	______
13. Soil and tissue testing	______
14. Utilization of N budgeting	______
15. Timing of N additions	______
16. Score: Total of lines 12 through 15	______

Plan (NBMP). An example of a nitrogen budget and fertilization plan utilized in the HUA is shown in Figure 11. This plan includes:

1. A field specific N budget. Space is provided to record information from several fields. This allows on-farm comparisons of N management strategies by the grower.

2. Instructions outlining how the budget information is collected (soil and tissue test guidelines, etc.).

3. A record-keeping framework for fertilizer additions and crop yield data (monitoring).

4. Supporting materials that encourage the most efficient N fertilizer application and timing methods.

5. A self-evaluation section which allows the grower to assess their N management plan.

By including these guidelines, a nitrogen budget and fertilization plan was developed by the University of Idaho College of Agriculture for distribution to HUA growers (Figure 11). This plan has five main sections: (1) total N requirements; (2) nitrogen credits; (3) total N fertilizer requirement; (4) record of N fertilizer additions; and (5) a self-evaluation. The N budget and fertilizer plan (Figure 11) can be explained as follows:

Section I:
Total N requirements (additions)
The purpose of the first section is to determine the total amount of N needed to meet crop yield goals.

1. Crop N requirement.
   To calculate crop N requirement, multiply the realistic yield goal for the field times the crop N uptake per unit yield value (Table A).

Examples:
For expected yield of 500 cwt of potatoes (500 x .5) = 250 lb N uptake.
For expected yield of 30 tons of sugarbeets (30 x 8) = 240 lb N uptake.

2. Nitrogen needed to breakdown fieldcorn and grain residues.

   Estimate stover residue yield from grain yield. Apply 20 lbs N per ton of field residues up to 60 lbs N per acre for field corn. Apply 15 lbs N per ton of straw yield up to 60 lbs N per acre.
   20 bu wheat = 1 ton straw
   37 bu corn = 1 ton straw

3. Add values in boxes 1 and 2.

Section II:
Nitrogen credits (subtractions)
This second section is used to determine the N already available to the crop. By calculating N credits, the amount of applied N fertilizer may be reduced.

4. Soil sampling for N management.

Timing:
For best results, a spring preplant soil test is recommended. Fall test results may be used if seasonal soil or tissue tests are planned.

Depth:
Sampling depth must represent the top third of the root zone.
Refer to Table B for recommended sampling depth.

Calculation:
Total soil test N (ppm) add 0 to 12" + 12 to 24" results X (times) the depth

sampled (feet) X (times) a multiplication factor of 3.6

e.g. (24 ppm) x (2 feet) x (3.6) = 173 lb N available per acre.

5. Expected N from mineralization. The amount of nitrogen made available to crops through mineralization of soil organic matter can be estimated using season length and percent organic matter (OM) from current or past soil tests. Soil OM remains fairly stable year to year.

Calculation:
Expected mineralization (lbs N per acre) = factor (Table C) x (percentage of OM in the soil)

e.g. 130 day corn grown on 1.5 percent OM 40 x 1.5 = 60 lbs N per acre

6. Manure or other organic additions.
Estimate the lb of N per ton of manure

Calculation:
percent N from test x percent dry matter x 2000 = lb N/ton
e.g. .02 x .15 x 2000 = 6 lb N/ton

Select fields for manure application using soil test

Assume 50 percent year 1 release of available nitrogen and 20 percent year 2 nitrogen release.

lbs N needed from soil test/(lbs N per ton x .5) = tons manure to apply

e.g. 100 lbs N / (6 lbs per ton x .5) = 33 tons manure

7. N from irrigation water.
Applied irrigation water can contain significant amounts of nitrogen.

Test irrigation water for NO_3-N and NH_4-N.

Calculation:
Water test value (ppm) x factor (table D) = lbs N per acre supplied

e.g. 4.2 ppm x 5 (grain) = 21 lbs N per acre

8. N credit for previous crop residues.

Alfalfa:
Credit for expected N release during the season must be based on crop season length. Credit +50, +75, +100 lbs N for short, medium, and long season crops respectively as defined in table C.

Sweetcorn/beans/ peas:
Beans and pea residues will release approximately 40 lbs N and sweetcorn 100 to 140 lbs N per acre by the following growing season.

9. Add values in boxes 4, 5, 6, 7 and 8.

Section III:
Total N fertilizer requirement
This section totals adds the total N requirements from section 1 and subtracts the credits found in section 2 obtaining a value for the total N fertilizer needed to meet the crop needs.

10. Fertilizer N requirement (line 10)

    Subtract value on line 9 from value on line 3.

Section IV:
Record of N fertilizer additions
This section is for recording when fertilization applications were made and how the fertilizer was applied. This is important because the timing of N application influences the crop use efficiency as does the method of application used which include broadcast, banding, sidedress, topdress and water run.

11. Total of all N fertilizer applied.

Section V:
Self evaluation

12. Ratio of N fertilizer applied

    Calculate the ratio of N applied to crop N uptake

    a. Crop N uptake = Actual yield x factor (table A)

    b. N applied as fertilizer (line 11) / crop N uptake = ratio
    0 = Ratio > 1.2 is poor
    1 = Ratio .8 to 1.2 is average
    2 = Ratio < .8 is good

13. Soil and Tissue Testing.
    0 = no samples taken
    1 = soil tested field but results not used for nitrogen budgeting
    2 = relied on soil or tissue tests to budget for nitrogen
    3 = used both soil and plant tissue sampling to budget for N

14. Utilization of N budgeting.
    0 = completed N fertilizer requirement section post-harvest
    1 = completed prior to majority (2/3) of N was applied
    2 = completed prior to first N addition

15. Timing of N additions.
    0 = > one third of N was fall applied
    1 = less than one third of total was fall applied
    2 = > 75% of N applied after crop established

16. Score for lines 10 to 14.

    The total of these four lines gives a score of 1 to 9 with 9 being the highest, most desirable score. A scoring system for this NBMP would be following:

8 – 9	excellent management
6 – 7	very good management
4 – 5	good management
2 – 3	fair management
< 2	poor management

Table A. Recommended crop N uptake values for crops grown in the HUA.

Crop		Unit of measure	lb N per Unit Yield Values
Corn	- grain	bushel	1.6
	- silage	ton	8.7
	- sweet corn	ton	20.0
	- seed	lbs	.08
Hops		lbs	.08
Mint oil		low yield	125 lbs N
		medium	150 lbs N
		high	175 lbs N
Onion		cwt	.4
Potato		cwt	.5
Small grains			
	- barley	bushel	1.5
	- oats	bushel	1.2
	- wheat	bushel	1.8
Sugarbeets		ton	8.0

Table B. Recommended soil sampling depth for nitrogen testing.

Suggest depth	Crops
12"	developing annuals, onion, mint
18"	beans, potato, sweetcorn
24"	field corn, small grains
24"+	alfalfa, orchards, sugarbeet

Table C. Season length factors for N mineralization calculations.

Season length	Factor	Crops
Short (<100 days)	20	alfalfa seed, dry beans
Medium (100 to 120 days)	30	sweetcorn, potato, mint
Long (120+ days)	40	hops, onion, orchards, sugarbeet

Table D. Multiplication factors for irrigation water N calculation.

Multiplier	Crops grouped by seasonal consumptive water use amount
5.0	beans, sweetcorn, hops, onion, smallgrain
6.5	field corn, mint, potato
8.0	sugarbeet, pasture
9.25	alfalfa, orchard crops

Integrated System of Irrigation, Nutrient, and Pesticide Management

Water management, pesticide management, and nutrient management must be linked together to provide effective surface and groundwater quality protection. Overwatering can negate proper nitrogen management. Likewise, judicious pesticide use is ineffective if excess irrigation results in leaching and eventual groundwater contamination. In the past, water, nutrient, and pesticide management were often treated as independent practices. However, without sound irrigation management, even the most diligent nutrient and pesticide management strategies can lead to contamination of surface and groundwater supplies.

During the 8-year HUA project many tours and field demonstrations were organized to exhibit new practices that could help enhance nutrient and pesticide use through improved irrigation management. The best attended tours exhibited new irrigation practices that improved irrigation efficiency and reduced erosion such as buried drip irrigation systems, automatic surge valves, micro-sprinklers, gated pipe enhanced systems, and soil moisture monitoring devices. By improving irrigation efficiency, there is less leaching of N and pesticides into groundwater and less erosion that reduces P, N and pesticide loads in surface waters. Field tour participation ranged from 12 to 125 people during the HUA project's duration and more than 170 field sites were visited.

Educational Programs

Through educational programs and the use of water management BMPs in the HUA project area, improvements were expected to be seen in surface and groundwater quality. The most common educational programs emphasized adoption of nutrient and pesticide BMPs within the HUA project area. Meetings, tours, publications, and exhibitions at fairs were used to accomplish this educational objective. During the 8-year duration of the HUA project, more than 200 meetings were conducted by HUA project staff. These meetings ranged from organizational steering committee meetings to outline the HUA goals and project logistics, to field tours and local workshops.

Publications were also an important method for distributing nutrient and pesticide management information to the 52 HUA cooperators and all HUA growers (>3,400 farms). The HUA project office issued a quarterly newsletter called "*The Farm Planner*" which focused on water quality BMPs. Circulation of this newsletter exceeded 2,500 per issue. Approximately 50 articles about the HUA and its progress were published in newspapers and magazines such as *Argus Observer, Capital Press, Idaho Farmer-Stockman, Independent Enterprise, and Signal American.*

Several programs were conducted to target pesticide management in the HUA. Integrated pest management (IPM) was emphasized as both an economically and environmentally sound alternative to reliance on total chemical pest management. Many people were trained about BMPs for pesticide management through the Idaho Home*A*Syst Program. As part of this program, workshops were conducted in conjunction with pesticide recertification programs required by the Idaho Department of Agriculture (IDA). Workshop topics included: (1) pesticide storage and handling; (2) IPM; (3) ground and surface water quality: nutrients and pesticides; (4) weed control management; (5) irrigation management; (6) nutrient and manure management; (7) pesticide safety; and (8) lawn and landscape pesticide management. During a follow-up survey sent to the two hundred workshop participants, it was found that many individuals were planning changes in their management strategies based upon this educational experience.

Surveys conducted in 1996 and again in 1998 indicated that the frequency of pesticide applications on HUA crops had declined between 12 and 18 percent compared to application frequencies observed in 1992. As a result of the educational programs implemented, nitrogen fertilizer applications on 35 fields that had received project assistance were reduced by 88 lb of nitrogen per acre. It is estimated that N application rates on crops grown in the HUA declined an average of 12 percent compared to application rates in 1992.

Summary

The Idaho Snake-Payette Rivers HUA Water Quality Project successfully accelerated the transfer of nutrient and pesticide BMPs to local growers to protect both ground and surface water quality. Highlights of the project's accomplishments include:

- Nutrient and pesticide use practices were surveyed for 11 of the more than 40 crops grown in the HUA that collectively represented about 80 percent of the planted land within the HUA.
- In 1992, soil and/or plant tissue samples were used as a basis for applying N on only 55 percent of the acreage surveyed. Educational programs helped increase this to 62 percent in 1998.
- A pocket-sized record book for fertilizer use, irrigation scheduling, and pesticide use was developed and distributed to more than nine hundred growers in the HUA project area.
- A Nitrogen Budgeting and Monitoring Plan (NBMP) was developed and implemented during the HUA project to help growers improve their nitrogen management practices. This budgeting plan was a forerunner to nutrient management plans which are now being implemented nationwide.
- By linking water, pesticide, and nutrient management together, improved surface and groundwater quality protection was accomplished.
- Because of improved irrigation management, there is less leaching of applied agrichemicals into the HUA groundwater.
- Improved irrigation management has also led to a decrease in soil erosion thus less P and pesticides have reached HUA surface waters.
- Nutrient management BMPs adopted through the HUA project resulted in a 13 percent decline in N application rates on crops between 1991 and 1998.
- Pesticide management BMPs adopted through the HUA project resulted in a 12 to 18 percent decline in the number of pesticide applications to crops between 1991 and 1998.
- A substantial number of HUA growers have participated in the Idaho Home*A*Syst program and many have taken corrective steps to improve their nutrient and pesticide use.
- Public meetings, tours of farms, publications, and exhibits at fairs and trade shows were educational tools used to increase the awareness and adoption of nutrient and pesticide BMPs to protect surface and groundwater quality.
- The HUA project office issued a quarterly newsletter called "*The Farm Planner*" that educated readers about nutrient and pesticide BMPs. Circulation of this newsletter exceeded 2,500 per issue.

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