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Best Management Practices for Nitrogen Use:
IRRIGATED POTATOES

BEST MANAGEMENT PRACTICES FOR NITROGEN APPLICATION

Best Management Practices for Nitrogen Use: Irrigated Potatoes

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Summary

Nitrogen (N) is an essential plant nutrient that contributes greatly to the economic viability of irrigated potato production. Unfortunately, the nitrate form of N can leach into groundwater if N is not managed properly. Contamination of water resources by agricultural production systems will not be tolerated by the public and could lead to laws regulating the use of N fertilizers if this contamination is not minimized.

Research-based Best Management Practices (BMPs) have been developed specifically for irrigated potatoes and integrated into the BMPs that were developed previously for other agronomic crops on coarse-textured soils. Various strategies are provided that take into account N rate, timing of application, method of application, and N source. Optimum N management also depends on the variety grown and its harvest date, so basic principles are similar but specific recommendations differ for early, mid-season, and late-season varieties.

The main objectives of these BMPs are to maintain profitability and minimize nitrate leaching. By following these recommendations, the threat of fertilizer regulations can be avoided and a more profitable and better community can be attained.

Introduction

Nitrogen is an essential plant nutrient that is applied to Minnesota crops in greater quantity than any other fertilizer. In addition, vast quantities of N are contained in the ecosystem, including soil organic matter. Biological processes that convert N to its mobile form, nitrate (NO_3), occur continuously in the soil system. (For greater understanding see: ***Understanding Nitrogen in Soils*** **AG-FO-3770**). Unfortunately, nitrate can move (leach) below the rooting zone and into groundwater.

In response to the Comprehensive Groundwater Protection Act of 1989, a Nitrogen Fertilizer Management Plan was developed with the purpose of managing N inputs for crop production to prevent degradation of Minnesota water resources while maintaining farm profitability. The central tool for achievement of this goal is the adoption of Best Management Practices for Nitrogen. Best management practices for N are broadly defined as economically sound, voluntary practices that are capable of minimizing nutrient contamination of surface and groundwater. The primary focus of the BMPs is commercial N fertilizers; however, consideration of other N sources and their associated agronomic practices is necessary for effective total N management.

General BMPs for all Regions of the State

The use of BMPs is based on the concept that accurate determination of crop N needs is essential for profitable and environmentally sound N management decisions. General BMPs that apply to all cropping regions in the state are listed below:

- Adjust the N rate according to a realistic yield goal (for all crops except corn and sugar beets) and the previous crop
- Do not apply N above recommended rates
- Plan N application timing to achieve high efficiency of N use
- Develop and use a comprehensive record-keeping system for field specific information.
- If manure is used, adjust the N rate accordingly and follow proper manure management procedures to optimize the N credit:
    - Test manure for nutrient content
    - Calibrate manure application equipment
    - Apply manure uniformly throughout a field
    - Injection of manure is preferable, especially on steep sloping soils
    - Avoid manure application to sloping, frozen soils
    - Incorporate broadcast applications whenever possible

For more detailed information on making the most efficient use of manure nutrients and avoiding potential adverse effects on water quality, see the University of Minnesota Extension publications listed at the end of this bulletin.

The Need for Best Management Practices for Irrigated Potatoes

Most of the BMPs developed for crop production in Minnesota have been based on research with corn and small grains. Management strategies for coarse-textured soils can be found in: ***Best Management Practices for Nitrogen Use on Coarse Textured Soils*** (**08556, revised 2008**). In contrast to most agronomic crops, potatoes are a relatively shallow rooted crop and require intensive management to promote growth and yield. In addition, adequate N needs to be available to maintain both yield and tuber quality. The shallow root system of potatoes, the need for adequate N, and the extensive production on sandy soils greatly increase the potential of nitrate contamination of shallow aquifers under irrigated potato production. Fortunately, University of Minnesota research strongly suggests that environmental impacts can be minimized by using nitrogen BMPs specifically designed for potatoes.

While the general BMPs developed for corn and small grains listed above will also apply to irrigated potato production, BMPs focused on irrigated potato production are described within this bulletin so that more precise management practices can be followed. The research-based nitrogen BMPs discussed here, therefore, have been tailored specifically for potato production on irrigated, coarse-textured soils. These BMPs are not only environmentally sound, they are also potentially more profitable. When N leaches below the potato root zone, where it can degrade water quality, it also becomes a purchased input

that is lost from the crop production system. Efficient N management that minimizes losses provides both economic and environmental benefits.

Specific Nitrogen Best Management Practices for Irrigated Potatoes

Nitrogen management considerations for irrigated potatoes include decisions regarding: 1) N rate, 2) timing of N application, 3) use of diagnostic procedures to determine N needs during the growing season, 4) effective water management, 5) sources of N, and 6) establishment of a cover crop after harvest. Suggested N management approaches for different varieties and harvest dates of irrigated potatoes are presented following the discussion on BMPs.

Selecting a Realistic Nitrogen Rate

The rate of N to apply to irrigated potatoes primarily depends on the cultivar and date of harvest, expected yield goal, amount of soil organic matter, and the previous crop. Rates of N recommended for potatoes can be found in ***Nutrient Management for Commercial Fruit and Vegetable Crops in Minnesota*** (**AG-BU-5886-F**) and in Appendix A of this document. Response to N by potato is typical of other crops in that the first increment of fertilizer usually brings about the greatest response in yield, followed by a more gradual increase with succeeding increments of N (Table 1). As the N rate increases, however, the potential for losses also increases. In addition to environmental concerns due to excessive N applications, high rates of N can detrimentally affect potato production by promoting excessive vine growth, delaying tuber maturity, reducing yields, decreasing specific gravity, increasing brown center, and inducing knobby, malformed, and hollow tubers. Selecting a realistic N rate is therefore important from both a production and an environmental standpoint. Unfortunately, the effect of excess N on tuber quality is dependent on soil moisture and temperature as well as the cultivar grown. This means that the N rate at which detrimental effects will occur is difficult to predict.

Base N rate on variety, harvest date, and realistic yield goals

Different potato varieties and differences in harvest date will have a pronounced effect on yields and yield goals. Because of lower yield and earlier harvest, early maturing varieties like Red Norland (Table 2) generally require less N than later maturing varieties, such as Russet Burbank (Table 1). A definition of harvest date is as follows: Early - vines are killed or the crop is green dug before August 1; Mid-season - vines are killed or the crop is green dug before September 1; Late –vines are killed or the crop is green dug September 1 or later. Unlike corn and sugar beets, the yield goal concept is still being used to guide N recommendations for potatoes, in conjunction with variety and harvest date, until a more complete measure of the N supplying capacity of the soil is available. Currently N recommendations are also adjusted for the amount of soil organic matter, with higher rates for low organic matter soils than for medium to high organic matter soils which have a greater capacity to release plant-available N. Yield goal for potatoes is based on the total yield obtained rather than the marketable yield, but the two are generally well-correlated. An overestimation of the yield goal will result in excessive applications of N, which can potentially result in nitrate losses to groundwater.

Table 1. Response of Russet Burbank potatoes to nitrogen rate at Becker MN, 2004-2005.

N rate	Marketable*	Total
lb N/A	---------- cwt/A	----------
0	299	377
30	326	485
80	423	550
120	547	651
160	531	629
180	583	667
240	611	690
320	594	663

*Marketable tubers are greater than 3 oz in size with no visible defects.

Table 2. Response of early harvested Red Norland potatoes to nitrogen rate at Becker MN, 1995-1997.

N rate	Total and Marketable
lb N/A	-- cwt/A --
125	336
165	325
205	324
245	317
285	303

Account for nitrogen from previous crops

Previous crop can also affect N needs. Legumes in a crop rotation can supply significant N to subsequent crops. Research in Wisconsin on sandy soils (Kelling, et al., 1991) found that maximum potato yields following sorghum sudangrass required 40 lb/A more N than following red clover and 80 lb/A more N than when following alfalfa. Similar results from a 20 year study in the Netherlands found that N requirements for optimum potato yield following oats were 60 lb N/A greater than following red clover and 90 lb N/A greater than following alfalfa (Neeteson, 1989). Failing to account for N supplied by legumes can lead to a buildup of soil N and increase the potential for nitrate leaching.

Test irrigation water for nitrogen content and adjust N fertilizer accordingly

The amount of N in the irrigation water should also be considered when adjusting N rates. Nitrate in irrigation water can supply a portion of the N required for crop production. In N calibration studies on potatoes at Becker MN, the nitrate-N concentration in irrigation water ranged from 7 to 10 ppm (parts per million). This concentration of N in the water should be considered as background, but amounts above 10 ppm should be credited as fertilizer N. Additionally, the time to credit N from irrigation water is when the plant is actively growing and taking up N. For late season potatoes this occurs from 20 to 60 days after emergence (Figure 1). Because nitrate-N levels in irrigation water can vary, samples of irrigation water need to be tested annually during the pumping season to determine approximate nitrate-N concentrations.

If nitrate-N in irrigation water is one ppm, then each inch of irrigation water applied is equal to 0.225 pounds of N applied per acre. As an example, if irrigation water is found to have 20 ppm nitrate-N and 9 inches of water are applied during the active part of the growing season, then about 40 lbs of N/A would be supplied with the water (0.225 * 9 * 20). After subtracting the background amount of 20 lb N/A, the remaining 20 lb N/A should be credited toward the total amount of N applied. In practice, you will not know how much N was applied in irrigation water until after the active growth period when all or most of the N fertilizer has already been applied, so for the current growing season you will have to estimate the N credit for irrigation water from records of previous years.

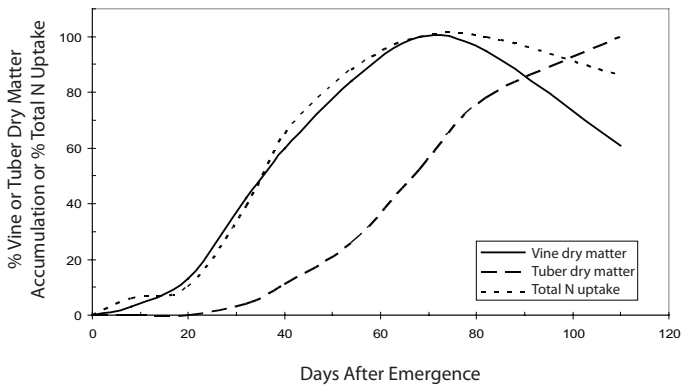

Figure 1. Relative tuber growth, vine growth and total nitrogen uptake by the potato crop. Based on data from the Russet Burbank variety.

Timing of Nitrogen Application: Match N Application with Demand by the Crop

One of the most effective methods of reducing nitrate leaching losses is to match N applications with N demand by the crop.

Do not fall apply N on sandy soils (sands, loamy sands, and sandy loams)

Do not use more than 40 lbs N/A in the starter for mid/late season varieties

Do not use more than 60 lbs N/A in the starter for early harvested varieties

Nitrogen applied through the hilling stage should be cultivated/incorporated into the hill

Plan the majority of soluble N inputs from 10 to 50 days after emergence

Nitrogen applications in the fall are very susceptible to leaching. Nitrogen applied early in the season when plants are not yet established is also susceptible to losses with late spring and early summer rains. Most nitrification inhibitors are not registered for potatoes and therefore cannot be recommended. Peak N demand and uptake for late season potatoes occurs between 20 and 60 days after emergence (Figure 1). Optimum potato production depends on having an adequate supply of N during this period. The recommendation is to apply some N at planting for early plant growth and to apply the majority of the N in split applications beginning slightly before (by 10 days) the optimum uptake period. This assures that adequate N is available at the time the plants need it and avoids excess N early in the season when plant growth is slow and N demand is low.

Research at the Sand Plain Research Farm at Becker, with full season varieties like Russet Burbank, demonstrates that nitrate movement below the root zone can be reduced by lowering the amount of N in the starter fertilizer without affecting yields (Table 4). Starter fertilizer should contain no more than 40 lb N/A for full season varieties. Uptake of N by the crop (vines plus tubers) increases when split N applications are used compared with large applications applied before emergence. Nitrogen applied through the hilling stage should be incorporated into the hill to maximize availability of the N to the potato root system.

Just as N fertilizer applied too early in the season can potentially lead to nitrate losses, so can N fertilizer applied too late in the season. Nitrogen applied beyond 10 weeks after emergence is rarely beneficial and can lead to nitrate accumulation in the soil at the end of the season. This residual nitrate is then subject to leaching.

For determinate early harvested varieties like Red Norland, higher rates of N in the starter may be beneficial (Table 5). These varieties tend to respond to higher rates of early N than indeterminate varieties, but the total amount of N required is generally lower because of lower yield potential and early harvest. In addition, late application of N to these varieties will tend to delay maturity and reduce yields, particularly if the goal is to sell for an early market. In many cases it is not possible to know when the exact harvest date will be as this will depend on market demands as well as weather conditions during the season. Because of these unknowns it is important to have some flexibility in both rate and timing of N application.

Table 4. Nitrogen starter effects on Russet Burbank potato yield and nitrate-N leaching to the 4½ ft depth. Means of 1991 and 1992.

Timing of N application			Yield		NO_3-N Leaching
Planting	Emergence	Hilling	Total	Marketable	
lb N/A			cwt/A		lb/A
0	0	0	359.9	292.3	18
0	120	120	602.7	532.8	76
40	100	100	594.0	518.5	114
80	80	80	612.9	519.7	134
120	60	60	589.4	493.5	158

Errebhi et al., 1998.

Table 5. Nitrogen starter effects on Red Norland potato yield, Becker - 1995-1997.

Timing of N application			Total Yield
Planting	Emergence	Hilling	
lb N/A			cwt/A
25	70	70	325
45	60	60	328
65	50	50	338
85	40	40	337

Use petiole analysis to aid in making post-hilling nitrogen applications

Increases in N use efficiency have been shown when some of the N is injected into the irrigation water after hilling (fertigation). Because the root system of the potato is largely confined to the row area during early growth, do not fertigate until plants are well established and potato roots have begun to explore the furrow area between rows. This is usually about

three weeks after emergence. Nitrogen applications after this time are most beneficial in years when excessive rainfall occurs early in the growing season (Tables 6 and 7). In dry years with minimal leaching, N applications later than 16 days after emergence show little if any advantages from a production standpoint over applying all of the N by that stage (Tables 7 and 8). However, leaching losses can still be reduced.

Table 6. Effect of N applications later than 16 days after emergence on Russet Burbank yield, Becker – 1991 (high leaching year).

Timing of N application[1]				Tuber Distribution					
Plant.	Emerge.	Post Emerge.	Late PE	Culls	<3 oz	3-7oz	7-14oz	>14oz	Total
--------- lb N/A ---------				---------- cwt/A ----------					
40	40	40	0	23	51	240	158	5	477
80	80	80	0	28	47	224	179	8	486
40	40	40	80	36	42	221	200	13	512

[1]Planting, emergence, 16 days post-emergence, and two late post-emergence applications more than 16 days after emergence of 40 lb N/A per application.

Table 7. Effects of excessive irrigation and nitrogen rate, source, and timing on cumulative NO_3-N leaching to the 4 ft depth (Zvomuya et al., 2003).

N Rate	N Source	Irrigation	
		Standard	Excessive
		NO_3-N leaching	
--- lb N/A ---		---------- lb N/A ----------	
0	----	46	61
125	urea[1]	59	88
125	PCU[2]	55	84
250	urea[3]	75	204
250	PCU[2]	50	128
250	posthill[4]	80	121

[1]25 lb N/A at planting, 50 lb N/A at emergence, and 50 lb N/A at hilling.
[2]Polyolefin-coated urea in a single application at planting.
[3]25 lb N/A at planting, 112 lb N/A at emergence, and 112 lb N/A at hilling.
[4]25 lb N/A as urea at planting, 72 lb N/A as urea at emergence, 72 lb N/A as urea at hilling, and 40 lb N/A as equal amounts of N from urea and ammonium nitrate at 3 and 5 weeks after hilling.

Table 8. Effect of N applications later than 16 days after emergence on Russet Burbank yield, Becker – 1992 (low leaching year).

Timing of N application[1]				Tuber Distribution					
Plant.	Emerge.	Post Emerge.	Late PE	Culls	<3 oz	3-7oz	7-14oz	>14oz	Total
--------- lb N/A ---------				---------- cwt/A ----------					
40	40	40	0	32	58	267	158	3	518
80	80	80	0	31	53	281	223	12	601
40	40	40	80	29	58	246	195	14	541

[1]Planting, emergence, 16 days post-emergence, and two late post-emergence applications more than 16 days after emergence of 40 lb N/A per application.

If applications of N later than 16 days after emergence are used, then 2/3 to 3/4 of the recommended N fertilizer should be applied by that stage. Timing of the remainder of the N applications should be based on petiole nitrate-N levels determined on either a dry weight or sap basis. Table 9 shows suggested sufficiency ranges for Russet Burbank potatoes through the growing season. Other potato varieties may vary slightly in their sufficiency ranges. However, the ranges in Table 9 are still a suitable starting point to adjust post-emergence N applications for other varieties. Typically if N is needed, 20 to 40 lb N/A can be injected per application.

Another potential in-season monitoring tool is soil testing for plant-available inorganic N in the upper 12 to 18 inches of the soil. Samples should be collected from the hill area in sets of five soil cores and analyzed for nitrate-N and ammonium-N. One core should be from the top of the hill, one core from each side of the hill half-way up the side slope, and one core from each side at the base of the hill. Initial research on in-season soil testing suggests that sufficiency levels for total inorganic N (nitrate-N + ammonium N) in the 0-1 ft depth for Russet Burbank are about 140 lb N/A (35 ppm) during initial bulking (June) and 80 lb N/A (20 ppm) during early bulking (July). Additional research is necessary to calibrate in-season soil tests and determine how much N to apply at specific soil test levels. Soil testing should be viewed as a tool to help fine tune N management and used in conjunction with, not as a substitute for, petiole testing.

One danger of relying on N applications through the irrigation system occurs when rainfall patterns during the time for fertigation are adequate or excessive. Applying N through the system in this case may potentially lead to an increase in nitrate leaching if high amounts of irrigation water are also applied. In situations where there is a demand for N, but rainfall has been adequate or excessive, low amounts (less than 0.3 inch) of water should be applied with the N fertilizer. Another potential problem with delayed N application occurs when the potato crop dies back early due to insects or diseases. In this situation, N applied more than 16 days after emergence may not be used as efficiently and they may increase N leaching losses. It is essential therefore, that an integrated cropping approach be taken to minimize nitrate leaching losses.

Selecting Appropriate Nitrogen Sources

Do not use fertilizers containing nitrate in the starter

Each fertilizer N source used for potatoes has advantages and disadvantages, depending on how they are managed. However, because leaching often does occur in the spring, fertilizer sources containing nitrate (i.e. UAN-28 and ammonium nitrate) should be avoided at planting. Ammonium sulfate, diammonium phosphate, monoammonium phosphate, poly ammonium phosphate (10-34-0), or urea are the preferred N sources for starter fertilizer. Advantages of urea compared with ammonium nitrate are greater availability, lower cost, and delayed potential for leaching. Disadvantages of urea are that it is hygroscopic (attracts water), it must be incorporated after application or ammonia volatilization losses may occur, and its slow conversion to nitrate in cool seasons may reduce yields. Anhydrous ammonia may be beneficial in delaying the potential for leaching losses; however, positional availability of the N in relation to the hill may be a problem with sidedress applications. Further research needs to be conducted on the use of anhydrous ammonia for potato.

Table 9. Petiole nitrate-N sufficiency levels for Russet Burbank potatoes on a dry weight and sap basis.

Time of Season/ Stage of Growth	Sap NO_3-N	Dry wt. NO_3-N
	ppm	
Early Vegetative/tuberization (June 15 - June 30)	1200 – 1600	17,000 - 22,000
Mid Tuber growth/bulking (July 1 - July 15)	800 – 1100	11,000 - 15,000
Late Tuber bulking/maturation (July 15 - August 15)	400 – 700	6,000 - 9,000

Table 10. Effect of a controlled release N source on potato (Russet Burbank) yield, Becker – 2005.

N rate[1]	N source			
	Urea	ESN[2]	Urea	ESN[2]
	Total Yield		Marketable Yield	
lb N/A	cwt/A			
80	643	679	499	526
160	698	695	579	582
240	676	677	583	560
320	660	625	576	519
240 (ESN emergence)	-	737	-	631

1All treatments received 40 lb N/A from diammonium phosphate at planting.
2ESN was applied at planting, except for the second 240 lb N/A rate which was applied at emergence.

Substantial reductions in nitrate leaching can occur if controlled release sources of N are used (Table 7). Controlled release N sources include polymer coated urea that can be formulated to release N over various time intervals. These controlled release sources can also be applied earlier in the season without the fear of nitrate leaching losses. The main disadvantages of controlled release N fertilizer are delayed release to ammonium and nitrate when soil temperatures are cool and the higher cost of many of the products compared to conventional quick release N fertilizers. However, there are some newer slow release fertilizers on the market that are more economical and the cost savings of being able to make a single N fertilizer application rather than multiple applications is another factor to consider. Table 10 shows the yield response to ESN, a relatively low cost controlled release N fertilizer, compared to quick release urea applied using standard split application practices. When ESN was applied at planting there was a reduction in marketable yield at the higher N rates compared with urea, but ESN (240 lb N/A) applied at emergence produced the highest total and marketable yields in the study. Further research with low cost controlled release sources needs to be conducted to evaluate effects on tuber quality and nitrate leaching.

For mid to late season varieties, apply ESN no later than emergence.

ESN for early harvested potatoes (vines killed or green dug before August 1) is not recommended due to slow release of N.

Water Management Strategies

Follow proven water management strategies to provide effective irrigation and minimize leaching

Water management has a profound effect on N movement. While leaching of nitrate due to heavy rainfall cannot be completely prevented, following the N management strategies discussed above will minimize these losses. However over-irrigation, even with optimum N rate applied and proper timing of N application, can cause substantial leaching losses. Therefore, effective water scheduling techniques based on soil moisture content and demand by the crop should be followed to prevent such losses. For more information on irrigation scheduling, refer to: ***Irrigation Water Management Considerations for Sandy Soils in Minnesota***, **AG-FO-3875**.

Cover Crops Following Potatoes

Establish a cover crop following potatoes whenever possible

For early harvested potatoes (July/August), any nitrate remaining in the soil is subject to leaching with rainfall. Establishing a cover crop such as winter rye will take up residual N to minimize this potential loss. An additional benefit of the cover crop is to reduce wind erosion. After the cover crop is killed or plowed under, N will be released from the vegetation the following spring. Cover crops can also be planted after potatoes harvested in September/October, although the purpose here is more for erosion control than to reduce N losses.

Specific Best Management Practices for Irrigated Potatoes on Coarse-Textured Soils

Best management strategies for irrigated potatoes need to be somewhat flexible because of differences due to soil type, unpredictable weather, and the numerous potato cultivars grown. However, some general guidelines should be followed with the understanding that modifications may be necessary to fit specific situations and that fine-tuning BMPs for N is an ongoing process. Based on the research conducted with potatoes on sandy soils, the following best management options for N are suggested (these suggestions are based on research with Russet Burbank, an indeterminate late season variety and Red Norland, a determinate early season variety; response may vary with other varieties):

Mid/late season varieties - Vines killed or green dug August 1 or later

Option 1 - when fertigation is available:

- Apply up to 40 lb N/A in the starter (this amount should be included in meeting the total recommended N rate)
- Apply one-third to one-half of the recommended N at or around emergence and cultivate/incorporate the fertilizer into the hill; if ESN is used, apply no later than emergence and incorporate in the hill
- If hilling at emergence is the final hilling operation, begin fertigation 14-21 days later and apply the remainder of the recommended N in increments not exceeding 40 lb N/A
- If a final hilling operation is done 10-14 days after emergence, apply one-third of the recommended N at that time and cultivate/incorporate the fertilizer into the hill. On

heavier textured soils during rainy periods, it may not be possible to time this application properly due to row closure; in this situation, the N can be applied using fertigation

- Base timing of subsequent N applications on petiole analysis; apply up to 40 lb N/A per application through the irrigation system
- Establish a cover crop after harvest whenever possible

Option 2 - for mid/late season varieties when fertigation is not available:

- Apply up to 40 lb N/A in the starter (this amount should be included in meeting the total recommended N rate)
- Apply one-third to one-half of the recommended N at or around emergence and cultivate/incorporate the fertilizer into the hill; if ESN is used, apply no later than emergence and incorporate in the hill
- Apply the remainder of the recommended N rate at final hilling and cultivate/incorporate the fertilizer into the hill
- Establish a cover crop after harvest whenever possible

Option 1 has generally shown better N use efficiency, particularly during years when excessive rainfall has occurred before hilling. Remember that best management practices are based on the most current research available. As more information becomes available through research efforts, some modification of BMPs may be necessary.

Early season varieties, with or without fertigation - Vines killed or green dug before August 1

- Apply up to 60 lb N/A in the starter (this amount should be included in meeting the total recommended N rate)
- Apply one-third to two-thirds of the recommended N at or around emergence and cultivate/incorporate the fertilizer into the hill
- Apply the remainder of the recommended N rate at final hilling and cultivate/incorporate the fertilizer into the hill
- If fertigation is available, base timing of subsequent N application on petiole analysis; if needed, apply up to 30 lb N/A per application through the irrigation system; avoid late applications of N, because that will delay maturity
- Establish a cover crop after harvest

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Publications on Manure Management

Manure Management in Minnesota, FO-3553

Fertilizing Cropland with Swine Manure, FO-5879

Fertilizing Cropland with Dairy Manure, FO-5580

Fertilizing Cropland with Poultry Manure, FO-5881

Fertilizing Cropland with Beef Manure, FO-5582

Self-assessment Worksheets for Manure Management Plans

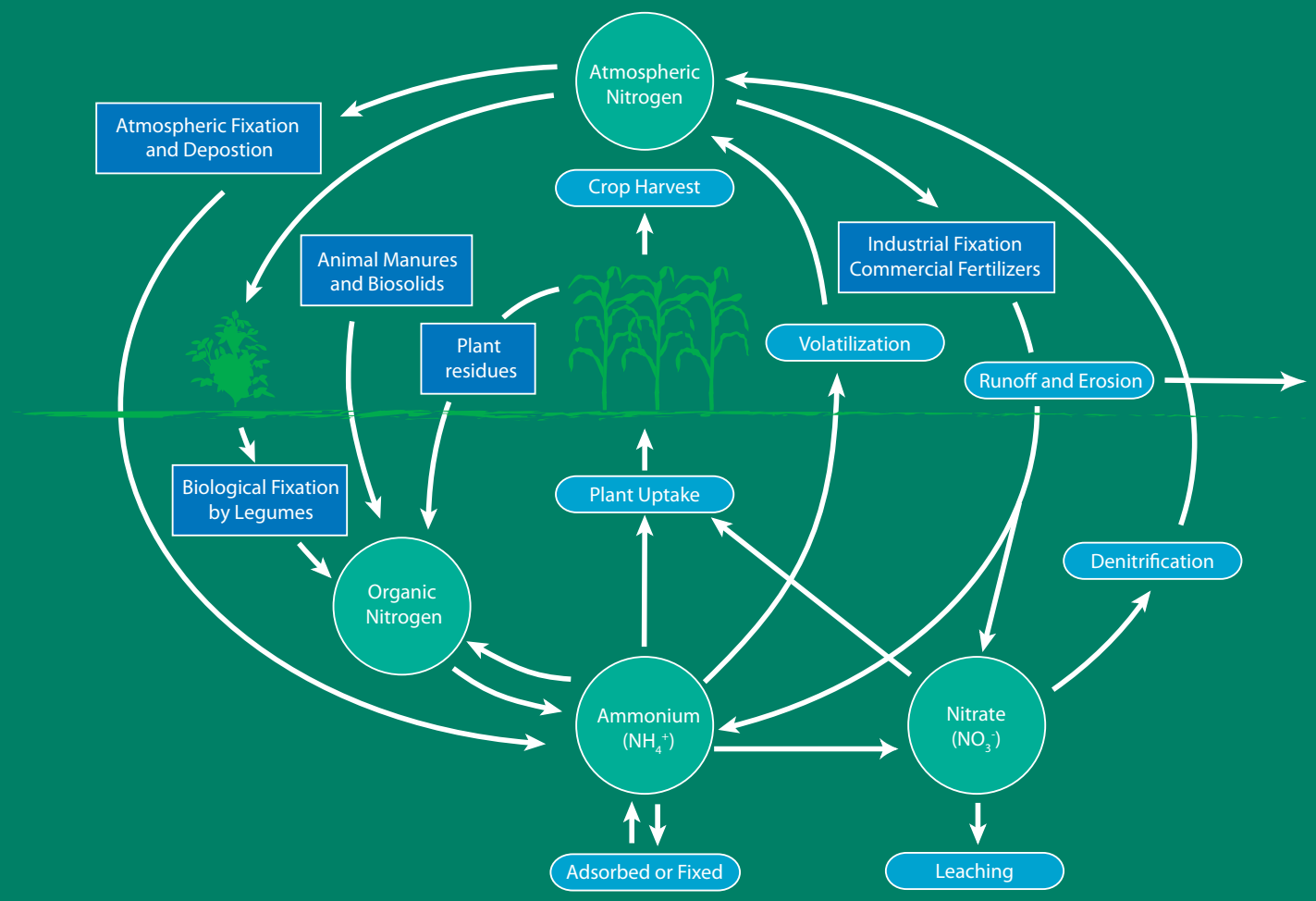
Appendix A

Nitrogen recommendations for irrigated potato production.

		Previous Crop and Organic Matter (O.M.) Level							
		alfalfa (good stand)[1] -O.M.[2]-		soybeans field peas -O.M.-		any crop in group 1 -O.M.-		any crop in group 2 -O.M.-	
Yield Goal[3]	Harvest Date[4]	low	medium to high	low	medium to high	low	medium to high	low	medium to high
cwt/A		N to apply (lb/A)							
<250	Early	0	0	80	60	60	40	100	80
250-299		25	0	105	85	85	65	125	105
300-349		50	30	130	110	110	90	150	130
350–399	Mid	75	55	155	135	135	115	175	155
400–449		100	80	180	160	160	140	200	180
450–499	Late	125	105	205	185	185	165	225	205
500+		150	130	230	210	210	190	250	230

Crops in Group 1	Crops in Group 2		
alfalfa (poor stand)[1]	barley	grass hay	sorghum-sudan
alsike clover	buckwheat	grass pasture	sugarbeets
birdsfoot trefoil	canola	millet	sunflowers
grass-legume hay	corn	mustard	sweet corn
grass-legume pasture	edible beans	oats	triticale
red clover	flax	potatoes	wheat
fallow		rye	vegetables

[1]Poor stand is less than 4 crowns per sq. ft.
[2]Low = less than 3.1% O.M., medium to high = 3.1-19% O.M.; greater than 19% O.M. would be an organic soil and not a coarse-textured soil.
[3]Yield in this table refers to total yield not marketable yield.
[4]Early = vines killed or green dug before August 1; Mid = vines killed or green dug August 1-August 31; late = vines killed or green dug after Sept 1.



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Best Management Practices for Nitrogen Use: Irrigated Potatoes

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